Cycle 15 Abstract Catalog
Generated from Phase I Submissions
April 19, 2006

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Proposal Category: GO
Scientific Category: UNRESOLVED STELLAR POPULATIONS
ID: 10785
Title: Luminosity Profiles of Extremely Massive Clusters in NGC 7252
PI: Nate Bastian
PI Institution: University College London (UCL)

The galactic merger remnant NGC 7252 represents one of the most extreme post-starburst environments in the local universe. During the disk-disk merger (~400 Myr ago) this galaxy produced the largest young massive star cluster population known, including two star clusters above 10^7 Msun, a factor of 100 more massive than typical globular clusters in the Milky Way. We propose ACS-HRC observations of 3 fields in NGC 7252 in order to explore the detailed properties, i.e. luminosity profiles, of these massive star clusters. These observations will be able to test massive cluster formation mechanisms (e.g. the cluster-merger scenario) as well as the possible tidal erosion and truncation of the outer regions of the clusters by the galactic potential. These observations will compliment our large on-going study, using archival HST data, of star cluster profiles outside the Local Group. The cluster population in NGC 7252 will extend our sample in cluster mass by an order of magnitude.
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Proposal Category: GO
Scientific Category: SOLAR SYSTEM
ID: 10786
Title: Rotational state and composition of Pluto's outer satellites
PI: Marc Buie
PI Institution: Lowell Observatory

We propose an intricate set of observations aimed at discovering the rotational state of the newly discovered satellites of Pluto, S/2005 P1 and S/2005 P2. These observations will indicate if the satellites are in synchronous rotation or not. If they are not, then the observations will determine the rotational period or provide tight constraints on the amplitude. The other primary goal is to extend the wavelength coverage of the colors of the surface and allow us to constrain the surface compositions of both objects. From these data we will also be able to significantly improve the orbits of P1 and P2, improve the measurement of the bulk density of Charon, and search for albedo changes on the surface of Pluto.

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Proposal Category: GO
Scientific Category: UNRESOLVED STELLAR POPULATIONS
ID: 10787
Title: Modes of Star Formation and Nuclear Activity in an Early Universe Laboratory
PI: Jane Charlton
PI Institution: The Pennsylvania State University

Nearby compact galaxy groups are uniquely suited to exploring the mechanisms of star formation amid repeated and ongoing gravitational encounters, conditions similar to those of the high redshift universe. These dense groups host a variety of modes of star formation, and they enable fresh insights into the role of gas in galaxy evolution. With Spitzer mid-IR observations in hand, we have begun to obtain high quality, multi-wavelength data for a well-defined sample of 12 nearby (<4500km/s) compact groups covering the full range of evolutionary stages. Here we propose to obtain sensitive BVI images with the ACS/WFC, deep enough to reach the turnover of the globular cluster luminosity function, and WFPC2 U-band and ACS H-alpha images of Spitzer-identified regions hosting the most recent star formation. In total, we expect to detect over 1000 young star clusters forming inside and outside galaxies, more than 4000 old globular clusters in >40 giant galaxies (including 16 early-type galaxies), over 20 tidal features, approximately 15 AGNs, and intragroup gas in most of the 12 groups. Combining the proposed ACS images with UV GALEX observations, ground-based H-alpha imaging, and HI data, we will conduct a detailed study of stellar nurseries, dust, and gas kinematics. To supplement and dramatically enhance this rich dataset, we also propose to obtain Chandra observations to investigate the high-energy phenomena associated with AGN and star formation activity.
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Proposal Category: GO
Scientific Category: RESOLVED STELLAR POPULATIONS
ID: 10788
Title: Probing the Central Dark Mass Concentration of the Collapsed-Core Globular Cluster M15
PI: Haldan Cohn
PI Institution: Indiana University System

We plan to probe the central dark mass concentration in the collapsed-core globular cluster M15 by analyzing the structure of its central stellar cusp with the highest possible angular resolution. The rapid rise of M/L toward the center of M15 can be alternatively explained by a central concentration of several thousand compact remnants (heavy white dwarfs and neutron stars) or instead by the presence of an intermediate-mass black hole (IMBH) of a few thousand solar masses. We propose to obtain one orbit of ACS/HRC F555W (V) imaging to supplement the available ACS/HRC F435W (B) imaging from GO-10401.

This will allow us (1) to improve the constraints on the radius of the as yet unresolved core and (2) to investigate the relation between cusp slope and stellar mass, the form of which depends on the size and mix of the remnant population and on whether or not an IMBH is present. We will compare the central cusp structure with predictions from both Fokker-Planck and GRAPE-6 N-body models, with and without IMBHs, to constrain the nature of the intriguing dark mass concentration.

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Proposal Category: GO
Scientific Category: UNRESOLVED STELLAR POPULATIONS
ID: 10789
Title: The Role of Environment in the Formation of Dwarf Galaxies
PI: Christopher Conselice
PI Institution: University of Nottingham

Clusters of galaxies contain an overdensity of dwarfs compared to the field. Within galaxy clusters there is also a correlation between the overdensity of dwarfs and local galaxy density, such that areas of lower galaxy density contain more dwarfs per giant. The origin of these 'extra' dwarfs is unknown, but a large fraction of them did not form through standard collapses early in the universe. Some dwarf ellipticals in clusters have metal rich and young (< 6 Gyr) stellar populations while others contain old metal poor populations, suggesting multiple formation mechanisms and time scales. We propose to test the idea that dwarfs descend from galaxies accreted into clusters during the past 8 Gyr by correlating ages and metallicities of dwarfs with their internal structures - spiral arms, bars, and disks. If dwarfs originate from more massive galaxies then these features should be common in metal rich and young dwarfs. On the other hand, if no correlation is found it would suggest that dwarfs form through in-situ collapses of gas in the intragalactic medium after the universe was reionized.

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Proposal Category: GO
Scientific Category: ISM AND CIRCUMSTELLAR MATTER
ID: 10790
Title: Planetary Nebulae, Globular Clusters and Binary Mergers
PI: Orsola De Marco
PI Institution: American Museum of Natural History

Four planetary nebulae (PNe) have been found within 130 of the 150 globular clusters (GCs) of our Galaxy. This might not seem like many, but stellar evolution predicts that the old populations of these clusters should contain no PN at all

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Proposal Category: GO

Scientific Category: HOT STARS
ID: 10791
Title: Proper motion may nail counterpart of unique X-ray pulsar
PI: Andrea DeLuca
PI Institution: CNR, Istituto di Astrofisica Spaziale

1E 1207.4-5209 is one of the most puzzling X-ray compact sources in the Galaxy. Long known to be a radio-quiet Neutron Star (NS) embedded in a young (~7000 y) supernova remnant, it displays a unique phenomenology, including multiple cyclotron absorption features in its thermal X-ray spectrum, as well as a possible non-monotonous evolution of its 424 ms rotational period. A candidate optical counterpart (I~23.4) with very red colours (not consistent with the expected emission of a NS, but rather with a low-mass stellar companion, or a fossil disk) was singled out with HST/ACS in 2003, at the margin of the Chandra error box. In order to test the reality of such an association, we propose to take advantage of the high space velocities characteristics of NSs to search for the expected displacement (~150 mas in the NE direction) of the candidate counterpart over a 3 years time span. One orbit observation, either unveiling the displacement or ruling it out, will settle the problem of the optical identification of 1E1207.4-5209. We stress that a null result would also be important for the understanding of this source.
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Proposal Category: GO
Scientific Category: AGN/QUASARS
ID: 10792
Title: Quasars at Redshift z=6 and Early Star Formation History
PI: Matthias Dietrich
PI Institution: The Ohio State University Research Foundation

We propose to observe four high-redshift quasars (z=6) in the NIR in order to estimate relative Fe/Mg abundances and the central black hole mass. The results of this study will critically constrain models of joint quasar and galaxy formation, early star formation, and the growth of supermassive black holes. Different time scales and yields for alpha-elements (like O or Mg) and for iron result into an iron enrichment delay of ~0.3 to 0.6 Gyr. Hence, despite the well-known complexity of the FeII emission line spectrum, the ratio iron/alpha - element is a potentially useful cosmological clock. The central black hole mass will be estimated based on a recently revised back hole mass - luminosity relationship. The time delay of the iron enrichment and the time required to form a supermassive black hole (logM>8 Msol, tau ~0.5Gyr) as evidenced by quasar activity will be used to date the beginning of the first intense star formation, marking the formation of the first massive galaxies that host luminous quasars, and to constrain the epoch when supermassive black holes start to grow by accretion.
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Proposal Category: GO
Scientific Category: COSMOLOGY
ID: 10793
Title: A Survey for Supernovae in Massive High-Redshift Clusters
PI: Avishay Gal-Yam
PI Institution: California Institute of Technology

We propose to continue our ongoing program designed to measure, to an unprecedented 30% accuracy, the SN-Ia rate in a sample of massive z=0.5-0.9 galaxy clusters. The SN-Ia rate is a poorly known observable, especially at high z, and in cluster environments. The SN rate and its redshift dependence can serve as powerful discrimiminants for a number of key issues in astrophysics and cosmology. Our observations will: 1. Put clear constraints on the characteristic SN-Ia "delay time," the typical time between the formation of a stellar population and the explosion of some of its members as SNe-Ia. Such constraints can exclude entire categories of SN-Ia progenitor models, since different models predict different delays. 2. Help resolve the question of the dominant source of the high metallicity in the intracluster medium (ICM) - SNe-Ia, or core-collapse SNe from an early stellar population with a top-heavy IMF, perhaps those population III stars responsible for the early re-ionization of the Universe. Since clusters are excellent laboratories for studying enrichment (they generally have a simple star-formation history, and matter cannot leave their deep potentials), the results will be relevant for understanding metal enrichment in general, and the possible role of first generation stars in early Universal enrichment. Observations obtained so far during cycle 14 yield many SNe in our cluster fields, but our follow-up campaign reveals most are not in cluster galaxies. Our interim results indicate a cluster SN rate at the very low end of the range considered, and its accuracy is limited by the small number of cluster SNe. We request additional visits to increase the number of cluster SNe and achieve a measurement that is not limited by Poisson errors. A detailed progress report is included.
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Proposal Category: GO
Scientific Category: UNRESOLVED STELLAR POPULATIONS
ID: 10794
Title: Direct Age Determination of the dE Galaxies NGC 147 and NGC 185
PI: Marla Geha
PI Institution: Carnegie Institution of Washington

Dwarf elliptical (dE) galaxies form some of the most numerous galaxies in the universe, yet their origins remain a mystery. The most popular formation scenarios are that dEs are either ancient, primordial objects, or the recent remnants of disrupted progenitor galaxies. These scenarios predict significantly different ratios of old and intermediate age stars. Stellar population characteristics can therefore discriminate between these scenarios.

Previous spectroscopic work based on line strengths has had too many uncertainties to uniquely infer the stellar populations. Resolved color magnitude diagrams are needed instead. Since dE galaxies generally do not have stars younger than 1 Gyr, resolving the main sequence turnoff is required to directly quantify the star formation histories. Only ACS on HST can reach this depth, and it can only do so for the nearest two dE galaxies in the Local Group: the M31 dE satellites NGC 147 and NGC 185. Their main sequence turnoffs are expected to be at an apparent magnitude of V=29; we request F606W/F814W imaging one half magnitude fainter than this limit (and more than four magnitudes fainter than the deepest previous dE observations). This will quantify the ratio of old to intermediate-age stars and will allow us to discriminate between the competing models of dE formation. On-going Keck/DEIMOS spectroscopy of several hundred red giant stars in each of these two dE galaxies, coupled with dynamical modeling and spectral synthesis, will complement the ACS measurement by providing information on chemical abundance patterns, dark matter content and internal dynamics. The proposed ACS data will be the first to directly quantify the onset and duration of star formation episodes in any dE galaxy. This measurement can only be done with HST/ACS, and it can only be done for these two galaxies in the dE class. This project will therefore be unique, and will be the most comprehensive study to date of any dE galaxy.

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Proposal Category:	GO
Scientific Category:	UNRESOLVED STELLAR POPULATIONS
ID:	10795
Title:	The Largest Galaxies in the Local Universe: New Light on Disk Galaxy Formation?
PI:	Timothy Heckman
PI Institution:	The Johns Hopkins University

In the standard scenario of disk galaxy formation in a hierarchical Universe, large disks form late via the accretion of either hot or cold gas. Direct observational evidence for such late accretion-driven disk formation has not been forthcoming. In this proposal, we describe the discovery of a rare new type of galaxy that may be examples of massive disks in the process of assembly. We have identified a sample of three such galaxies selected from the SDSS DR4. They are extremely large (diameters over 100 kpc) and highly luminous systems with amorphous structures (no obvious spiral arms or bulges). They are larger than the largest normal spirals in the survey, and have significantly bluer colors, lower metallicities, lower dust extinctions, higher UV luminosities and higher total star formation rates than the most massive ordinary spirals. We request HST images in the rest-frame near-UV and red to provide detailed maps of the underlying structure of these galaxies as well as the distribution of the young stars. The interstellar medium of these galaxies is evidently quite different from that of normal large spirals and starburst galaxies and they may be experiencing a different mode of star formation. We believe they are worthy of further investigation with the high-

resolution imaging capabilities of HST.
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Proposal Category: SNAP
Scientific Category: ISM AND CIRCUMSTELLAR MATTER
ID: 10796
Title: A SNAP Image of the Circumstellar Ejecta of AE And in M31
PI: Roberta Humphreys
PI Institution: University of Minnesota - Twin Cities

The "supernova impostor" or Luminous Blue Variable AE Andromedae in M31 has a spectrum that more closely resembles eta Car than any other known LBV, including the presence of anomalously strong and peculiar Fe II emission. An early FOC ultraviolet image of AE And showed a faint, fuzzy extension of the presumed stellar object. This may be nebulosity from an earlier eruption, or a very nearby UV-bright star. Possibly AE And is embedded in a bipolar nebula. In any case, 2-color ACS/HRC imaging will show the nature of this object. The presence of ejecta will be relevant to understanding the anomalous emission. If nebulous, the shape and extent of the ejecta can provide information on the wind geometry. An extended bipolar structure, similar to eta Car, would be especially interesting as it may be a clue to the mechanism of the more energetic giant eruptions. The required observations are suitable for a SNAP observation.
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Proposal Category: GO
Scientific Category: AGN/QUASARS
ID: 10797
Title: HE0450-2958: Lonesome black hole, scantly dressed quasar or massively dust obscured host galaxy?
PI: Knud Jahnke
PI Institution: Max-Planck-Institut fur Astronomie, Heidelberg

We propose to obtain a deep NICMOS image of the bright z=0.285 quasar HE0450-2958 that has an exceptional, undetected host galaxy, at least 6 times fainter than expected for the quasar luminosity. Several mutually exclusive explanations that were put forward after publication of these results are attempting to explain the apparently undermassive host galaxy, having important implication for their respective areas: The host could be a dust obscured ultra-luminous infrared galaxy in transition to become a quasar; HE450-2958 could have a normal host galaxy but an undermassive central black hole; or the quasar could recently have been ejected from a nearby companion galaxy in a 3-body black hole interaction or by gravitational recoil. We want to use NIC2 with the minimum-background F160W filter to finally detect the host galaxy, using the higher sensitivity of NIC2 and the lower susceptibility to dust in F160W, compared to the currently available optical image with ACS F606W, in order to set strong constraints for these very different scenarios.
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Proposal Category: GO
Scientific Category: COSMOLOGY
ID: 10798
Title: Dark Halos and Substructure from Arcs & Einstein Rings
PI: Leon Koopmans
PI Institution: Kapteyn Astronomical Institute

The surface brightness distribution of extended gravitationally lensed arcs and Einstein rings contains super-resolved information about the lensed object, and, more excitingly, about the smooth and clumpy mass distribution of the lens galaxies. The source and lens information can non-parametrically be separated, resulting in a direct "gravitational image" of the inner mass-distribution of cosmologically-distant galaxies (Koopmans 2005; Koopmans et al. 2006 [astro-ph/0601628]). With this goal in mind, we propose deep HST ACS-F555W/F814W and NICMOS-F160W WFC imaging of 20 new gravitational-lens systems with spatially resolved lensed sources, of the 35 new lens systems discovered by the Sloan Lens ACS Survey (Bolton et al. 2005) so far, 15 of which are being imaged in Cycle-14. Each system has been selected from the SDSS and confirmed in two time-efficient HST-ACS snapshot programs (cycle 13&14). High-fidelity multi-color HST images are required (not delivered by the 420s snapshots) to isolate these lensed images (properly cleaned, dithered and extinction-corrected) from the lens galaxy surface brightness distribution, and apply our "gravitational maging" technique. Our sample of 35 early-type lens galaxies to date is by far the largest, still growing, and most uniformly selected. This minimizes selection biases and small-number statistics, compared to smaller, often serendipitously discovered, samples. Moreover, using the WFC provides information on the field around the lens, higher S/N and a better understood PSF, compared with the HRC, and one retains high spatial resolution through drizzling. The sample of galaxy mass distributions - determined through this method from the arcs and Einstein ring HST images - will be studied to: (i) measure the smooth mass distribution of the lens galaxies (dark and luminous mass are separated using the HST images and the stellar M/L values derived from a joint stellar-dynamical analysis of each system); (ii) quantify statistically and individually the incidence of mass-substructure (with or without obvious luminous counter-parts such as dwarf galaxies). Since dark-matter substructure could be more prevalent at higher redshift, both results provide a direct test of this prediction of the CDM hierarchical structure-formation model.

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Proposal Category: GO
Scientific Category: SOLAR SYSTEM
ID: 10799
Title: Photometric Mapping of Vesta's Southern Hemisphere
PI: Lucy-Ann McFadden
PI Institution: University of Maryland

We propose to image asteroid 4 Vesta throughout one complete rotation during its opposition and close approach to Earth in May or early June of 2007 in four broad band filters for the purposes of improving knowledge of its spin pole, size, shape, albedo and composition across its surface. We will conduct a search for satellites of Vesta. Multi-filter imaging will extend the range of photometric mapping into the southern hemisphere where a large basin exists, and will extend compositional mapping further into the southern hemisphere than previous observations. The results in improve our understanding of protoplanetary processes and support scientific planning for NASA's Dawn mission to orbit Vesta and Ceres in 2011 and 2014 respectively.

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Proposal Category:	SNAP
Scientific Category:	SOLAR SYSTEM
ID:	10800
Title:	Kuiper Belt Binaries: Probes of Early Solar System Evolution
PI:	Keith Noll
PI Institution:	Space Telescope Science Institute

Binaries in the Kuiper Belt are a scientific windfall: in them we have relatively fragile test particles which can be used as tracers of the early dynamical evolution of the outer Solar System. We propose to continue a Snapshot program using the ACS/HRC that has a demonstrated discovery potential an order of magnitude higher than the HST observations that have already discovered the majority of known transneptunian binaries. With this continuation we seek to reach the original goals of this project: to accumulate a sufficiently large sample in each of the distinct populations collected in the Kuiper Belt to be able to measure, with statistical significance, how the fraction of binaries varies as a function of their particular dynamical paths into the Kuiper Belt. Today's Kuiper Belt bears the imprints of the final stages of giant-planet building and migration; binaries may offer some of the best preserved evidence of that long-ago era.

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Proposal Category:	GO
Scientific Category:	SOLAR SYSTEM
ID:	10801
Title:	Direct Determination of Kuiper Belt Object Diameters with HST
PI:	Keith Noll
PI Institution:	Space Telescope Science Institute

When it comes to fundamental properties of an astronomical object, it is difficult to think of a more fundamental physical property than its size. Because of their distance, objects in the Kuiper Belt are generally too small for their disks to be resolved. The heterogeneous albedo and color of the Kuiper Belt population makes size estimates from observed absolute magnitude

highly uncertain. And the long-awaited data from the Spitzer Space Telescope suffers from our ignorance of crucial macro- and micro-physical properties such as spin period, pole orientation, surface roughness, and thermal inertia. We propose to add a new dimension to the measurement of KBO diameters by employing two techniques that will directly measure the diameters of three large KBOs. We expect to obtain diameter measurements with uncertainties of 10% or better and utilize these to validate and cross calibrate the growing web of diameter measurements for KBOs.

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Proposal Category: GO
Scientific Category: COSMOLOGY
ID: 10802
Title: SHOES-Supernovae, HO, for the Equation of State of dark energy
PI: Adam Riess
PI Institution: Space Telescope Science Institute

The present uncertainty in the value of the Hubble constant (resulting in an uncertainty in Omega_M) and the paucity of Type Ia supernovae at redshifts exceeding 1 are now the leading obstacles to determining the nature of dark energy. We propose a single, integrated set of observations for Cycle 15 that will provide a 40% improvement in constraints on dark energy. This program will observe known Cepheids in six reliable hosts of Type Ia supernovae with NICMOS, reducing the uncertainty in H_0 by a factor of two because of the smaller dispersion along the instability strip, the diminished extinction, and the weaker metallicity dependence in the infrared. In parallel with ACS, at the same time the NICMOS observations are underway, we will discover and follow a sample of Type Ia supernovae at z > 1. Together, these measurements, along with prior constraints from WMAP, will provide a great improvement in HST's ability to distinguish between a static, cosmological constant and dynamical dark energy. The Hubble Space Telescope is the only instrument in the world that can make these IR measurements of Cepheids beyond the Local Group, and it is the only telescope in the world that can be used to find and follow supernovae at z > 1. Our program exploits both of these unique capabilities of HST to learn more about one of the greatest mysteries in science.

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Proposal Category: GO
Scientific Category: HOT STARS
ID: 10803
Title: Detecting the progenitors of core-collapse supernovae
PI: Stephen Smartt
PI Institution: The Queen's University of Belfast

Modern supernova searches in the nearby Universe are discovering large numbers of SNe which have massive star progenitors (Types II, Ib and Ic). The

extensive HST image archive within ~20Mpc enables the indvidual bright stellar content of starforming galaxies to be resolved. As massive, evolved stars are the most luminous single objects in a galaxy, the progenitors of core-collapse SNe are often directly detectable on pre-explosion archive images. We have discovered three progenitors of recent type II-Plateau SNe, showing them to be red supergiants of 8-12 solar masses. This is the first direct evidence that red supergiants do indeed produce normal type II explosions. We have set upper mass limits on a further 7 progenitor stars and suggest that faint type II supernovae are unlikely to come from the collapse of very massive stars which form black holes. These discoveries are providing strong constraints on theoretical models of pre-supernova evolution, explosion models and the origin of the supernova types. We request time to continue this successful project and require ACS observations of future SNe which are discovered in galaxies closer than 20Mpc and which have pre-explosion HST archive images available. This will allow the SNe to be precisely positioned on the pre-explosion images. We have set a final goal for this project of determining masses and types, or setting restrictive mass-limits, for 30 supernovae over the remainder of HST's project life.

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Proposal Category: GO
Scientific Category: COSMOLOGY
ID: 10804
Title: Are (some) short gamma-ray bursts associated with young progenitors?
PI: Jesper Sollerman
PI Institution: Stockholm University

The host galaxy of the short-hard Gamma-Ray Burst (GRB) 050709 is a star-forming galaxy. This is contrary to the other (two) elliptical galaxies associated with short burts, and it has been argued that this implies a broad range of progenitor ages for the origins of the short bursts. This conclusion is very interesting, because it could argue for multiple kinds of progenitor systems for the short bursts. The stellar populations of the explosion sites is likely to be the only way to probe this issue until the era of the gravitational wave detectors. However, this conclusion is clearly also premature. That there are young stars in the host of GRB 050709 does not neccesarily mean that the progenitor was a young system. This proposal aims to investigate this matter by a detailed image in H-alpha (ramp filter), to directly probe the star formation rate at the very explosion site (which is known from previous HST imaging). We request a single HST orbit to probe the star formation rate down to 0.005 solarmasses per year, for this galaxy which is nearby emough (z=0.16) to resolve the different star formation locations within the galaxy.

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Proposal Category: GO
Scientific Category: SOLAR SYSTEM

ID: 10805
Title: ACS Imaging of Uranus' Atmosphere Near Equinox
PI: Lawrence Sromovsky
PI Institution: University of Wisconsin - Madison

Uranus' 97-degree spin axis inclination results in the largest fractional seasonal variation of solar insolation in the solar system. Uranus is now close to its 7 December 2007 equinox, and we can now see most of the northern hemisphere, which was in darkness when Voyager provided our first detailed view of the planet in 1986. If Uranus' seasonal response has the large phase shift expected from its long radiative time constant, it should now exhibit nearly maximal hemispheric contrast. Although the long time constant also suggests a small physical response, significant hemispheric asymmetries in cloud structure and dynamics are becoming apparent. We propose a detailed characterization of Uranus' current response to this forcing with a 10-orbit program consisting of 4 orbits of WFC imaging with narrowband ramp filters and 6 orbits of HRC imaging using both broadband and narrowband filters. Nine narrow-band filters between 0.62 and 0.955 microns will provide vertical sensing depths scanning through the pressure range where the putative methane and deeper H2S clouds might plausibly exist and provide strong constraints on their optical properties and parent gas mixing ratios. The high resolution HRC images will characterize the dynamics of discrete features at the 15-30 hour time scale unavailable from the ground. Short wavelength HRC images will enable a characterization of the stratospheric haze. These observations have unique combinations of spectral range and resolution with needed temporal and spatial resolution not available from groundbased observations.
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Proposal Category: GO
Scientific Category: HOT STARS
ID: 10806
Title: Accretion in the closest binary systems known
PI: Danny Steeghs
PI Institution: Smithsonian Institution Astrophysical Observatory

Recently, three variable stars have been identified as likely accreting binary systems with ultra-short orbital periods. Optical and X-ray observations have revealed periodicities of 5-10 minutes, making them the closest binaries known as well as strong sources of gravitational wave emission. Such short-period accreting binaries form the cornerstone to our understanding of binary formation and evolution, in particular of the large double white dwarf population in our galaxy, a candidate progenitor population for Type Ia supernovae. We propose to obtain the first UV spectroscopy of these objects using the ACS prisms in order to (i) determine the temperature of the primary and the composition of their donor stars, (ii) correlate the UV variability with other wavebands and determine if the periods are indeed orbital. These UV observations are essential in order to unequivocally determine whether these are indeed the most compact binaries known.

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Proposal Category: GO
Scientific Category: COOL STARS
ID: 10807
Title: The knotty jet of He 2-90: An ideal laboratory for studying the formation and propagation of jets in dying stars
PI: Matthias Stute
PI Institution: Jet Propulsion Laboratory

Previous WFPC2 observations have led to the serendipitous discovery of an extended, highly-collimated, ``pulsed'' bipolar jet emanating from a compact planetary nebula, He 2-90. Subsequently, an average proper motion of the knots in the jet was measured, which together with radial velocities, enabled us to characterise the basic physical properties of the jet. The knotty jet in He 2-90 resembles other prominent examples of pulsed jets in young stellar objects or symbiotic stars, but is probably by far the best example yet of a non-relativistic, symmetric, jet in a ``clean'' astrophysical environment. The formation (acceleration and collimation) of jets is not fully understood, specially in the case of jets in dying stars. We now propose to re-image He 2-90 with WFPC2 and exploit the factor 3.5 longer time baseline now available from the first-epoch observations in September 1999, in order to measure the proper motion of individual knots in the jet with unprecedented accuracy. These data will enable us to characterise the ejection history of the source, specially deviations from a constant period (latter is related to the binary period of the system), e.g., due to instabilities in the accretion mechanism. We will also be able to test if the ejection mechanism is symmetric: any deviation in the ejection history of the knots in the opposing jet beams, will indicate a magnetic field structure and/or the accretion disk which is not symmetric across the equatorial plane. We will also carry out deep imaging with the ACS/WFC camera in order to determine the shapes/sizes of a large number of knots. The shapes/sizes of the knots, and changes with distance from the source probe the strength of the magnetic field inside the jet. HRC imaging of the central source and jet on sub-arcsecond scales will be carried out to probe the magnetic field close to the jet source, and deviations from linearity in the jet-beam which may result from instabilities in the magnetic field. These data will allow us to significantly improve our existing 2-dimensional MHD model of the He2-90 jet, and/or provide impetus for new 3-dimensional models.
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Proposal Category: GO
Scientific Category: COSMOLOGY
ID: 10808
Title: Morphologies of spectroscopically-confirmed "red and dead" galaxies at z~2.5
PI: Pieter van Dokkum

PI Institution: Yale University

Using a combination of wide-field near-infrared imaging and very deep follow-up near-infrared spectroscopy we have identified a population of massive "red and dead" galaxies at z~2.5. The galaxies lack emission lines and have strong Balmer/4000 Angstrom breaks, demonstrating directly that they have evolved stellar populations. These objects are very likely progenitors of massive ellipticals today and may be descendants of the first generation of galaxies. We propose to image 10 of these objects with the NIC2 camera to determine their morphologies. The goals are to 1) determine whether they have the sizes of present-day early-types or are more compact, as predicted by models, 2) determine the morphology, using visual classification and quantitative methods, and 3) constrain the evolution of the Kormendy relation from z~2.5 to the present. These observations will show whether the oldest and most massive galaxies at z~2.5 were already fully formed or still in the process of assembly.

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Proposal Category: GO
Scientific Category: COSMOLOGY
ID: 10809
Title: The nature of "dry" mergers in the nearby Universe
PI: Pieter van Dokkum
PI Institution: Yale University

Recent studies have shown that "dry" mergers of red, bulge-dominated galaxies at low redshift play an important role in shaping today's most massive ellipticals. These mergers have been identified in extremely deep ground-based images of red sequence galaxies at z ~ 0.1. The ground-based images reach surface brightness limits of AB ~ 29, but lack the resolution to study the morphologies of the galaxies inside the effective radius. Here we propose to obtain ACS images of a representative sample of 40 of these red sequence galaxies: 15 ongoing dry mergers, 15 remnants, and 10 undisturbed objects. We will measure the isophote shapes and ellipticities of the galaxies, their dust content, morphological fine structure (shells and ripples), AGN content, and their location on the Fundamental Plane. By comparing galaxies in different stages of the merging process we can constrain the amount of gas associated with these red mergers, the effect of active nuclei, and track structural changes. As two galaxies can be observed in a single orbit 20 orbits are requested to observe the 40 galaxies.

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Proposal Category: GO
Scientific Category: STAR FORMATION
ID: 10810
Title: The Gas Dissipation Timescale: Constraining Models of Planet Formation
PI: Edwin Bergin

PI Institution: University of Michigan

We propose to constrain planet-formation models by searching for molecular hydrogen emission around young (10-50 Myr) solar-type stars that have evidence for evolved dust disks. Planet formation models show that the presence of gas in disks is crucial to the formation of BOTH giant and terrestrial planets, influences dust dynamics, and through tidal interactions with giant planets leads to orbital migration. However, there is a lack of systematic information on the presence and lifetime of gas residing at planet-forming radii. We will use a newly identified broad continuum emission feature of molecular hydrogen at 1600 Angstrom to search for residual gas within an orbital radius of 5-10 AU around young stars that have evolved beyond the optically thick T Tauri phase. These observations will enable the most sensitive probe to date of remant gas in circumstellar disks, detecting surfaces densites of ~0.0001 g/cm^2, or less than 10^-5 of the theoretical "mininum mass" solar nebula from which our solar system is thought to have formed. Our observations are designed to be synergistic with ongoing searches for gas emission that is being performed using the Spitzer Space Telescope in that the proposed HST observations are ~100 times more sensitive and will have 50 times higher angular resolution. These combined studies will provide the most comprehensive view of residual gas in proto-planetary disks and can set important constraints on models of planet formation.

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Proposal Category: GO
Scientific Category: UNRESOLVED STELLAR POPULATIONS
ID: 10811
Title: Morphology of a most spectactular Spitzer selected galaxy
PI: Colin Borys
PI Institution: California Institute of Technology

By using ground based sub-millimeter observations to followup Spitzer-selected galaxies, we have discovered a starburst dominated hyperluminous infrared galaxy. A mid-infrared spectrum obtained with Spitzer-IRS provides a redshift of z=1.325, which has been subsequently confirmed using both NIR spectroscopy at Keck, and sub-mm spectroscopy with IRAM and the CSO. By combining the Spitzer and ground based sub-mm data, we measure an integrated IR luminosity of 4 x 10^13 Lsun. This is the only such object found in the 9 square degree NDWFS survey, and hence is incredibly rare. The only other dusty galaxies this bright show strong evidence of AGN activity, but this source does not. One reason this object could be so bright is due to lensing, and indeed a foreground source spectroscopically confirmed at z=1.034 seems directly aligned with the target. However it is unlikely that the geometry of this galaxy-galaxy lensing system could support an amplification more than a factor of a few. Our IRAC images reveal very faint and red satellite systems near our target, hence another possibility is that the galaxy is so luminous because of merging induced star-formation activity. Morphology is the best way to discriminate between these hypotheses, and hence

HST observations are essential since the scales on which the merging or lensing are occuring are much smaller than what can be resolved from the ground.

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Proposal Category: GO
Scientific Category: QUASAR ABSORPTION LINES AND IGM
ID: 10813
Title: MgII Absorption Line Systems: Galaxy Halos or the Metal-Enriched IGM?
PI: David Bowen
PI Institution: Princeton University

MgII QSO absorption lines detected in the spectra of background QSOs were used over a decade ago to infer that all redshift z > 0.2 galaxies have gaseous halos of radius ~ 60 kpc. The actual size of the halo was believed to be proportional to the luminosity of the galaxy. However, these conclusions are now much harder to understand in light of the results from numerical simulations which show how gas evolves in the universe. These models predict that gas and galaxies merely share the same filamentary structures defined by dark matter. If these models are correct, how are MgII systems and galaxies really related? We can better understand the distribution of absorbing gas if we FIRST select galaxies close to QSO sightlines and THEN search for MgII absorption at the redshift of the intervening galaxies. This is the antithesis of the original experiments which sought to find absorbing galaxies based on known MgII systems. The frequency with which we detect MgII lines from randomly selected galaxies should enable us to better understand if absorption arises in the halos of individual galaxies, or if MgII merely arises in the same IGM that galaxies inhabit. We have used ground-based telescopes to indentify twenty z = 0.31-0.55 galaxies within 14-51 kpc of a g < 20 QSO, and to search for MgII absorption at the galaxies' redshifts. Surprisingly, we find that only 50% of our QSOs show MgII absorption. In this proposal, we seek multi-color ACS images of twelve of the fields to i) correlate the incidence of MgII with galaxy morphology; ii) determine if absorption (or lack thereof) is related to galaxy disks or halos; iii) search for signs of galaxy interactions which may explain the large cross-sections of MgII systems; and iv) look for faint interloping galaxies closer to the line of sight than the one we identified. An important component of the program is to observe each field in the SDSS g-, r- and i-bands, to permit an estimate of the photometric redshift of any objects which lie closer to the QSO sightline than the identified galaxy, and which might actually be responsible for the absorption.

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Proposal Category: GO
Scientific Category: UNRESOLVED STELLAR POPULATIONS
ID: 10814
Title: The Masses for ultraluminous X-ray sources
PI: Joel Bregman

PI Institution: University of Michigan

Ultraluminous X-ray sources are non-nuclear sources in normal disk galaxies that are either stellar mass black holes that are super-Eddington emitters, or 1E3-1E4 Msolar black holes emitting normally. We can distinguish between these models by obtaining constraints for the mass of the primary, which can be accomplished through UV objective prism spectra. This strategy begins with the optical identification of the secondary and identification of its spectral type in order to determine its mass and the Roche Lobe radius. Secondly, we need to determine whether an accretion disk is present and if its high ionization UV line luminosities point to a stellar mass black hole or a more massive object. Finally, if the black hole is 1E3-1E4 Msolar, the orbital velocity of the secondary is so large that a Doppler shift will be detectable, even at the modest resolution of the prism.

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Proposal Category: GO
Scientific Category: RESOLVED STELLAR POPULATIONS
ID: 10815
Title: The Blue Hook Populations of Massive Globular Clusters
PI: Thomas Brown
PI Institution: Space Telescope Science Institute

Blue hook stars are a class of hot (~35,000 K) subluminous horizontal branch stars that have been recently discovered using HST ultraviolet images of the globular clusters omega Cen and NGC 2808. These stars occupy a region of the HR diagram that is unexplained by canonical stellar evolution theory. Using new theoretical evolutionary and atmospheric models, we have shown that the blue hook stars are very likely the progeny of stars that undergo extensive internal mixing during a late helium core flash on the white dwarf cooling curve. This "flash mixing" produces an enormous enhancement of the surface helium and carbon abundances, which suppresses the flux in the far ultraviolet. Although flash mixing is more likely to occur in stars that are born with high helium abundances, a high helium abundance, by itself, does not explain the presence of a blue hook population - flash mixing of the envelope is required. We propose ACS ultraviolet (SBC/F150LP and HRC/F250W) observations of the five additional globular clusters for which the presence of blue hook stars is suspected from longer wavelength observations. Like omega Cen and NGC 2808, these five targets are also among the most massive globular clusters, because less massive clusters show no evidence for blue hook stars. Because our targets span 1.5 dex in metallicity, we will be able to test our prediction that flash-mixing should be less drastic in metal-rich blue hook stars. In addition, our observations will test the hypothesis that blue hook stars only form in globular clusters massive enough to retain the helium-enriched ejecta from the first stellar generation. If this hypothesis is correct, then our observations will yield important constraints on the chemical evolution and early formation history in globular clusters, as well as the role of helium self-enrichment in producing blue horizontal branch

morphologies and multiple main sequence turnoffs. Finally, our observations will provide new insight into the formation of the hottest horizontal branch stars, with implications for the origin of the hot helium-rich subdwarfs in the Galactic field.

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Proposal Category: GO
Scientific Category: RESOLVED STELLAR POPULATIONS
ID: 10816
Title: The Formation History of Andromeda's Extended Metal-Poor Halo
PI: Thomas Brown
PI Institution: Space Telescope Science Institute

We propose deep ACS imaging in the outer spheroid of the Andromeda galaxy, in order to measure the star formation history of its true halo. For the past 20 years, nearly all studies of the Andromeda "halo" were focused on the spheroid within 30 kpc of the galaxy's center, a region now known to host significant substructure and populations with high metallicity and intermediate ages. However, two groups have recently discovered an extended metal-poor halo beyond 30 kpc; this population is distinct in its surface-brightness profile, abundance distribution, and kinematics. In earlier cycles, we obtained deep images of the inner spheroid (11 kpc on the minor axis), outer disk (25 kpc on the major axis), and giant tidal stream, yielding the complete star formation history in each field. We now propose deep ACS imaging of 4 fields bracketing this 30 kpc transition point in the spheroid, so that the inner spheroid and the extended halo populations can be disentangled, enabling a reconstruction of the star formation history in the halo. A wide age distribution in the halo, as found in the inner spheroid, would imply the halo was assembled through ongoing accretion of satellite galaxies, while a uniformly old population would be a strong indication that the halo was formed during the early rapid collapse of the Andromeda proto-galaxy.

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Proposal Category: GO
Scientific Category: ISM IN EXTERNAL GALAXIES
ID: 10817
Title: Unveiling Starburst Morphology of Distant Damped Ly-alpha Galaxies Hosting Gamma-Ray Bursts
PI: Hsiao-Wen Chen
PI Institution: University of Chicago

The damped Lya systems (DLAs), `clouds' with high columns of neutral hydrogen, dominate the neutral gas mass at z>2 and are believed to be the building blocks of galaxies like the Milky Way. At present, high resolution spectroscopy of the DLAs provide the only detailed study of the ISM of young galaxies during early epochs. Yet by the very nature of their discovery - along bright quasar sightlines - direct imaging of the stellar counterparts

presents a major obstacle. The use of gamma-ray bursts (GRBs) presents a novel new alternative: GRB afterglows are temporarily as bright as quasars, allowing for high-quality spectroscopy to identify and study new DLAs out to redshifts comparable to those probed by quasars. Afterglows then disappear after a few weeks, affording a direct and unimpeded view of the faint DLAs free from a glaring background source. Through an extensive ground-based program in 2005, we have now obtained early-time high-resolution echelle spectra of several NASA/Swift GRB afterglows. These data reveal that nearly all GRB host galaxies produce a DLA feature. Furthermore, the associated metal absorption lines indicate an ISM environment around the GRB progenitors --- extremely dense gas and warm temperature --- that has never been seen beyond the local universe. We request ACS late-time imaging of fields surrounding nine GRBs, all of which exhibit a strong DLA signature or strong metal absorption lines that indicate a DLA at the redshift of the host. In concert with our afterglow absorption line studies and stellar properties of both the GRB host galaxies and galaxies that give rise to strong intervening absorbers, these proposed observations will provide an unprecedented glimpse into the nature of DLAs beyong redshift of unity. As a complete sample, this study will provide robust measurements of the morphology and luminosity of DLA galaxies in a manner inaccessible to QSO lines of sight.

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Proposal Category: GO
Scientific Category: UNRESOLVED STELLAR POPULATIONS
ID: 10818
Title: Very Young Globular Clusters in M31 ?
PI: Judith Cohen
PI Institution: California Institute of Technology

We propose to use HST's unique high spatial resolution imaging capabilities to conclusively confirm or refute the presence of alleged very young globular clusters in M31. Such young globular clusters with ages < 3 Gyr are not present in our galaxy, and, if real, would lead to a striking difference in the age distribution of the GCs between M31 and the Millky Way. If the apparent presence of very young globular clusters in M31 is confirmed through our proposed ACS imaging with HST, this would suggest major differences in the history of assembly of the two galaxies, with probable substantial late accretion into M31 which did not occur in our own galaxy.

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Proposal Category: GO
Scientific Category: RESOLVED STELLAR POPULATIONS
ID: 10819
Title: The Nearest Gas-Rich Giant Galaxy
PI: Mike Disney
PI Institution: University of Wales, College of Cardiff (UWCC)

NGC 4592 is the nearest of a new class of galaxies revealed by our all-sky

neutral hydrogen survey. The entire evolution of these quite numerous objects appears to be delayed in the sense that most of their baryons remain as gas even though all of them have some stars. Studying galaxies in such an 'early' stage of their evolution could be important to the whole subject of galaxy formation and development - even at high redshifts. We propose to image this nearest 'underevolved' giant through the F606W and F814W filters using ACS for 16 orbits.

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Proposal Category: GO
Scientific Category: COSMOLOGY
ID: 10820
Title: Galaxy properties in a Filament in Abell 851
PI: Alan Dressler
PI Institution: Carnegie Institution of Washington

We propose to image two fields that cover the filament of galaxies that is streaming into the remarkable cluster Abell 851, z=0.41, one of the two examples of the expected mechanism of cluster growth. These observations will test theories of alteration of galaxy morphology and star formation history for galaxies infalling into intermediate redshift clusters.

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Proposal Category: GO
Scientific Category: HOT STARS
ID: 10821
Title: UV spectroscopy of the LBV NGC 2363-V1
PI: Laurent Drissen
PI Institution: Universite Laval

In 1996, we reported the discovery of a bright variable star in the giant extragalactic HII region NGC 2363. Subsequent photometry and high quality HST/STIS spectroscopy of this star, NGC 2363-V1, revealed that we are witnessing a significant event in the evolution of a massive star, namely a major eruption of a Luminous Blue Variable (LBV), similar to that of Eta Carina in the 19th century. We have monitored spectroscopically NGC 2363-V1 with HST from 1997 until the failure of STIS in August 2004. A quantitative analysis of the STIS datasets gathered during this period allowed us to determine some important properties of the star and their evolution during the course of the eruption: luminosity, mass loss rate, wind terminal velocity, surface temperature and even Fe content of this erupting LBV. It is clear from our analysis that NGC 2363-V1 is slowly coming back to the blue side of the H-R diagram: its surface temperature rose from 11000K in 1997 to 21000K in 2004. Because such events are rare, continuous monitoring of the physical parameters of NGC 2363-V1 over the course of its present eruption will provide an invaluable set of constraints for theoretical models. We continue to monitor the variations in the visible range with HIRES on Keck, and we therefore propose here to obtain crucial information on the shape of the ultraviolet

part of the spectrum with low resolution spectra of this star in the
ultraviolet with ACS.
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Proposal Category: GO
Scientific Category: ISM AND CIRCUMSTELLAR MATTER
ID: 10822
Title: CIII] Imagery of Planetary Nebulae
PI: Reginald Dufour
PI Institution: Rice University

We propose to image five planetary nebulae (PNe) with the F185W filter of
WFPC2 in order to study the spatial distribution of the ultraviolet C III]
1909 Angstrom line relative to [O III] 5007 Angstrom and other optical lines.
This program follows a Cycle 12 SNAP program (GO 9740) of WFPC2 F185W imaging
of PNe and H II regions which validated the feasibility of obtaining images of
bright PNe in C III] through careful continuum subtraction and calibrations
based on archival IUE SWP and LWP/R spectra. However, in the SNAP program
only short (10 minute) exposures of four PNe were taken; we now propose much
longer exposures (60-72 minutes) to obtain the desired signal-to-noise to
develop high quality C++ ionization maps for comparison with O++ and other
ions via photoionization modeling. The five PNe chosen: NGC 2392, NGC 3242,
NGC 6543, NGC 6720, and NGC 7662 were selected on the basis of their high
surface brightness, extensive UV spectra available from IUE and HST, and
numerous WFPC2 images in the archives in other emission lines. We expect the
results of this study to impact the utility and accuracy of using the C III]
1909 lines compared to [O III] 5007 for C/O abundance derivations in PNe and H
II regions.
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Proposal Category: GO
Scientific Category: HOT STARS
ID: 10823
Title: The spectrum of a magnetar in the blue and ultraviolet.
PI: Martin Durant
PI Institution: University of Toronto

Magnetars are natural laboratories for investigating the behaviour of matter
at the very extremes of nature. The magnetar CXOU J010043.1-721134 was
serendipitously discovered by WFPC2 imaging of the SMC. Because of the low
reddening to this source compared to the other magnetars, this is a unique
opportunity to measure the spectral shape in the blue and ultraviolet. We hope
also to establish the feasibility of spectroscopic follow-up. We are asking
for two orbits of ACS imaging.
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Proposal Category: GO
Scientific Category: RESOLVED STELLAR POPULATIONS

ID: 10824
Title: Measuring the Shape and Orientation of the Galactic Dark-Matter Halo using Hypervelocity Stars
PI: Oleg Gnedin
PI Institution: The Ohio State University Research Foundation

We propose to obtain high-resolution images of five hypervelocity stars in the Galactic halo in order to establish the first-epoch astrometric frame for them, as a part of a long-term program to measure precise proper motions. The origin of these recently discovered stars, all with positive radial velocities above 540 km/s, is consistent only with being ejected from the deep potential well of the massive black hole at the Galactic center. The deviations of their space motions from purely radial trajectories probe the departures from spherical symmetry of the Galactic potential, mainly due to the triaxiality of the dark-matter halo. Reconstructing the full three-dimensional space motion of the hypervelocity stars, through astrometric proper motions, provides a unique opportunity to measure the shape and orientation of the dark halo. The hypervelocity stars allow measurement of the potential up to 75 kpc from the center, independently of and at larger distances than are afforded by tidal streams of satellite galaxies such as the Sagittarius dSph galaxy. HVS3 may be associated with the LMC, rather then the Galactic center, and would therefore present a case for a supermassive black hole at the center of the LMC. We request one orbit with ACS/WFC for each of the five hypervelocity stars to establish their current positions relative to background galaxies. We will request a repeated observation of these stars in Cycle 17, which will conclusively measure the astrometric proper motions.
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Proposal Category: GO
Scientific Category: UNRESOLVED STELLAR POPULATIONS
ID: 10825
Title: The Formation Epoch of Early-type Galaxies: Constraints from the Fundamental Plane at z=1.3
PI: Bradford Holden
PI Institution: University of California - Santa Cruz

Field and cluster surveys both show a ~50% decrease in the number of early-type galaxies at redshifts near 1. Galaxies that have either recently transformed into early-types or undergone star formation should have younger appearing stellar populations. The resulting change in the mass-to-light ratio can be detected by the offset in the fundamental plane with redshift. We will use the fundamental plane to test whether a significant fraction of early-type galaxies have evidence of recent star formation, using a sample of ~20 z=1.3 cluster and field early-type galaxies. This is 7 times larger than the sample previously used at this redshift. We already have the high signal-to-noise 12-20 hour long Keck spectra for these galaxies we need for velocity dispersions. To use the fundamental plane, we require sizes and surface brightnesses. We propose 12 orbits of NICMOS Camera 2 imaging to measure the

sizes and surface brightness distributions of these objects in a rest-frame optical passband. These data will provide high quality surface brightness profiles out two ~2 half-light radii, at wavelengths comparable to previous fundamental plane studies. When combined with our spectra, the HST data will establish the mass-to-light ratio evolution for massive early-type galaxies from the fundamental plane. We will define the epoch of last star formation for these z=1.3 galaxies, directly testing the claims of strong evolution at z=1.

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Proposal Category: GO
Scientific Category: UNRESOLVED STELLAR POPULATIONS
ID: 10826
Title: Galaxy Evolution During Half the Age of the Universe: ACS imaging of rich galaxy clusters
PI: Inger Jorgensen
PI Institution: Gemini Observatory, Northern Operations

Detailed studies of nearby galaxies (z<0.05) show that galaxies have very complex histories of formation and evolution involving mergers, bursts of star formation, and morphological changes. Even so, the global properties of the galaxies (radii, luminosities, rotation velocities, velocity dispersions, and absorption line strengths) follow a number of very tight (empirical) scaling relations, e.g. the Tully-Fisher relation and the Fundamental Plane (FP). We use the scaling relations plus quantative morphological measures for galaxy clusters up to z=1 to constrain models for galaxy evolution. Here we request 24 orbits to obtain ACS imaging of the remaining three clusters in our sample at z~0.7-1.0. High resolution imaging of the clusters is critical for our study of star formation histories and structural evolution in dense environments since z<1. We have previously obtained deep spectroscopic observations of the clusters with Gemini. The data will provide samples large enough to establish the slope of the FP for each cluster. With multiple clusters at similar redshifts, we can probe evolutionary differences within a single epoch in order to decouple changes due to different environments. Our two other high-z clusters exhibit different chemical enrichment histories, which we argue are due to the different merging histories of these clusters.

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Proposal Category: GO
Scientific Category: AGN/QUASARS
ID: 10827
Title: Imaging Polarimetry of the Seyfert 1 MCG-6-30-15: Clues to the Structure of Warm Absorbers
PI: Gerard Kriss
PI Institution: Space Telescope Science Institute

Imaging polarimetry at high spatial resolution, which is only possible with HST, offers a potentially powerful new tool for determining the orientation

and geometry of AGN containing warm absorbers. These absorbed AGN tend to be more highly polarized than unabsorbed Type 1s, but less polarized than Type 2s. If the polarized flux is due to a polar scattering region as seen in polarized flux images of Seyfert 2s, imaging polarimetry of nearby absorbed Type 1 objects using HST can detect and resolve these scattering regions. We propose to make the first HST imaging polarimetry study of an absorbed Seyfert 1 by obtaining broad and narrow-band polarization images with the ACS of the prototypical "dusty warm absorber" in MCG-6-30-15 (z=0.0077, D~33 Mpc). We will measure the wavelength dependence of the polarized light free from dilution by the host galaxy starlight in order to assess whether the polarization is due to a nuclear scattering region or dichroic transmission through the absorbing dust. Narrow-band H-alpha polarization images will enable us to separate the polarization of the nucleus from the known circumnuclear emission-line disk. These observations will enable us to (1) use the wavelength dependence of unresolved polarized flux to understand the properties of the absorbing dust suggested by X-ray spectral features attributed to Fe~I absorption, and (2) test whether polarization in warm absorbers is due to resolved polar scattering regions. Resolving the scattering region in a moderately polarized Seyfert 1 such as MCG-6-30-15 will let us answer the question of whether line-of-sight inclination can be directly linked to observed outflow characteristics, as suggested by the most recent unified models of AGN outflows.

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Proposal Category: GO
Scientific Category: ISM AND CIRCUMSTELLAR MATTER
ID: 10828
Title: Debris Disks Around Nearby Young M Dwarfs
PI: Michael Liu
PI Institution: University of Hawaii

We propose to obtain HST/ACS F606W coronagraphic imaging of two young (10--50 Myr), nearby (25--55 pc) M dwarfs to resolve their debris disks in scattered light. Little is known about debris disks around M dwarfs, as very few examples are known and only one, the AU Mic debris disk, has been spatially resolved thus far. IR/sub-mm photometry of our targets indicate large quantities of exceptionally cold dust, comparable to the prototype AU Mic system, and make them excellent candidates for resolved studies with physical resolutions of 1-2 AU. HST/ACS provides an excellent capability for detection of disks in scattered light. Modeling the disk images will allow us to quantify the radial and vertical structure and to search for disk sub-structure, a potential probe of the planet formation process in these young systems. Our program can expand the census of young resolved debris disks, of which very few are currently known. M dwarfs have been largely over-looked in myriad imaging searches: our program will complement the many current programs focusing on the higher-mass AFGK stars. Because our targets belong to nearby young moving groups with known resolved disks around higher mass stars, a key potential outcome of our program is comparative study of coeval debris disks

over a range of stellar masses.
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Proposal Category: GO
Scientific Category: ISM IN EXTERNAL GALAXIES
ID: 10829
Title: Secular Evolution at the End of the Hubble Sequence
PI: Paul Martini
PI Institution: The Ohio State University Research Foundation

The bulgeless disk galaxies at the end of the Hubble Sequence evolve at a glacial pace relative to their more violent, earlier-type cousins. The causes of their internal, or secular evolution are important because secular evolution represents the future fate of all galaxies in our accelerating Universe and is a key ingredient to understanding galaxy evolution in lower-density environments at present. The rate of secular evolution is largely determined by the stability of the cold ISM against collapse, star formation, and the buildup of a central bulge. Key diagnostics of the ISM's stability are the presence of compact molecular clouds and narrow dust lanes. Surprisingly, edge-on, pure disk galaxies with circular velocities below 120 km/s do not appear to contain such dust lanes. We propose to obtain ACS/WFC F606W images of a well-selected sample of extremely late-type disk galaxies to measure the characteristic scale size of the cold ISM and determine if they possess the unstable, cold ISM necessary to drive secular evolution. Our sample has been carefully constructed to include disk galaxies above and below the critical circular velocity of 120 km/s where the dust properties of edge-on disks change so remarkably. We will then use surface brightness profiles to search for nuclear star clusters and pseudobulges, which are early indicators that secular evolution is at work, as well as measure the pitch angle of the dust lanes as a function of radius to estimate the central mass concentrations.
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Proposal Category: GO
Scientific Category: AGN/QUASARS
ID: 10830
Title: J170902+641728: ACS Imaging of an Unusual Compact Object
PI: Neal Miller
PI Institution: Associated Universities, Inc.

This proposal seeks a single orbit of ACS/WFC observations to image the unusual compact object J170902+641728. Its optical spectrum is that of a narrow-line Seyfert 1 and reveals the presence of a 1E6 solar mass black hole, yet ground-based imaging and spectroscopy are unable to provide evidence for the expected 1E9 solar mass of stars. Thus, it is a candidate "naked black hole" and potentially of paramount interest in the study of the formation and evolution of galaxies. Despite the simplicity and short duration of the proposed observations, they will be pertinent to multiple astronomical questions. Should a host galaxy be detected, the system will provide another

data point in extrapolating black hole and bulge mass correlations to lower masses. There are few such systems available despite their great importance in evaluating models of black hole and galaxy growth, and those that do exist are in galaxies less compact than J170902+641728. It would also provide important context in the assessment of HE0450-2958, the most recently claimed potential naked black hole. These two objects share optical spectral properties and lack firm detections of host galaxies, yet J170902+641728 is a factor of four more nearby and hence easier to study.

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Proposal Category: GO
Scientific Category: COSMOLOGY
ID: 10831
Title: A new wide-separation Einstein Cross at z=2.7
PI: Leonidas Moustakas
PI Institution: Jet Propulsion Laboratory

We propose ACS F555W and F814W imaging observations of a new wide-separation Einstein Cross selected from SDSS spectroscopy through a bright anomalous emission line and confirmed recently with Keck imaging and spectroscopy. The source galaxy is a moderately luminous (L~0.2L*) Lyman-alpha emitter at z=2.699, which is magnified and extended by more than a factor of twenty, making it one of the most accessible high-redshift bright Ly-a emitters on the sky. Its apparent flux is only 1.2 magnitudes fainter than MS1612-cB58, making this an ideal system for detailed study of the metallicity and initial mass function of a high-redshift star forming galaxy. The Einstein Radius is ~1.8arcsec, one of the widest known, making future spectroscopic ground-based followup optimal. This angle subtends ~5 kpc at the lens galaxy at z=0.331. The high resolution, high signal to noise imaging we propose to obtain will allow us to build accurate lensing models, including source reconstructions; combined with existing and planned Keck spectroscopy, will make possible a map of the host dark matter halo density profile to greater than one effective light radius; and will reveal lower surface brightness features associated with the bright star-forming knot lensed into the Cross. Finally, it will be an exquisite Hubble Heritage galaxy, which will be indispensable for many other applications. We are requesting a very modest proprietary period, in order to provide high-level reductions and ancillary data publically available simultaneously.

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Proposal Category: GO
Scientific Category: COOL STARS
ID: 10832
Title: Solving the microlensing puzzle: An HST high-resolution imaging approach
PI: Brian Patten
PI Institution: Smithsonian Institution Astrophysical Observatory

We propose to use the HST Advanced Camera for Surveys High Resolution Channel to obtain high resolution imaging data for 10 bona-fide LMC microlensing events seen in the original MACHO survey. The purpose of this survey will be to assess whether or not the lens and source stars have separated enough to be resolved since the original microlensing event took place - about a decade has passed since the original MACHO survey and the HST WFPC2 follow-up observations of the microlensing events. If the components of the lensing event are resolved, we will determine the apparent magnitude and color of both the lens and the source stars. These data, in combination with Spitzer/IRAC data and Magellan near-IR JHK data, will be used to ascertain the basic properties of the lens stars. With the majority of the microlensing events in the original MACHO survey observed at the highest spatial resolution currently possible, we will be able to draw important conclusions as to what fraction of these events have lenses which belong to some population of dwarf stars in the disk and what fraction must be due to lenses in the halo or beyond. These data will greatly increase our understanding of the structure of the Galaxy by characterizing the stellar population responsible for the gravitational microlensing.

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Proposal Category: GO
Scientific Category: AGN/QUASARS
ID: 10833
Title: Host Galaxies of Reverberation Mapped AGNs
PI: Bradley Peterson
PI Institution: The Ohio State University Research Foundation

We propose to obtain unsaturated high-resolution images of 17 reverberation-mapped active galactic nuclei in order to remove the point-like nuclear light from each image, thus yielding a "nucleus-free" image of the host galaxy. This will allow investigation of host galaxy properties: our particular interest is determination of the host-galaxy starlight contribution to the reverberation-mapping observations. This is necessary (1) for accurate determination of the relationship between the AGN nuclear continuum flux and the size of the broad Balmer-line emitting regions of AGNs, which is important in estimating black hole masses for large samples of QSOs, and (2) for accurate determination of the bolometric luminosity of the AGN proper. Through observations in Cycles 12 and 14, we have obtained or will obtain images of 18 of the 35 objects in the reverberation-mapping compilation of Peterson et al. (2004). These observations revealed that the host-galaxy contribution, even in the higher-luminosity AGNs, is higher than expected and that all of the reverberation-mapped AGNs will have to be observed, not just the lower-luminosity sources; each source is different, and each source is important. Therefore we request time to observe the 17 remaining reverberation-mapped AGNs.

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Proposal Category: GO
Scientific Category: HOT STARS

ID: 10834
Title: The Shell of the Recurrent Nova T Pyx
PI: Bradley Schaefer
PI Institution: Louisiana State University and A & M College

T Pyx is the only known recurrent nova with a shell. This 'shell' is mysterious because it has been resolved into thousands of knots that apparently aren't expanding. We propose to take a deep F658N image of T Pyx during one orbit to serve as a 12 year baseline from the previous HST WFPC2 images in 1994 and 1995. This much longer baseline will allow us to push down the limits on expansion velocities to ~10 km/s and will allow us to measure the lifetimes of the knots. Also, we expect to discover the expanding inner shell from the last eruption in 1966 which should now have expanded to ~0.9" in radius. Detailed modeling of the observed line fluxes will give the mass of the individual knots and the shells. The details of the expansion velocities, lifetimes, and masses of the knots will determine the nature of the T Pyx shell; with alternatives being a nova shell, a planetary nebula, stalled shocks in a pre-existing shell, or a cloud ionized by the high luminosity and temperature of the white dwarf. If we can separate out the mass ejected during the 1966 eruption, then we can compare it to the total mass accreted between the 1944 and 1966 eruptions (6.0x10^-6 solar mass) so as to determine whether the white dwarf is gaining or losing mass on average. If the white dwarf is gaining mass, then it must inevitably exceed the Chandrasekhar mass and collapse as a Type Ia supernova, and thus recurrent novae would be shown to be an important component of the solution to the Type Ia progenitor problem.
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Proposal Category: GO
Scientific Category: UNRESOLVED STELLAR POPULATIONS
ID: 10835
Title: Probing The Globular Cluster / Low Mass X-ray Binary Connection in Early-type Galaxies At Low X-ray Luminosities
PI: Gregory Sivakoff
PI Institution: The University of Virginia

Combined high-resolution imaging from Hubble and Chandra (CXO) has revolutionized our understanding of extragalactic low-mass X-ray binaries (LMXBs) and globular clusters (GCs), yet their connection in early-type galaxies has remained unstudied at the luminosities of the Galactic LMXBs in GCs. NGC 4278 and 3379 will be the first two prototypical elliptical galaxies with deep CXO observations enabling the study of LMXBs at lower luminosities. We propose mosaic ACS observations of both galaxies (5 fields per galaxy) that will provide the most comprehensive view into the connection between GCs and LMXBs in early-type galaxies. We will detect ~860 and ~270 GCs in all of NGC 4278 and NGC 3379, respectively. These two galaxies will have among the greatest number of detected GC-LMXBs to date (~130 & 50) and will include the

faintest GC-LMXBs in a normal early-type galaxy. We will measure the fraction of GCs which contain LMXBs, as a function of X-ray luminosity, galactocentric distance, color, and GC half-light radius. Using the radial profiles of optical light, GCs, and LMXBs, we will determine the percentage of field LMXBs which may have originated in GCs. We will use the measured GC properties over the entire extent of both galaxies to constrain theories of GC formation and evolution.

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Proposal Category: GO
Scientific Category: UNRESOLVED STELLAR POPULATIONS
ID: 10836
Title: The Red Sequence at 1.3 < z < 1.4 in Galaxy Clusters
PI: S. Stanford
PI Institution: University of California - Davis

We propose to obtain NIC3/F160W imaging of three new IRAC-selected galaxy clusters at 1.3 < z < 1.5. In combination with deep ACS/F850LP images being obtained in Cycle 14, the resulting precision photometry in a rest ~U - R color will allow us to construct color-magnitude diagrams which can be used to measure the slope and scatter in the red sequence galaxies, thereby constraining the history of star formation in the early-type galaxies. The number of morphologically-selected early-type galaxies more luminous than L* will allow us to test the predictions of the hierarchical merging scenario for galaxy formation in clusters at the highest available redshifts in galaxy clusters.

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Proposal Category: GO
Scientific Category: HOT STARS
ID: 10837
Title: Establishing the Nature of a Mysterious Evolved Star, HD179821
PI: Toshiya Ueta
PI Institution: USRA SOFIA Office/NASA Ames Research Center

We propose to reobserve the spherical circumstellar shells of an evolved star, HD 179821. The nature of this object, whether it is an intermediate-mass post-asymptotic giant branch star or a massive super-giant, has been debated over years. The past investigations scrutinized the properties of the object and its circumstellar shells. This enigmatic object possesses characteristics of a post-AGB star and a yellow hyper-giant, and there is no evidence that unambiguously defines the nature of this object. The circumstellar shell of HD 179821 was imaged in the previous WFPC2 observations during cycle 6, and its multiple concentric arcs extending out to about 8 arcsec were revealed. The purpose of the proposed HST observations is to obtain the second-epoch images of this source and perform proper-motion measurements of the shells in order to directly determine the distance to this object, thereby establishing

its incredibly elusive nature once and for all. It has been nearly 10 years since the last observations. Given the object's rather high expansion velocity of 34 km/s, the expected angular expansion is 72 milli-arcsec if the object is located at 1 kpc and 12 milli-arcsec if 6 kpc. These values are well above the smallest material motion we can measure, 2 to 3 milli-arcsec, in our methodology that has been proven in our recent proper-motion measurements on a proto-planetary nebula, the Egg Nebula, using the archived HST/NICMOS near-IR continuum data. We estimate that the new distance measurement is of about 10% error. Once we obtain the distance to HD 179821, we will construct a radiative transfer model of the object to constrain physical parameters of the star and shells with a greater certainty. Then, we can confront theories of the stellar evolution with the newly obtained revelation. In addition, we can examine if all shells are moving at the same speed, since there are multiple shells around HD 179821. It is typically assumed that the expansion of the circumstellar shells is constant over the lifetime of the nebula. Our results will immediately test the validity of this one of the most fundamental assumptions in the stellar outflows.

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Proposal Category: GO
Scientific Category: RESOLVED STELLAR POPULATIONS
ID: 10838
Title: Understanding the Least Luminous Galaxies in the Nearby Universe
PI: Daniel Zucker
PI Institution: University of Cambridge

We propose to obtain deep color-magnitude data of the M31 satellites Andromeda IX and Andromeda X, which we recently discovered (Zucker et al. 2004, 2006) and which are possibly the least luminous galaxies known (Mv ~ -8). These objects are laboratories to study this extreme regime of galaxy formation and understand whether there is a clear lower limit to the galaxy mass function. Specifically, we want to check, from deep ACS pointings (F606W, F814W) at their centers, whether these objects contain single or multiple age stellar populations, possibly with a metallicty spread. To bypass the age-metallicity degeneracy we require accurate photometry for the main sequence turnoff and giant branch stars. We also wish to map the overall structure of these objects via 3 x 3 mosaics of ACS single-orbit pointings (also F606W and F814W). From this, we can determine if they are round and relaxed, or display signs of tidal distortion. In addition, the mosaic will enable us to measure stellar population substructure, such as a metallicity gradient with radius.

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Proposal Category: GO
Scientific Category: AGN/QUASARS
ID: 10839
Title: The NICMOS Polarimetric Calibration
PI: Dan Batcheldor

PI Institution: Rochester Institute of Technology

Recently, it has been shown that NICMOS possesses an instrumental polarization at a level of 1.2%. This completely inhibits the data reduction in a number of previous GO programs, and hampers the ability of the instrument to perform high accuracy polarimetry. In all, 90 orbits of HST data are affected, with potentially many more in Cycle 15. We propose to obtain high signal to noise observations of three polarimetric standards at the cardinal roll angles of the NICMOS polarizers for both NIC1 and NIC2. These observations are designed to fully characterize the instrumental polarization in order for NICMOS to reach its full potential by enabling high accuracy polarimetry of sources with polarizations around 1%. The residual polarization will also be determined as a function of position and spectral energy distribution. Our group will rapidly turn around the required data products and produce reports and software for the accurate representation of the instrumental polarization. These items will be presented to STScI for dissemination among the wider astronomical community.

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Proposal Category: GO
Scientific Category: STAR FORMATION
ID: 10840
Title: The FUV fluxes of Tauri stars in the Taurus molecular cloud
PI: Nuria Calvet
PI Institution: University of Michigan

Present and forthcoming ground-based and space surveys of the T Tauri stars in the Taurus molecular cloud will provide information from high energy stellar and accretion radiation to low energy solid state and molecular emission from the disk, making those stars perfect laboratories to carry out self-consistent studies of disk physics and evolution. We propose to complete this wealth of information by obtaining ACS/FUV spectra for a significant sample of Taurus T Tauri stars, covering a range of accretion properties and dust evolutionary stages. FUV fluxes carry ~ 10 - 100 more energy than X-rays into these disks and are thus crucial gas heating agents and key to disk dispersal by photoevaporation. These observations are a pre-requisite to interpret observations with Spitzer, SOFIA, Herschel, and ALMA, and will become one of the important legacies of HST to the star formation community.

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Proposal Category: GO
Scientific Category: RESOLVED STELLAR POPULATIONS
ID: 10841
Title: A Proper Motion Search for Intermediate Mass Black Holes in Globular Clusters (2nd Epoch Observations)
PI: Rupali Chandar
PI Institution: The Johns Hopkins University

Establishing the presence or absence of intermediate-mass black holes (IMBH) in globular clusters is crucial for understanding the evolution of dense stellar systems. Observationally, this search has been hampered by the low number of stars with known velocities in the central few arcseconds. This limits our knowledge of the velocity dispersion in the region where the gravitational influence of any IMBH would be felt. In Cycle 13, we successfully obtained ACS/HRC images of the centers of five carefully chosen Galactic globular clusters (GO-10401) for a new proper motion study. Although the science case was approved and the first epoch images obtained, the requested future cycle observations were not granted (due to a general policy decision based on the strong uncertainties at the time concerning the immediate future of HST). We have now assessed the quality of the first epoch observations. The HRC resolution reveals many isolated stars in to the very center of each cluster that remained blended or unresolved in previous WFPC2 data. Given a two year baseline, we are confident that we can achieve the proper motion precision required to place strict limits on the presence of an IMBH. Therefore, we request the second-epoch, follow-up observations to GO-10401 in order to measure the proper motions of stars in our target clusters. These velocity measurements will allow us to: (i) place constraints on the mass of a central black hole in each cluster; (ii) derive the internal velocity dispersion as a function of cluster radius; (iii) verify or reject previous reports of cluster rotation; and (iv) directly measure velocity anisotropy as a function of radius. If no second epoch data are obtained then the observing time already invested in the first epoch will have been wasted.

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Proposal Category:	GO
Scientific Category:	COSMOLOGY
ID:	10842
Title:	A Cepheid Distance to the Coma Cluster
PI:	Kem Cook
PI Institution:	Lawrence Livermore National Laboratory

We propose to use the Advanced Camera for Surveys to search for Cepheid variables in two spiral galaxies in the core of the Coma cluster. A direct application of the canonical primary distance indicator at 100 Mpc will measure the far-field Hubble constant free of many of the systematic uncertainties which beset current determinations relying on secondary indicators. Establishing the far-field H_o with Cepheids will provide one of the strongest links in the extragalactic distance scale and will directly calibrate the fiducial fundamental plane of elliptical galaxies in Coma. With ACS/HRC, S/N=5 to 10 or better can be reached for Cepheids with periods of 40d to 70d at mean light in 5 orbits with the F606W filter if H_o=72 km/s/Mpc. Efficient detection and phasing can be done with twelve epochs optimally spaced for periods of 40-70d.

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Proposal Category: GO
Scientific Category: UNRESOLVED STELLAR POPULATIONS
ID: 10843
Title: Deep Imaging of Extremely Metal-Poor Galaxies
PI: Michael Corbin
PI Institution: Arizona State University

Conflicting evidence exists regarding whether the most metal-poor and actively star-forming galaxies in the local universe such as I Zw 18 contain evolved stars. We propose to help settle this issue by obtaining deep ACS/HRC U, narrow-V, I, and H-alpha images of nine nearby ($z < 0.01$) extremely metal-poor ($12 + O/H < 7.65$) galaxies selected from the Sloan Digital Sky Survey. These objects are only marginally resolved from the ground and appear uniformly blue, strongly motivating HST imaging. The continuum images will establish: 1.) If underlying populations of evolved stars are present, by revealing the objects' colors on scales ~10 pc, and 2.) The presence of any faint tidal features, dust lanes, and globular or super star clusters, all of which constrain the objects' evolutionary states. The H-alpha images, in combination with ground-based echelle spectroscopy, will reveal 1.) Whether the objects are producing "superwinds" that are depleting them of their metals; ground-based images of some of them indeed show large halos of ionized gas, and 2.) The correspondence of their nebular and stellar emission on scales of a few parsecs, which is important for understanding the "feedback" process by which supernovae and stellar winds regulate star formation. One of the sample objects, CGCG 269-049, lies only ~2 Mpc away, allowing the detection of individual red giant stars in it if any are present. We have recently obtained Spitzer images and spectra of this galaxy to determine its dust content and star formation history, which will complement the proposed HST observations.

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Proposal Category: GO
Scientific Category: HOT STARS
ID: 10844
Title: Following Eta Carinae's Change of State
PI: Kris Davidson
PI Institution: University of Minnesota - Twin Cities

Eta Carinae is now known to be undergoing some unusually rapid changes on a timescale of several years. They are probably essential for modeling the star's long-term recovery from its Giant Eruption 160 years ago -- the prototype "supernova impostor" event. Since high spatial resolution is needed to isolate the central star, and the present state will probably not recur in the future, it is important to obtain HST data during the next two years. We propose a cost-effective set of ACS observations with three goals: (1) to obtain a continuing record of the star's rapid UV and visual brightening; (2) to lengthen the temporal baseline of ACS images enough to settle an important question concerning ejecta ages; and (3) to extend the record of

morphological changes in the inner ejecta past the midpoint of eta Car's 5.5-year cycle.

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Proposal Category: GO
Scientific Category: RESOLVED STELLAR POPULATIONS
ID: 10845
Title: HUNTING FOR OPTICAL COMPANIONS TO BINARY MILLISECOND PULSARS IN TERZAN 5 AND NGC6266
PI: Francesco Ferraro
PI Institution: Universita di Bologna

We propose deep ACS/WFC and NICMOS observations to search for optical companions to binary millisecond pulsar (MSPs) in two Globular Clusters (GCs): Terzan 5 and NGC6266. Terzan 5 has the largest MSP population of any GC: 33 MSP (17 in binary systems) have been discovered up to now in this stellar system. NGC6266 ranks fifth among the GC for wealth of MSPs but it is the only one in which all the (six) detected MSPs are in binary systems. Only 5 optical counterparts to binary MSP companions are known in GCs (two of them have been discovered by our group): hence even the addition of a few new identifications are crucial to investigate the variety of processes occurring in binary MSPs in dense environment. The observations proposed here would easily double/triple the existing sample of known MSP companions, allowing the first meaningful study of the phenomena which drive the formation and evolution of these exotic systems. Moreover, since most of binary MSP in GC are formed via stellar interactions in the high density regions of the cluster, the determination of the nature of the companion and the incidence of this collisionally induced population have a significant impact on our knowledge of the cluster dynamics. Even more interesting, the study of the optical companions to NSs in a GC allows to derive tighter constraints (than those obtainable for NS binaries in the galactic field) on the properties (mass, orbital inclination and so on) of the compation star. This has, in turn, an intrisic importance for fundamental physics since it offers the opportunity of measuring the mass of the NS and hence to put constraints to the equation of state of matter at nuclear equilibrium density.

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Proposal Category: GO
Scientific Category: COSMOLOGY
ID: 10846
Title: The Halo Structure of RCS2-2327.4-0204
PI: Michael Gladders
PI Institution: Carnegie Institution of Washington

We propose ACS, NICMOS, and Chandra observations of the central region of the extraordinary and newly discovered galaxy cluster: RCS2-2327.4-0204 at z=0.700. This cluster shows 3 or more arcs in ground-based imaging, with an Einstein radius of 49". Such a large Einstein radius (3-4 times larger than

seen in most clusters) has been seen in precisely one other cluster in the universe - namely Abell 1689 at z=0.18. From our proposed data we expect to see ~70 lensed source images, from ~20 image families. We will use both strong and weak lensing constraints from these data to construct the central mass profile of the cluster, which, when combined with ground based data extending to a half degree FOV, will allow us to measure critically important dark matter halo parameters (such as concentration). The target cluster is selected from a large ongoing survey with a well-defined search volume, which allows us to compare our results to expectations from simulations. We will also compare the lensing derived mass profiles to the x-ray equivalent measures; this will illuminate whether the dominant baryonic component is in equilibrium with the potential. The area of high magnification behind this cluster is an order of magnitude larger than typical lensing clusters observed previously by HST; this order of magnitude increase in area directly translates into a 10 times better chance for finding very high redshift galaxies. Many of the highest redshift galaxies found to date have been found behind massive lensing clusters observed by HST, and we expect to add to that sample dramatically.

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Proposal Category:	GO
Scientific Category:	ISM AND CIRCUMSTELLAR MATTER
ID:	10847
Title:	Coronagraphic Polarimetry of HST-Resolved Debris Disks
PI:	Dean Hines
PI Institution:	Space Science Institute

We propose to take full advantage of the recently commissioned coronagraphic polarimetry modes of ACS and NICMOS to obtain imaging polarimetry of circumstellar debris disks that were imaged previously by the HST coronagraphs, but without the polarizers. It is well established that stars form in gas-rich protostellar disks, and that the planets of our solar system formed from a circum-solar disk. However, the connection between the circumstellar disks that we observe around other stars and the processes of planet formation is still very uncertain. Mid-IR spectral studies have suggested that disk grains are growing in the environments of young stellar objects during the putative planet-formation epoch. Furthermore, structures revealed in well resolved images of circumstellar disks suggest gravitational influences on the disks from co-orbital bodies of planetary mass. Unfortunately, existing imaging data provides only rudimentary information about the disk grains and their environments. Our proposed observations, which can be obtained only with HST, will enable us to quantitatively determine the sizes of the grains and optical depths as functions of their location within the disks (i.e., detailed tomography). Armed with these well-determined physical and geometrical systemic parameters, we will develop a set of self-consistent models of disk structures to investigate possible interactions between unseen planets and the disks from which they formed. Our results will also calibrate models of the thermal emission from these disks, that will in turn enable us to infer the properties of other debris disks that

cannot be spatially resolved with current or planned instruments and telescopes.

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Proposal Category: GO
Scientific Category: AGN/QUASARS
ID: 10848
Title: Relating the host galaxies of type-2 quasars to their infrared properties
PI: Mark Lacy
PI Institution: California Institute of Technology

The obscured quasar population has been found to consist of a wide variety of objects. In this proposal, we wish to study the host galaxies of six z~0.6 type-2 quasars selected via their mid-infrared emission. Infrared spectra and photometry of these objects show that they include both actively star-forming and non-starforming galaxies, and have dust columns to the AGN ranging from moderate to high. We will relate the host galaxy properties to the infrared properties of these type-2 quasars, and to the host galaxies of type-1 quasars of similar redshift and bolometric luminosity. These observations will thus help us to understand how the different types of obscured quasars are related to each other, and to the normal quasar population.

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Proposal Category: GO
Scientific Category: ISM AND CIRCUMSTELLAR MATTER
ID: 10849
Title: Imaging Scattered Light from Debris Disks Discovered by the Spitzer Space Telescope around 21 Sun-like Stars
PI: Stanimir Metchev
PI Institution: University of California - Los Angeles

We propose to use the high-contrast capability of the NICMOS coronagraph to image a sample of newly discovered circumstellar disks associated with Sun-like stars. These systems were identified by their strong thermal infrared (IR) emission with the Spitzer Space Telescope as part of the Spitzer Legacy Science program titled "The Formation and Evolution of Planetary Systems" (FEPS, P.I.: M.Meyer). Modeling of the thermal excess emission from the spectral energy distributions alone cannot distinguish between narrowly confined high-opacity disks and broadly distributed, low-opacity disks. By resolving light scattered by the circumstellar material, our proposed NICMOS observations can break this degeneracy, thus revealing the conditions under which planet formation processes are occuring or have occured. For three of our IR-excess stars that have known radial-velocity planets, resolved imaging of the circumstellar debris disks may further offer an unprecedented view of planet-disk interactions in an extrasolar planetary system. Even non-detections of the light scattered by the circumstellar material will place strong constraints on the disk geometries, ruling out disk models with high

optical depth. Unlike previous disk imaging programs, our program contains a well-defined sample of ~1 solar mass stars covering a range of ages from 3 Myr to 3 Gyr, thus allowing us to study the evolution of disks from primordial to debris for the first time. The results from our program will greatly improve our understanding of the architecture of debris disks around Sun-like stars, and will create a morphological context for the existence of our own solar system. This proposal is for a continuation of an approved Cycle 14 program (GO/10527, P.I.: D. Hines).
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Proposal Category: GO
Scientific Category: RESOLVED STELLAR POPULATIONS
ID: 10850
Title: A Precision White Dwarf Cooling Age for NGC 6397
PI: R. Rich
PI Institution: University of California - Los Angeles

We propose to obtain second epoch imaging of the globular cluster NGC 6397 to enable the construction of a proper motion - cleaned white dwarf cooling sequence reaching fainter than the observed truncation point of the white dwarf luminosity function; a byproduct will be absolute proper motions (relative to the extragalactic reference frame) of the rich spheroid field population. Our data appears to show the long sought ``blue hook'', a feature in the WD cooling sequence predicted in theoretical white dwarf models; the improved photometry and statistics afforded by the second epoch observations are needed to confirm the blue hook and to test other aspects of white dwarf cooling models. The proposed observations will provide formal constraints on the age and formation timescale of NGC 6397 that will be smaller than 1 Gyr. The final proper motion-purified white dwarf sequence will be a powerful constraint for white dwarf cooling models and atmospheres, the basis for white dwarf-based globular cluster age determinations.
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Proposal Category: GO
Scientific Category: COOL STARS
ID: 10851
Title: Solving the Riddle of the Red Rectangle: Proper Motion Study of a Bipolar Nebula around a Binary
PI: Raghvendra Sahai
PI Institution: Jet Propulsion Laboratory

We propose to use ACS to obtain second-epoch, high spatial-resolution images of the nearest Pre-Planetary nebula, the Red Rectangle (RR). The RR is a Rosetta Stone for testing our understanding of binarity in the evolution of AGB stars to bipolar planetary nebulae, because it is a known binary with well determined orbital and circumbinary disk characteristics, and because of its proximity (330-700 pc). Recent analysis of archival STIS data shows evidence for outflow motion of about 100 km/s. Thus, 2nd epoch observations, in

combination with those of 8 years ago, will yield a direct detection of proper motion of sharp nebular structures and the overall expansion rate of this nebula. The observations will therefore detect and characterise for the first time, the outflow motions of a (possibly) disk-collimated outflow from an evolved binary shaping a bipolar nebula. Deep narrow-band imaging of the RR using the HRC and WFC with the F658N filter will be used to trace H-alpha emission in the central and distant parts of RR, as a probe of the shocked gas. We will run numerical simulations of two currently competing models for shaping the RR, using the FLASH MHD code. This code has been implemented on the JPL supercomputer to study interacting wind processes in the formation of pre-planetary and planetary nebulae. The model predictions of the proper motion vectors will be compared to the observed values, and we will investigate whether tuning of the model parameters is adequate to find fits to the data, or these models have to be abandoned in favor of new ones. This study will help to improve our currently very limited understanding of the role of binarity in the tranformation of AGB stars to planetary nebulae.

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Proposal Category: GO
Scientific Category: STAR FORMATION
ID: 10852
Title: Coronagraphic Polarimetry with NICMOS: Dust grain evolution in T Tauri stars
PI: Glenn Schneider
PI Institution: University of Arizona

The formation of planetary systems is intimately linked to the dust population in circumstellar disks, thus understanding dust grain evolution is essential to advancing our understanding of how planets form. By combining (1) the coronagraphic polarimetry capabilities of NICMOS, (2) powerful 3-D radiative transfer codes, and (3) observations of objects known to span the Class II-III stellar evolutionary phases, we will gain crucial insight into dust grain growth. By observing objects representative of a known evolutionary sequence of YSOs, we will be able to investigate how the dust population evolves in size and distribution during the crucial transition from a star+disk system to a system containing planetesimals. When combine with our previous study on dust grain evolution in the Class I-II phase, the proposed study will help to establish the fundamental time scales for the depletion of ISM-like grains: the first step in understanding the transformation from small submicron sized dust grains, to large millimeter sized grains, and untimely to planetary bodies.

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Proposal Category: GO
Scientific Category: UNRESOLVED STELLAR POPULATIONS
ID: 10853
Title: M82 as a Fossil Starburst: Probing the Super Star Cluster Content of Region B

PI: Linda Smith
PI Institution: University College London

M82 is the nearby archetype starburst galaxy. Its proximity makes it the best local laboratory for understanding and investigating the critical small scale details of the starburst phenomenon. The importance of M82 as a benchmark for starburst studies has been recognised by the STScI-sponsored ACS/WFC mosaic of M82 in the B, V, I and H alpha filters. This proposal supplements this unique legacy dataset by obtaining U-band observations (F330W filter) of the fossil starburst region B in M82. This region is rich in compact intermediate age (~ 1 Gyr) star clusters; their numbers and luminosities indicate that the star formation in this region must once have rivalled that of the present-day nuclear starburst. The combination of U-band photometry with the ACS/WFC STScI BVI survey and archival NICMOS JH data will allow us to derive accurate ages, luminosities and masses for this rare population of intermediate age massive star clusters. The U-band is essential for determining ages of clusters < 2 Gyr old because it measures the depth of the Balmer jump. We will use these data to determine the true shape of the cluster luminosity function (CLF) for the M82-B fossil starburst region and thus address the question of whether young massive clusters will eventually become globular clusters. Is the CLF a power-law (as seen in younger massive cluster populations) or a Gaussian distribution (as seen for old globular cluster systems)? The proposed observations will also allow us to unravel the long-term star formation history by mapping the ages and masses of the clusters within region B to provide information on the evolution and dynamical mixing of starburst clumps within M82.

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Proposal Category: GO
Scientific Category: ISM AND CIRCUMSTELLAR MATTER
ID: 10854
Title: Coronagraphic Imaging of Bright New Spitzer Debris Disks II.
PI: Karl Stapelfeldt
PI Institution: Jet Propulsion Laboratory

Fifteen percent of bright main sequence stars possess dusty circumstellar debris disks revealed by far-infrared photometry. These disks are signposts of planetary systems: collisions among larger, unseen parent bodies maintain the observed dust population against losses to radiation pressure and P-R drag. Images of debris disks at optical, infrared, and millimeter wavelengths have shown central holes, rings, radial gaps, warps, and azimuthal asymmetries which indicate the presence of planetary mass perturbers. Such images provide unique insights into the structure and dynamics of exoplanetary systems. Relatively few debris disks have been spatially resolved. Only thirteen have ever been resolved at any wavelength, and at wavelengths < 10 microns (where subarcsec resolution is available), only ten. Imaging of many other debris disk targets has been attempted with various HST cameras/coronagraphs and

adaptive optics, but without success. The key property which renders a debris disk observable in scattered light is its dust optical depth. The ten disks imaged so far all have a dust excess luminosity >~ 0.01% that of the central star; no disks with smaller optical depths have been detected. Most main sequence stars known to meet this requirement have already been observed, so future progress in debris disk imaging depends on discovering additional stars with large infrared excess. The Spitzer Space Telescope offers the best opportunity in 20 years to identify new examples of high optical depth debris disk systems. We propose to complete ACS coronagraphic imaging followup of bright, new debris disks discovered during the first two years of the Spitzer mission, by observing three additional targets in Cycle 15. Our goal is to obtain the first resolved images of these disks at ~3 AU resolution, define the disk sizes and orientations,and uncover disk substructures indicative of planetary perturbations. The results will open wider a window into the structure of planetary systems.

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Proposal Category: GO
Scientific Category: STAR FORMATION
ID: 10855
Title: The Near-IR Spectra and Thermal Emission of Hot Jupiters
PI: Mark Swain
PI Institution: Jet Propulsion Laboratory

We propose to observe the brightest transiting exoplanet systems, HD 209458b and HD 189733b, during both primary eclipse (transit) and secondary eclipse (when the planet is behind the star). A successful measurement would result in the spectral characterization of both dayside and nightside thermal emission. This, in turn, would result in several important determinations, including (1) the temperature of the dayside, (2) the temperature of the nightside, (3) the probable detection of water, (4) strong constraints on the presence or absence of clouds, and (5) constraints on models of atmospheric transport between the day and night sides. Our selected wavelength region of 1.4 to 2.4 microns includes the two most prominent predicted features (water) in models for hot Jupiter emission. For these observations, we propose to use the NICMOS 3 grism and selected narrow band filters in a carefully designed, differential observation intended to achieve a dynamic range of 10,000:1. Our proposed observations are uniquely enabled by HST, which alone has the combination of stability, sensitivity, wavelength coverage, and dynamic range to make these high-impact observations possible.

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Proposal Category: GO
Scientific Category: UNRESOLVED STELLAR POPULATIONS
ID: 10856
Title: Delayed Negative Feedback in the Super Star Clusters of SBS0335-052E
PI: Rodger Thompson

PI Institution: University of Arizona

The critical unanswered question in calculations of galaxy formation and evolution is the degree of feedback from the formation of the first massive stars on subsequent evolution. Even the sign of the term is uncertain. Super Star Clusters give one very dramatic answer by forming several thousand O stars in a volume with a radius of only a few parsecs. How can that many massive stars form in such a small volume without immediate dissipation of all gas by the intense ionizing radiation from the stars? SBS0335-052E has done this, not once but at least 6 times in a region of approximately 500 parsecs in size. It has also managed to do this with the third lowest metallicity of any known galaxy. The record lowest metallicity is held by its companion SBS0335-052W. These observations are designed to test one answer to this enigma; that all of the ionizing photons are absorbed within a few hundred AU of the stars that emit them. This delays the negative feedback from photoionization and allows the formation of other stars in the immediate neighborhood who are oblivious to the massive stars nearby. This scenario predicts that both molecular and ionized gas exist within the radius of the super star clusters and that their emission should be spatially coincident. We propose to test this hypothesis with high spatial resolution NICMOS camera 2 images in the hydrogen Pa alpha and molecular hydrogen (1-0) S(1) emission lines. Spatial coincidence of the emission regions will confirm that gas within the cluster is shielded from ionizing and dissociating photons and is capable of forming new stars within this tiny region in spite of the presence of thousands of massive stars. The current burst of star formation was probably triggered by interaction with the giant spiral galaxy NGC 1376. This proposal contains parallel observations of this galaxy with the ACS WFC. Due to the intense interest in SBS0335-052 we waive all proprietary rights. The observations will then immediately compliment observations by the Great Observatories, Spitzer and ground base observatories .

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Proposal Category: GO
Scientific Category: ISM AND CIRCUMSTELLAR MATTER
ID: 10857
Title: Are Organics Common in Outer Planetary Systems?
PI: Alycia Weinberger
PI Institution: Carnegie Institution of Washington

Mixtures of water ice and organics seem to pervade surfaces in the outer Solar System, from the rings of Saturn to the Kuiper Belt Objects. The early Earth was bombarded by the leftover planetesimals from the formation of the planets, and these must have been rich in both ice and carbon to provide the building blocks of life. Scattered light from debris disks is remarkably similar in albedo (total scattering efficiency) and color (red) to the objects in the outer solar system. Thus, we have a hint that the same photochemical processes that happened close to home also happen around other stars. We propose to study the color of two debris disks in some detail. Scattering of light is the

only window available to us to see the composition of debris disks in a spatially resolved manner and to assess their potential for containing planets like ours.

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Proposal Category: GO
Scientific Category: COSMOLOGY
ID: 10858
Title: NICMOS Imaging of the z ~ 2 Spitzer Spectroscopic Sample of Ultraluminous Infrared Galaxies
PI: Lin Yan
PI Institution: California Institute of Technology

We propose to obtain NICMOS images of the first large sample of high-z ultra-luminous infrared galaxies (ULIRGs) whose redshifts and physical states have been determined with Spitzer mid-IR spectra. The detection of strong silicate absorption and/or PAH emission lines suggest that the these sources are a mixture of highly obscured starbursts, AGNs and composite systems at z=2. Although some of the spectra show PAH emission similar to local starburst ULIRGs, their bolometric luminosities are roughly an order of magnitude higher. One important question is if major mergers, which are the trigger for 95% of local ULIRGs, also drive this enormous energy output observed in our z=2 sample. The NICMOS images will allow us to (1) measure surface brightness profiles of z~2 ULIRGs and establish if major mergers could be common among our luminous sources at these early epochs, (2) determine if starbursts and AGNs classified based on their mid-IR spetra would have different morphological signatures, thus different dynamic state; (3) make comparisons with the similar studies of ULIRGs at z ~ 0 - 1, thus infer any evolutionary connections between high-z ULIRGs and the formation of normal, massive galaxies and quasars observed today.

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Proposal Category: GO
Scientific Category: AGN/QUASARS
ID: 10859
Title: Precise Measurements of Sgr A* Flare Activity
PI: Farhad Yusef-Zadeh
PI Institution: Northwestern University

Correlated X-ray and near-IR flare emission from Sgr A*, the closest supermassive black hole, contains information about the hydrodynamics, energetics, and accretion behavior of matter within the innermost ten Schwarzschild radii of the hole. We propose HST/NICMOS observations of near-IR flares, in conjunction with already approved obsrevations using XMM-Newton (214 ksec) and CSO (3 nights), which can make the precise, new measurements necessary to understand the radiation mechanism and low luminosity of Sgr A*. HST/NICMOS is required due to its very low and stable background, and its stable, tightly focused PSF, which allow accurate measurement of fainter

flares than can be observed using groundbased adaptive optics systems. We will measure the spectral index distribution, the time-averaged flux and duration of flares, and the statistics of flare activity, and will confirm previously reported quasi-periodic variability. These measurements will have far-reaching implications for testing the inverse Compton scattering (ICS) and synchrotron models of low-luminosity flares, for understanding the process of accretion onto and outflow from supermassive black holes, and for constraining the acceleration mechanism of flares and the inferred black hole spin. This knowledge, in turn, will help us understand more generally low-luminosity AGN and X-ray binaries in a very low/quiescent accretion state.

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Proposal Category: GO
Scientific Category: SOLAR SYSTEM
ID: 10860
Title: The largest Kuiper belt objects
PI: Michael Brown
PI Institution: California Institute of Technology

The past year has seen an explosion in the discoveries of Pluto-sized objects in the Kuiper belt. With the discoveries of the methane-covered 2003 UB313 and 2005 FY9, the multiple satellite system of 2003 EL61, and the Pluto-Charon analog system of Orcus and its satellite, it is finally apparent that Pluto is not a unique oddball at the edge of the solar system, but rather one of a family of similarly large objects in the Kuiper belt and beyond. HST observations over the past decade have been critical for understanding the interior, surface, and atmosphere of Pluto and Charon. We propose here a comprehensive series of observations designed to similarly expand our knowledge of these recently discovered Pluto-sized and near-Pluto-sized Kuiper belt objects. These observations will measure objects' sizes and densities, explore the outcome of collisions in the outer solar system, and allow the first ever look at the interior structure of a Kuiper belt object. Our wide field survey that discovered all of these objects is nearly finished, so after five years of continuous searching we are finally almost complete in our tally of these near-Pluto-sized objects. This large HST request is the culmination of this half-decade search for new planetary-sized objects. As has been demonstrated repeatedly by the approximately 100 previous orbits devoted to the study of Pluto, only HST has the resolution and sensitivity for detailed study of these distant objects. With these new Pluto-sized objects only now being discovered we have a limited window left to still use HST for these critical observations.

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Proposal Category: GO
Scientific Category: UNRESOLVED STELLAR POPULATIONS
ID: 10861
Title: An ACS Treasury Survey of the Coma cluster of galaxies
PI: David Carter

PI Institution: Liverpool John Moores University

We propose to use the unique spatial resolution of HST and ACS to construct a Treasury imaging survey of the core and infall region of the richest local cluster, Coma. We will observe samples of thousands of galaxies down to magnitude B=27.3 with the aim of studying in detail the dwarf galaxy population which, according to hierarchical models of galaxy formation, are the earliest galaxies to form in the universe. Our initial scientific objectives are: 1) A study of the structure of the dwarf galaxies, including scaling laws, nuclear structure and morphology, to compare with hierarchical and evolutionary models of their formation. 2) A study of the stellar populations from colors and color gradients, and how the internal chemical evolution of galaxies is affected by interaction with the cluster gaseous and galaxy environment. 3) To determine the effect of the cluster environment upon morphological features, disks, bulges and bars, by comparing these structure in the Coma sample with field galaxy samples. 4) Identification of dwarf galaxy samples for further study with the new generation of multi-object and integral-field spectrographs on 8-10 metre class telescopes such as Keck, Subaru, Gemini, and GTC. This is the first such survey of a nearby rich cluster. It will provide a key database for studies of galaxy formation and evolution, and a very needed reference for comparison with similar galaxy surveys both in lower density environments in the nearby universe, and in high density environments at high redshifts.

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Proposal Category: GO
Scientific Category: SOLAR SYSTEM
ID: 10862
Title: Comprehensive Auroral Imaging of Jupiter and Saturn during the International Heliophysical Year
PI: John Clarke
PI Institution: Boston University

A comprehensive set of observations of the auroral emissions from Jupiter and Saturn is proposed for the International Heliophysical Year in 2007, a unique period of especially concentrated measurements of space physics phenomena throughout the solar system. We propose to determine the physical relationship of the various auroral processes at Jupiter and Saturn with conditions in the solar wind at each planet. This can be accomplished with campaigns of observations, with a sampling interval not to exceed one day, covering at least one solar rotation. The solar wind plasma density approaching Jupiter will be measured by the New Horizons spacecraft, and a separate campaign near opposition in May 2007 will determine the effect of large-scale variations in the interplanetary magnetic field (IMF) on the Jovian aurora by extrapolation from near-Earth solar wind measurements. A similar Saturn campaign near opposition in Jan. 2007 will combine extrapolated solar wind data with measurements from a wide range of locations within the Saturn magnetosphere by Cassini. In the course of making these observations,

it will be possible to fully map the auroral footprints of Io and the other satellites to determine both the local magnetic field geometry and the controlling factors in the electromagnetic interaction of each satellite with the corotating magnetic field and plasma density. Also in the course of making these observations, the auroral emission properties will be compared with the properties of the near-IR ionospheric emissions (from ground-based observations) and non thermal radio emissions, from ground-based observations for Jupiter□s decametric radiation and Cassini plasma wave measurements of the Saturn Kilometric Radiation (SKR).

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Proposal Category: GO
Scientific Category: COSMOLOGY
ID: 10863
Title: Magnifying the High-z Universe with the Bullet Cluster 1E0657-56
PI: Anthony Gonzalez
PI Institution: University of Florida

We propose to use the bullet cluster 1E0657-56 (z=0.296) as a gravitational telescope to conduct a pencil beam survey of the galaxy population to z=7. The cluster 1E0657-56, one of the hottest and most X-ray luminous clusters known, is a highly efficient lens with critical curves comparable in size to Abell 1689. The proposed observations will yield a high-fidelity strong+weak lensing map of the cluster core, enabling identification of lensed, high-redshift sources and also providing a precision measurement of the cluster mass (good to 5% within 350 kpc). The mass measurement will also serve as a key input for numerical simulations designed to reconstruct the dynamical history of the cluster merger and provide a new constraint on the dark matter self-interaction cross-section. In the cluster core the requested imaging will reach (de-magnified) magnitudes comparable to the Hubble Ultra Deep Field for lensed sources, but with 2+ magnitudes of magnification facilitating spectroscopic follow-up.

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Proposal Category: GO
Scientific Category: STAR FORMATION
ID: 10864
Title: Mapping the Gaseous Content of Protoplanetary and Young Planetary Systems with ACS
PI: Carol Grady
PI Institution: Eureka Scientific Inc.

One of the key problems in planetary system formation is understanding how rapidly, and over what time interval Jovian planets can form. Dust in the protoplanetary disk is critical in planetesimal formation, but it is the gas which produces giant planets, and which is essential for their migration. However, compared to data on the circumstellar dust, information on the gas

component is sparse, especially in the planet-formation zone. This severely limits our ability to put observational constraints on giant planet formation, except to note that the process must be largely complete by 12 Myr, given the paucity of Herbig Ae or classical T Tauri stars older than 10-12 Myr. In the FUV, photo-excited molecular hydrogen transitions have the requisite contrast to the stellar photosphere, accretion shock, and reflection nebulosity, and can be traced 50-100 AU from the exciting stars in both envelopes and outflow cavities and protoplanetary disks. Central disk cavities, an expected consequence of planet formation, larger than 0.1" are directly detectable in HST FUV spectra, while smaller cavities may be detected by comparison with protoplanetary disks which are still accreting onto their stars. We propose augmenting existing HST coronagraphic imagery of 6 Herbig Fe and T Tauri disks with ACS Solar-Blind Channel Lyman alpha imagery and slitless spectroscopy simultaneously sampling the disk in molecular hydrogen and small-grain reflection nebulosity. These data will be used to quantify the amount of vertical stratification in these disks, to map the mass-loss geometry from the star, and to determine whether removal of molecular material preceeds, lags, or is contemporary with clearing of the dust.

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Proposal Category: GO
Scientific Category: RESOLVED STELLAR POPULATIONS
ID: 10865
Title: The Halo of Centaurus A: Tracing its Outermost Limits, Metallicity Distributions, and Merger Models
PI: William Harris
PI Institution: McMaster University

Because NGC 5128 (Centaurus A) is only 4 Mpc distant, we can probe the stellar populations of this giant E/S0 galaxy far more deeply than is possible for any other such galaxy. From our previous HST-based studies, we now know that its halo stars are predominantly both old (8 Gy mean age) and metal-rich ([Fe/H]~ -0.5). We propose to use the ACS/WFC camera to trace the halo of NGC 5128 to its outermost detectable limits at R ~ 140 kpc, and to measure the stellar metallicity distribution function (MDF) outward along both the major and minor axes. This material will allow us to apply entirely new tests on the commonly held idea that NGC 5128 is the result of a merger formation process, since merger models can predict the detailed form of the MDF in the final gE as functions of the progenitor disk and halo metallicity properties. To support our interpretation of the halo metallicity profile, we will construct a comprehensive new series of merger simulations tuned to match this new data.

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Proposal Category: GO
Scientific Category: HOT STARS
ID: 10866
Title: ACS polarimetry of the Vela Pulsar Wind Nebula
PI: Oleg Kargaltsev

PI Institution: The Pennsylvania State University

Observations of the Vela pulsar region with the Chandra X-ray observatory have revealed the fine structure of its synchrotron pulsar-wind nebula (PWN). Deep radio observations have also shown a large, highly polarized (~70%) radio nebula located further away from the pulsar. However, no firm optical detection of the Vela PWN has been reported yet. The detection of the extended emission in previous observations was hindered by the presence of a bright background due to SNR filaments and field stars. Since the degree of polarization in the optical should be similar to that observed in radio, we propose to use the ACS/WFC imaging polarimetry to detect the highly polarized optical emission from the Vela PWN. By subtracting the images obtained with different polarizers we will eliminate the very weakly polarized background component and preserve the strongly polarized PWN emission. Polarimetry will allow us to determine the magnetic field structure inside the PWN. This approach has been successfully tested with ASC/WFC polarimetry of the Crab PWN. Detection of the optical nebula, combined with the radio and X-ray data, will establish the properties of the relativistic pulsar wind, including its energetics, magnetic field structure, spatial evolution and interaction with the ambient medium.

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Proposal Category: GO
Scientific Category: ISM AND CIRCUMSTELLAR MATTER
ID: 10867
Title: SAINTS - Supernova 1987A INTensive Survey
PI: Robert Kirshner
PI Institution: Harvard University

SAINTS is a program to observe SN 1987A, the brightest supernova in 383 years, as it morphs into the youngest supernova remnant at age 19. HST is a unique tool for spatially-resolved observations of the many physical components of SN 1987A. A violent encounter is now underway between the fastest-moving debris and the circumstellar ring: the collision excites "hotspots" that light up suddenly. The optical, infrared and X-ray fluxes are rising rapidly and vary significantly on 6-month time scales: regularly-spaced HST, SPITZER, and CHANDRA observations are needed to understand the physics of these shocked regions. In Cycle 15, the many separate hotspots may begin to fuse as the shock fully enters the circumstellar ring. Photons from these shocks may excite previously invisible gas outside the ring, revealing the true extent of the mass loss that preceded the explosion of Sanduleak -69 202. The inner debris of the explosion itself, still excited by radioactive isotopes produced in the explosion, is now resolved by ACS and seen to be aspherical, providing direct evidence on the asymmetry of the explosion. Many questions about SN 1987A remain unanswered despite our diligent efforts at observation and analysis since the launch of HST. How did the enigmatic three rings form? Precisely what took place in the core during the core collapse and bounce? Is a black hole or a neutron star left behind in the debris? The rich and deep

data set from SAINTS will be a resource for current use and for future reference to help answer these central questions of supernova science.

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Proposal Category: GO
Scientific Category: RESOLVED STELLAR POPULATIONS
ID: 10868
Title: Dynamics of the Galactic bulge/bar
PI: Konrad Kuijken
PI Institution: Universiteit Leiden

We request second-epoch ACS observations of four star fields in the Galactic bar. These will allow us to measure proper motions for tens of thousands of stars well below the turnoff, to construct a dynamical model for the bulge/bar (in combination with data already in hand from other HST fields, and from VLT spectroscopy), and hence to take a unique look at the internal dynamical structure of the central regions of our Galaxy. By relating the kinematics with stellar population we can elucidate the formation history of the bulge and bar, and their relation to the surrounding Galactic disk.

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Proposal Category: GO
Scientific Category: STAR FORMATION
ID: 10869
Title: The upper atmosphere and the escape state of the transiting very-hot-Jupiter HD189733b
PI: Alain Lecavelier des Etangs
PI Institution: CNRS, Institut d'Astrophysique de Paris

The observation of the HD209458b transits in Hydrogen I, Carbon II and Oxygen I in the UV revealed that the atmosphere of this planet is hydrodynamically escaping. These observations raised the question of the evaporation state of hot-Jupiters. Is the evaporation specific to HD209458b or general to hot-Jupiters? What is the evaporation mechanism, and how does the escape rate depend on the planetary system characteristics? The recent discovery of HD189733b, a planet transiting a bright and nearby K0 star (V=7.7), offers the unprecedented opportunity to answer these questions. Indeed, among the stars harboring transiting planets, HD189733 presents the largest apparent brightness in Lyman-alpha, providing capabilities to constrain the escape rate to high accuracy. With ACS/PR110L we propose to observe HI, CII and OI stellar emission lines to search for atmospheric absorptions during the transits. The HI-Lyman alpha occultation light curve will constrain the escape rate and the dynamics of the escaping hydrogen atoms. The observations of CII and OI will constrain the escape velocity and discriminate between Jeans escape and "blow-off". In short, the atmosphere of only a single extrasolar planet has been detected so far leading to the discovery of the evaporation of a hot-Jupiter. Observations of other cases under various physical conditions will provide important constraints on the evaporation state and mechanisms. HD189733b being

a very short period planet orbiting a nearby late type star with bright chromospheric emission lines, it is by far the best target to make significant progress in that field.

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Proposal Category: GO
Scientific Category: SOLAR SYSTEM
ID: 10870
Title: The Ring Plane Crossings of Uranus in 2007
PI: Mark Showalter
PI Institution: SETI Institute

The rings of Uranus turn edge-on to Earth in May and August 2007. In between, we will have a rare opportunity to see the unlit face of the rings. With the nine optically thick rings essentialy invisible, we will observe features and phenomena that are normally lost in their glare. We will use this opportunity to search thoroughly for the embedded "shepherd" moons long believed to confine the edges of the rings, setting a mass limit roughly 10 times smaller than that of the smallest shepherd currently known, Cordelia. We will measure the vertical thicknesses of the rings and study the faint dust belts only known to exist from a single Voyager image. We will also study the colors of the newly-discovered faint, outer rings; recent evidence suggests that one ring is red and the other blue, implying that each ring is dominated by a different set of physical processes. We will employ near-edge-on photometry from 2006 and 2007 to derive the particle filling factor within the rings, to observe how ring epsilon responds to the "traffic jam" as particles pass through its narrowest point, and to test the latest models for preserving eccentricities and apse alignment within the rings. Moreover, this data set will allow us to continue monitoring the motions of the inner moons, which have been found to show possibly chaotic orbital variations; by nearly doubling the time span of the existing ACS astrometry, the details of the variations will become much clearer.

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Proposal Category: GO
Scientific Category: SOLAR SYSTEM
ID: 10871
Title: Observations of the Galilean Satellites in Support of the New Horizons Flyby
PI: John Spencer
PI Institution: Southwest Research Institute

On February 28 2007 the New Horizons (NH) spacecraft will fly by Jupiter on its way to Pluto, and will conduct an extensive series of observations of the Jupiter system, including the Galilean satellites. We propose HST observations to support and complement the New Horizons observations in four ways: 1) Determine the distribution and variability of Io's plumes in the two weeks before NH closest approach, to look for correlations with Io-derived

dust streams that may be detected by New Horizons, to understand the origin of the dust streams; 2) Imaging of SO2 and S2 gas absorption in Io's plumes in Jupiter transit, which cannot be done by NH; 3) Color imaging of Io's surface to determine the effects of the plumes and volcanos seen by New Horizons on the surface- New Horizons cannot image the sunlit surface in color due to saturation; 4) Imaging of far-UV auroral emissions from the atmospheres of Io, Europa, and Ganymede in Jupiter eclipse, near-simultaneously with disk-integrated NH UV spectra, to locate the source of the UV emissions seen by NH and use the response of the satellite atmospheres to the eclipse to constrain production mechanisms.

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Proposal Category: GO
Scientific Category: COSMOLOGY
ID: 10872
Title: Lyman Continuum Emission in Galaxies at z=1.2
PI: Harry Teplitz
PI Institution: California Institute of Technology

Lyman continuum photons produced in massive starbursts may have played a dominant role in the reionization of the Universe. Starbursts are important contributors to the ionizing metagalactic background at lower redshifts as well. However, their contribution to the background depends upon the fraction of ionizing radiation that escapes from the intrinsic opacity of galaxies below the Lyman limit. Current surveys suggest escape fractions of a few percent, up to 10%, with very few detections (as opposed to upper limits) having been reported. No detections have been reported in the epochs between z=0.1 and z=2. We propose to measure the fraction of escaping Lyman continuum radiation from 15 luminous z~1.2 galaxies in the GOODS fields. Using the tremendous sensitivity of the ACS Solar-blind Channel, we will reach AB=30 mag., allowing us to detect an escape fraction of 1%. We will correlate the amount of escaping radiation with the photometric and morphological properties of the galaxies. A non-detection in all sources would imply that QSOs provide the overwhelming majority of ionizing radiation at z=1.3, and it would strongly indicate that the properties of galaxies at higher redshift have to be significantly different for galaxies to dominate reionization. The deep FUV images will also be useful for extending the FUV study of other galaxies in the GOODS fields.

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Proposal Category: GO
Scientific Category: AGN/QUASARS
ID: 10873
Title: The Radio-quiet Jet Flow in Markarian 34
PI: Mark Whittle
PI Institution: The University of Virginia

The properties of AGN jet flows are notoriously difficult to ascertain. We

are currently studying jets in Seyferts by combining emission-line diagnostics with radio observations. We have devised a method of analysis which -- with only modest and reasonable assumptions -- leads to a physical description of the jet flow: its mass, momentum and energy flux, along with its density, velocity and Mach number. We have applied this method to a rich dataset on Markarian 78 and discovered that its jet is very weak, slow, and dense relative to the kind of jets found in radio loud AGN (Whittle \& Wilson 2004, Whittle et al 2005, 2006). Such a difference between radio quiet and radio loud jet flows would be a major result -- if it were found to be generally true. We have more modest observations of a further six Seyferts with jets, but only one of these -- Mkn 34 -- approaches Mkn 78 as a clean enough case to allow our full analysis. Our existing VLA and STIS data are excellent, but the HST archive emission-line and continuum images are of poor quality and low resolution. We are requesting just 3 orbits to obtain higher S/N images at high resolution (ACS/HRC) in [OIII] 5007, [OII] 3727, green and red continuum, bringing the total dataset up to a par with that of Mkn 78. We will then be able to apply our full analysis to determine the nature of the jet flow in this second radio quiet AGN.

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Proposal Category: GO
Scientific Category: COSMOLOGY
ID: 10874
Title: Search for Extremely Faint z>7 Galaxy Population with Cosmic Lenses
PI: Wei Zheng
PI Institution: The Johns Hopkins University

Deep UDF/NICMOS observations find a significant decrease in the number of galaxy candidates between redshift z=6 and 7, but the sampe at z>7 is too small to draw conclusions. From our observations of 15 clusters we have found a number of bright z-dropouts, aided by the lensing amplification. We propose deep NICMOS observations of the best cases of cluster centers where a rare combination of a significant lensing effect and the richness in z-band dropouts in background may dramatically increase the discovery rate. The NICMOS images will reach an unprecendented depth of AB~27.8, or AB~30 in nonlensed intrinsic magnitude, and may find many faint (~0.05L*) galaxies at z=7-10, at a level that the UDF reaches for z~6 objects. We produce precision mass distribution maps from weak-lensing models, which enable us to derive the candidates' intrinsic magnitudes and their luminosity function. The knowledge of such faint galaxy population at z>7 will facilitate the models of the IGM reionization and future JWST planning.

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Proposal Category: SNAP
Scientific Category: COSMOLOGY
ID: 10875
Title: A Snapshot Survey of The Most Massive Clusters of

Galaxies
PI: Harald Ebeling
PI Institution: University of Hawaii

We propose the continuation of our highly successful Cycle14 snapshot survey of a sample of 123 very X-ray luminous clusters in the redshift range 0.3-0.7. As demonstrated by the 21 snapshots obtained so far in Cycle14 these systems frequently exhibit strong gravitational lensing as well as spectacular examples of violent galaxy evolution. The proposed observations will provide important constraints on the cluster mass distributions, the physical nature of galaxy-galaxy and galaxy-gas interactions in cluster cores, and a set of optically bright, lensed galaxies for further 8-10m spectroscopy. Acknowledging the broad community interest in this sample we waive our data rights for these observations.

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Proposal Category: SNAP
Scientific Category: COSMOLOGY
ID: 10876
Title: SL2S: The Strong Lensing Legacy Survey
PI: Jean-Paul Kneib
PI Institution: Observatoire de Marseille

Strong Gravitational Lensing is an invaluable tool to constrain the absolute mass distribution of structures irrespective of their light distribution. Strong Lensing has successfully been applied to single galaxies lensing quasars into multiple images, and to massive clusters lensing background sources into giant arcs. More recently, the Sloan Lens ACS Survey also found numerous examples of isolated, yet massive ellipticals lensing background galaxies into Einstein rings. We have started the Strong Lensing Legacy Survey (SL2S) looking for strong lenses in the 170 sq. degree CFHT-Legacy Survey, using dedicated automated search procedures, optimized for detection of arcs and Einstein rings. Thanks to the unsurpassed combined depth, area and image quality of the CFHT-LS, we uncovered a new population of lenses: the intermediate mass halo and sub-halo lenses. This new population effectively bridges the gap between single galaxies and massive clusters. Here, we propose to obtain SNAPSHOT ACS images of the 50 first strong lens candidates with Einstein radii 2"<Re<9" (found in the first 45 sq. degrees of CFHT-LS data released). The ACS images will allow us to model in details the mass distribution of this new population of lensing groups under various lensing configurations. Using ACS images, we ultimately hope to provide a better understanding of the formation of structures by studying the lensing signatures of the key population of galaxy groups.

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Proposal Category: SNAP
Scientific Category: UNRESOLVED STELLAR POPULATIONS
ID: 10877

Title: A Snapshot Survey of the Sites of Recent, Nearby Supernovae
PI: Weidong Li
PI Institution: University of California - Berkeley

During the past few years, robotic (or nearly robotic) searches for supernovae (SNe), most notably our Lick Observatory Supernova Search (LOSS), have found hundreds of SNe, many of them in quite nearby galaxies (cz < 4000 km/s). Most of the objects were discovered before maximum brightness, and have follow-up photometry and spectroscopy; they include some of the best-studied SNe to date. We propose to conduct a snapshot imaging survey of the sites of some of these nearby objects, to obtain late-time photometry that (through the shape of the light and color curves) will help reveal the origin of their lingering energy. The images will also provide high-resolution information on the local environments of SNe that are far superior to what we can procure from the ground. For example, we will obtain color-color and color-magnitude diagrams of stars in these SN sites, to determine the SN progenitor masses and constraints on the reddening. Recovery of the SNe in the new HST images will also allow us to actually pinpoint their progenitor stars in cases where pre-explosion images exist in the HST archive. This proposal is an extension of our successful Cycle 13 snapshot survey with ACS. It is complementary to our Cycle 15 archival proposal, which is a continuation of our long-standing program to use existing HST images to glean information about SN environments.
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Proposal Category: SNAP
Scientific Category: QUASAR ABSORPTION LINES AND IGM
ID: 10878
Title: An ACS Prism Snapshot Survey for z~2 Lyman Limit Systems
PI: John O'Meara
PI Institution: Massachusetts Institute of Technology

We propose to conduct a spectroscopic survey of Lyman limit absorbers at redshifts 1.7 < z < 2.2, using ACS/HRC and the PR200L prism. We have selected 100 quasars at 2.3 < z < 2.6 from the Sloan Digital Sky Survey Spectroscopic Quasar sample, for which no BAL signature is found at the QSO redshift and no strong metal absorption lines are present at z > 2.3 along the lines of sight. The survey has three main observational goals. First, we will determine the redshift frequency dN/dz of the LLS over the column density range 16.3 <log N_HI < 20.3 cm^-2. Second, we will measure the column density frequency distribution f(N) for the partial Lyman limit systems (PLLS) over the column density range 16.3 < log N_HI < 17.5 cm^-2. Third, we will identify new sightlines for measurements of the primordial D/H ratio. With this survey, we will also constrain two key quantities of cosmological relevance: First, the measurements of dN/dz for optically thick LLS and f(N) for the PLLS are critical to estimating the attenuation of extragalactic ionizing sources (e.g. QSOs). Currently, uncertainties in dN/dz and f(N) are the greatest sources of uncertainty for inferring the shape and intensity of the UV background

radiation field. Second, we will estimate the amount of metals in the LLS using the f(N) and ground based observations of metal line transitions. It is possible that a significant fraction of the "missing metals" at z~2 are associated with these highly ionized absorbers. Third, analysis of the LLS lends to investigations of the interface between galaxies (i.e. the damped Lyman alpha systems) and the intergalactic medium (i.e. the Lyman alpha forest). This survey is ideal for a snapshot observing program, because the on-object integration times are less than 10 minutes, and the targets cover the majority of the northern sky.

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Proposal Category: SNAP
Scientific Category: COOL STARS
ID: 10879
Title: A search for planetary-mass companions to the nearest L dwarfs - completing the survey
PI: Iain Reid
PI Institution: Space Telescope Science Institute

We propose to extend the most sensitive survey yet undertaken for very low-mass companions to ultracool dwarfs. We will use NICMOS to complete imaging of an all-sky sample of 87 L dwarfs in 80 systems within 20 parsecs of the Sun. The combination of infrared imaging and proximity allows us to search for companions with mass ratios q>0.25 at separations exceeding ~3 AU, while probing companions with q>0.5 at ~1.5 AU separation. This resolution is crucial, since no ultracool binaries are known in the field with separations exceeding 15 AU. Fifty L dwarfs from the 20-parsec sample have high-resolution imaging, primarily through our Cycle 13 HST proposal which identified six new binaries, including an L/T system. Here, we propose to target the remaining 30 dwarfs.

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Proposal Category: SNAP
Scientific Category: AGN/QUASARS
ID: 10880
Title: The host galaxies of QSO2s: AGN feeding and evolution at high luminosities
PI: Henrique Schmitt
PI Institution: Naval Research Laboratory

Now that the presence of supermassive black holes in the nuclei of galaxies is a well established fact, other questions related to the AGN phenomena still have to be answered. Problems of particular interest are how the AGN gets fed, how the black hole evolves and how the evolution of the black hole is related to the evolution of the galaxy bulge. Here we propose to address some of these issues using ACS/WFC + F775W snapshot images of 73 QSO2s with redshifts in the range 0.3<z<0.4. These observations will be combined with similar archival data of QSO1s and ground based data of Seyfert and normal galaxies. First, we

will intestigate whether interactions are the most important feeding mechanism in high luminosity AGNs. This will be done in a quantitative way, comparing the asymmetry indices of QSO2 hosts with those of lower luminosity AGNs and normal galaxies. Second, we will do a detailed study of the morphology of the host galaxies of both QSO types, to determine if they are similar, or if there is an evolutionary trend from QSO2s to QSO1s. The results from this project will represent an important step in the understanding of AGN evolution, and may also introduce a substantial modification to the Unified Model.
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Proposal Category: SNAP
Scientific Category: COSMOLOGY
ID: 10881
Title: The Ultimate Gravitational Lensing Survey of Cluster Mass and Substructure
PI: Graham Smith
PI Institution: University of Birmingham

We propose a systematic and detailed investigation of the mass, substructure, and thermodynamics of one hundred X-ray luminous galaxy clusters at $0.15<z<0.3$. The primary goal is to test our recent suggestion that this population is dominated by dynamically immature disturbed clusters, and that the observed mass-temperature relation suffers strong structural segregation. If confirmed, this would represent a paradigm shift in our observational understanding of clusters, that were hitherto believed to be dominated by mature, undisturbed systems. The key observation to this endeavor is Hubble imaging of cluster cores to identify robustly tangential and radial multiple arcs and measure the shape of faint galaxies. These strong and weak lensing signals will give an accurate measure of the total mass and structure of the dark matter distribution that we will subsequently compare with X-ray and Sunyaev Zeldovich Effect observables. The broader applications of our project include 1) the calibration of mass-temperature and mass-SZE scaling relations which will be critical for the calibration of proposed dark energy experiments, and 2) the low redshift baseline study of the demographics of massive clusters to aid interpretation of future high redshift ($z>1$) cluster samples. For this ultimate cluster survey, we request ACS SNAPSHOTS through the F606W filter drawn from a target list of 143 clusters.
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Proposal Category: SNAP
Scientific Category: AGN/QUASARS
ID: 10882
Title: Emission Line Snapshots of 3CR Radio Galaxies
PI: William Sparks
PI Institution: Space Telescope Science Institute

Radio galaxies are an important class of extragalactic objects: they are one of the most energetic astrophysical phenomena and they provide an exceptional

probe of the evolving Universe, lying typically in high density regions but well-represented across a wide redshift range. In earlier Cycles we carried out extensive HST observations of the 3CR sources in order to acquire a complete and quantitative inventory of the structure, contents and evolution of these important objects. We discovered new optical jets, dust lanes, and revealed point-like nuclei whose properties support AGN unified schemes. Here, we propose to obtain ACS emission line images at low and high excitation of 3CR sources with z<0.3, both low- and classical high-power radio galaxies, as a major enhancement to an already superb dataset. We aim to probe fundamental relationships between warm optical line-emitting gas, radio source structure (jets and lobes) and X-ray coronal halos. We will combine our existing UV images with new emission-line images to establish quantitative star formation characteristics and their relation to dust and merging, and with emission-line excitation maps, test theories on ionization beam patterns and luminosities from active nuclei. We will seek jet induced star formation and knowing optical emission-line physics, investigate quantitative jet physics. The nuclear emission line properties of the galaxies will themselves be established and used as ingredients in continuing tests of unified AGN theories. The resulting database will be an incredibly valuable resource to the astronomical community for years to come.

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Proposal Category: SNAP
Scientific Category: ISM IN EXTERNAL GALAXIES
ID: 10883
Title: Light Echoes for Type Ia Supernovae
PI: Lifan Wang
PI Institution: Lawrence Berkeley National Laboratory

We propose a SNAPshot survey of light echoes from highly extinct SNIa. The major science goal is to determine whether the dust causing the reddening of SNIa is of circumstellar origin or interstellar origin. We plan to observe about 25 SNIa. These observations are relevant for the studies of SNIa progenitor systems and for extinction corrections for supernova cosmology.

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Proposal Category: SNAP
Scientific Category: UNRESOLVED STELLAR POPULATIONS
ID: 10884
Title: The Dynamical Structure of Ellipticals in the Coma and Abell 262 Clusters
PI: Gary Wegner
PI Institution: Dartmouth College

We propose to obtain images of 13 relatively luminous early type galaxies in the Coma cluster and Abell 262 for which we have already collected ground based major and minor axis spectra and images. The higher resolution HST images will enable us to study the central regions of these galaxies which is

crucial to our dynamical modelling. The complete data set will allow us to perform a full dynamical analysis and to derive the dark matter content and distribution, the stellar orbital structure, and the stellar population properties of these objects, probing the predictions of galaxy formation models. The dynamical analysis will be performed using an up-to-date axi-symmetric orbit superposition code.
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Proposal Category:	GO
Scientific Category:	UNRESOLVED STELLAR POPULATIONS
ID:	10885
Title:	Deep Photometry of NGC 1569: Understanding the Closest and Strongest Starburst of the Nearby Universe
PI:	Alessandra Aloisi
PI Institution:	Space Telescope Science Institute - ESA

Massive starbursts drive the evolution of galaxies at high redshift, but they can only be studied in detail in the nearby Universe where they are much rarer. The dwarf irregular galaxy NGC 1569 at 2.2 Mpc is the closest example of a true starburst. It has sustained exceptionally high star formation (SF) activity over the last Gyr, 2-3 orders of magnitude higher than in normal dwarf irregulars and spirals. This SF has been probed extensively by previous HST observations that have reached just below the tip of the red giant branch (RGB). But the data have not been able to constrain the more ancient SF history (SFH), so that our understanding remains very incomplete. It is an open question whether NGC 1569 just started to form stars around 1 Gyr ago, or whether significant SF was already active before that. We do not know what triggered the recent SF, how long the current intense SF activity has been going on, and whether such SF activity has been a more common occurrence in the past history of this galaxy. More importantly, most of these questions remain unanswered for other starburst galaxies in the nearby and distant universe as well. HST is the only telescope that can do the necessary crowded-field photometry to resolve these issues. We propose to use ACS/WFC to build a deep I vs. V-I color-magnitude diagram (CMD) that goes some 4 magnitudes deeper than the RGB tip. This will detect and characterize the red clump (RC) and horizontal branch (HB) features. The CMD will be interpreted by fitting synthetic CMDs constructed from evolutionary tracks to infer the SFH. The joint constraints from the presence, apparent magnitude, and width of the RC, HB and RGB features will independently constrain both the age and metallicity of the old and evolved stellar population of NGC 1569, the presence of multiple bursts if any, and their duration and metallicity spread. This will reveal the evolutionary status over cosmic time, and more generally will constrain the processes at play in the origin and evolution of galaxies. This project is only possible because of the high sensitivity of ACS, and it can be done very efficiently because of the location of NGC 1569 in the CVZ. Since NGC 1569 is so close, it may be the only nearby starburst for which these issues can be addressed in the foreseeable future.
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Proposal Category: GO
Scientific Category: COSMOLOGY
ID: 10886
Title: The Sloan Lens ACS Survey: Towards 100 New Strong Lenses
PI: Adam Bolton
PI Institution: Smithsonian Institution Astrophysical Observatory

As a continuation of the highly successful Sloan Lens ACS (SLACS) Survey for new strong gravitational lenses, we propose one orbit of ACS-WFC F814W imaging for each of 50 high-probability strong galaxy-galaxy lens candidates. These observations will confirm new lens systems and permit immediate and accurate photometry, shape measurement, and mass modeling of the lens galaxies. The lenses delivered by the SLACS Survey all show extended source structure, furnishing more constraints on the projected lens potential than lensed-quasar image positions. In addition, SLACS lenses have lens galaxies that are much brighter than their lensed sources, facilitating detailed photometric and dynamical observation of the former. When confirmed lenses from this proposal are combined with lenses discovered by SLACS in Cycles 13 and 14, we expect the final SLACS lens sample to number 80--100: an approximate doubling of the number of known galaxy-scale strong gravitational lenses and an order-of-magnitude increase in the number of optical Einstein rings. By virtue of its homogeneous selection and sheer size, the SLACS sample will allow an unprecedented exploration of the mass structure of the early-type galaxy population as a function of all other observable quantities. This new sample will be a valuable resource to the astronomical community by enabling qualitatively new strong lensing science, and as such we will waive all but a short (3-month) proprietary period on the observations.
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Proposal Category: GO
Scientific Category: UNRESOLVED STELLAR POPULATIONS
ID: 10887
Title: Stellar Populations in a z=4 Lensed Galaxy with NICMOS
PI: Andrew Bunker
PI Institution: University of Exeter

We propose to use NICMOS on HST to undertake deep high-resolution H-band imaging of a z=4 galaxy, lensed by a rich foreground cluster into highly-magnified arcs 3-5arcsec in length. By combining this with existing deep K-band imaging from Keck and high-quality archival WFPC2 and ACS data, we can spatially resolve stellar populations along the arcs. The WFPC2 images clearly reveal several bright knots, which may correspond to sites of active star formation. Indeed, our Keck/LRIS spectra (Bunker, Moustakas & Davis 2000) are consistent with OB-star spectral energy distributions in the rest-ultraviolet. However, there are considerable portions of the arcs which appear redder with no Ly-alpha emission, consistent with being post-starburst regions. The sensitivity and resolution afforded by NIC2 is crucial to study the inter-knot

flux in H-band (F160W), a goal unachievable from the ground. In conjunction with our deep Keck K' data, NIC2 imaging will straddle the 4000Ang+Balmer break and thus allow us to `age-date' the stellar populations by the inferred amplitude of the break along the transverse extent of the arcs. We can achieve this in 8 orbits, and address whether this star-forming galaxy at z=4 has had extended formation histories - vital for the interpretation of the Lyman Break Galaxies, and their relation to the evolved Extremely Red Objects.
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Proposal Category:	GO
Scientific Category:	RESOLVED STELLAR POPULATIONS
ID:	10888
Title:	Complexity in the Smallest Galaxies: Star Formation History of the Sculptor Dwarf Spheroidal
PI:	Andrew Cole
PI Institution:	University of Minnesota - Twin Cities

The Sculptor dwarf spheroidal galaxy (Scl dSph) is one of the most luminous of the Milky Way dSph satellites, suffers virtually no foreground confusion or reddening because of its high galactic latitude, and is nearby at 80 kpc from the Sun. It is of great interest to astronomy to understand the detailed histories of dSph galaxies because they may be survivors of the hierarchical merging process that created giant galaxies like our own. Despite this, the age distribution of stars in Scl dSph remains remarkably poorly constrained because of a dearth of high-quality color-magnitude diagrams (CMDs) of its central regions. Scl dSph is known to be complex on the basis of shallower photometry, radial velocity studies, and investigations of the metallicity; however, the age range of significant star-formation and the proportion of stars older and younger than 10 Gyr is still completely unknown. The age of the centrally concentrated, metal-rich population has never been measured. We propose to obtain deep optical images of the core of Scl dSph with the ACS/WFC in order to measure the temporal evolution of its star-formation rate over its entire lifetime. The ONLY way to reliably measure the variation in star-formation rate on Gyr timescales at ages of 10-13 Gyr is with photometry of a large number of stars at and below the oldest main-sequence turnoffs to magnitudes of (B,I) = (25.1, 24.5). Because of the high stellar density and resulting image crowding, it is impossible to achieve the required level of photometric precision except with diffraction-limited imaging. These data will permit the first reliable measurement of the star-formation history of the main body of Scl dSph; limited inferences from WFPC2 data in an outer field have been made, but they were hindered not only by small number statistics but by the subsequent revelation of extremely strong population gradients in Scl dSph, such that the stars in the WFPC2 field are not representative of the galaxy as a whole. Our proposed program will shed strong new light on the formation processes of the smallest galaxies. Only by measuring the detailed early histories of galaxies like Scl dSph can we evaluate the impact of outside influences like ram-pressure stripping, tidal stirring, and photoionization feedback on the evolution of small galaxies.

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Proposal Category: GO
Scientific Category: COSMOLOGY
ID: 10889
Title: The Nature of the Halos and Thick Disks of Spiral Galaxies
PI: Roelof de Jong
PI Institution: Space Telescope Science Institute

We propose to resolve the extra-planar stellar populations of the thick disks and halos of seven nearby, massive, edge-on galaxies using ACS, NICMOS, and WFPC2 in parallel. These observations will provide accurate star counts and color-magnitude diagrams 1.5 magnitudes below the tip of the Red Giant Branch sampled along the two principal axes and one intermediate axis of each galaxy. We will measure the metallicity distribution functions and stellar density profiles from star counts down to very low average surface brightnesses, equivalent to ~32 V-mag per square arcsec. These observations will provide the definitive HST study of extra-planar stellar populations of spiral galaxies. Our targets cover a range in galaxy mass, luminosity, and morphology and as function of these galaxy properties we will provide: - The first systematic study of the radial and isophotal shapes of the diffuse stellar halos of spiral galaxies - The most detailed comparative study to date of thick disk morphologies and stellar populations - A comprehensive analysis of halo and thick disk metallicity distributions as a function of galaxy type and position within the galaxy. - A sensitive search for tidal streams - The first opportunity to directly relate globular cluster systems to their field stellar population We will use these fossil records of the galaxy assembly process preserved in the old stellar populations to test halo and thick disk formation models within the hierarchical galaxy formation scheme. We will test LambdaCDM predictions on sub-galactic scales, where it is difficult to test using CMB and galaxy redshift surveys, and where it faces its most serious difficulties.
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Proposal Category: GO
Scientific Category: UNRESOLVED STELLAR POPULATIONS
ID: 10890
Title: Morphologies of the Most Extreme High-Redshift Mid-IR-Luminous Galaxies
PI: Arjun Dey
PI Institution: National Optical Astronomy Observatories, AURA

The formative phase of the most massive galaxies may be extremely luminous, characterized by intense star- and AGN-formation. Till now, few such galaxies have been unambiguously identified at high redshift, restricting us to the study of low-redshift ultraluminous infrared galaxies as possible analogs. We have recently discovered a sample of objects which may indeed represent this

early phase in galaxy formation, and are undertaking an extensive multiwavelength study of this population. These objects are bright at mid-IR wavelengths (F[24um]>0.8mJy), but deep ground based imaging suggests extremely faint (and in some cases extended) optical counterparts (R~24-27). Deep K-band images show barely resolved galaxies. Mid-infrared spectroscopy with Spitzer/IRS reveals that they have redshifts z ~ 2-2.5, suggesting bolometric luminosities ~10^(13-14)Lsun

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Proposal Category: GO
Scientific Category: COOL STARS
ID: 10891
Title: The Dynamical Mass of the Bright Cepheid Polaris
PI: Nancy Evans
PI Institution: Smithsonian Institution Astrophysical Observatory

Cepheid variables are of central importance in Galactic and extragalactic astronomy. They are the primary standard candles for measuring extragalactic distances, and they provide critical tests of stellar-evolution theory. Surprisingly, however, until now there was not a single Cepheid with a purely dynamical measurement of its mass. Polaris (alpha UMi) is the nearest and brightest of all Cepheids. It offers the unique opportunity to measure the dynamical mass of a Cepheid, because it is in a binary system for which a single-lined spectroscopic orbit is already available. In Cycle 14, we resolved the system in the UV using ACS/HRC, thus providing the first direct detection of the companion, as well as a first approximation to the dynamical mass. In the present proposal we request one HST orbit per year for the next 3 Cycles, in order to refine the visual orbit. Combined with the HST/FGS parallax (see below), this program will provide an accurate mass for the Cepheid (the error should be about 0.5 Msun by Cycle 17), and the only one based purely on dynamical information. Only HST's combination of high spatial resolution and UV sensitivity can achieve this result. The parallax is a key ingredient in the mass determination. In an ongoing multi-year program (GO-9888, GO-10113, GO-10482), we are using the FGS to improve significantly upon the Hipparcos parallax of Polaris. The continued ACS imaging proposed here will thus provide extremely valuable astrophysical information from a very modest additional investment of observing time.

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Proposal Category: GO
Scientific Category: ISM IN EXTERNAL GALAXIES
ID: 10892
Title: Imaging Dust Near Type Ia Supernovae: A New Light Echo Candidate
PI: Peter Garnavich
PI Institution: University of Notre Dame

Light echos are excellent probes of circumstellar and interstellar dust. We

have been using the unique power of light echos to study the progenitors of type Ia supernovae, but currently, only two distant echos are known: SN 1991T and 1998bu. Both events show dust close to the progenitors and the echo light curve suggests that the dust actually surrounds SN 1991T. Here we propose to use HST to confirm a third echo and study its size, brightness and color.
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Proposal Category: GO
Scientific Category: COSMOLOGY
ID: 10893
Title: Sweeping Away the Dust: Reliable Dark Energy with an Infrared Hubble Diagram
PI: Peter Garnavich
PI Institution: University of Notre Dame

We propose building a high-z Hubble Diagram using type Ia supernovae observed in the infrared rest-frame J-band. The infrared has a number of exceptional properties. The effect of dust extinction is minimal, reducing a major systematic tha may be biasing dark energy measurements. Also, recent work indicates that type Ia supernovae are true standard candles in the infrared meaning that our Hubble diagram will be resistant to possible evolution in the Phillips relation over cosmic time. High signal-to-noise measurements of 9 type Ia events at z~0.4 will be compared with an independent optical Hubble diagram from the ESSENCE project to test for a shift in the derived dark energy equation of state due to a systematic bias. Because of the bright sky background, H-band photometry of z~0.4 supernovae is not feasible from the ground. Only the superb image quality and dark infrared sky seen by HST makes this test possible. This experiment may also lead to a better, more reliable way of mapping the expansion history of the universe with the Joint Dark Energy Mission.
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Proposal Category: GO
Scientific Category: UNRESOLVED STELLAR POPULATIONS
ID: 10894
Title: Probing the Birth of Super Star Clusters with NICMOS
PI: Kelsey Johnson
PI Institution: The University of Virginia

The formation of ``super star clusters'' represents an extreme mode of star formation in the local universe. Star clusters with radii < 5pc and masses exceeding 10^4 solar masses are now known to be common in starbursts. These clusters are amazingly densely packed with massive stars, and can have a violent impact on their host galaxies and the surrounding IGM. The effects of massive star clusters perhaps were even more important in the earlier universe, when galaxy mergers and starbursts were common, and the formation of massive globular clusters was ubiquitous. However, our knowledge of the formation and early evolution of such massive clusters remains poorly

understood, and observations have only begun to probe these stages. The near-IR fluxes and colors of natal clusters change dramatically in their early stages of evolution, providing important diagnostics. We will use NICMOS to explore the early evolution of massive star clusters through observations of a sample of nearby starburst galaxies containing the recently discovered ultra-young massive star clusters. First identified as compact optically-thick free-free radio sources, these natal clusters are still embedded in their birth material and obscured at optical wavelengths. Sensitive, high-resolution observations in the near-IR are critical for investigating the properties of these clusters as they evolve from being completely obscured by their natal clouds to fully emerged and optically visible. NICMOS F160W, F205W, F187N, and F190N (roughly H, K, and Pa-alpha) images will allow us to determine their ages, extinctions, ionizing fluxes, embedded stellar masses, and the morphological relationship between radio, mid-IR, and optically visible clusters. These results will ultimately provide insight into the earliest stages of super star cluster evolution and the properties of massive star formation throughout the universe.

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Proposal Category: GO
Scientific Category: ISM AND CIRCUMSTELLAR MATTER
ID: 10895
Title: Closure on the IRAS "Big Four": A High Contrast Study of Epsilon Eridani's Dust Belt in Scattered Light.
PI: Paul Kalas
PI Institution: University of California - Berkeley

The ACS / HRC coronagraph has now demonstrated an unmatched capability to detect dusty debris disks around bright, nearby stars. Among the "Big Four" debris disks discovered with IRAS twenty years ago, only Epsilon Eridani (SpT=K2V, d=3.2 pc) has yet to be targeted with ACS. Beta Pictoris, Fomalhaut and Vega have been imaged with the ACS coronagraph, with the recent detection of reflected light from Fomalhaut's dust belt (Kalas, Graham & Clampin 2005). The direct detection of dust scattered light around Fomalhaut shows disk structure and asymmetry that can be directly linked to dynamical models of planetary perturbation. Here we propose to use the ACS HRC and WFC to detect Eps Eri's dust belt. A new motivation to attempt this observations arises from recent 350 micron images that reveal two dust arcs ~60 AU to the southeast and northwest of the star. Contrary to previous 850 and 450 micron maps, the northwest arc is brighter than the southeast arc, and the northwest region has not been targeted by previous STIS imaging at lower contrast. The optical detection of dust features around Eps Eri would be significant because a high resolution optical image, together with Spitzer and sub-mm images, would help anchor dynamical models of Eps Eri's planetary system, in addition to providing direct visual indications of disk-planet interactions.

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Proposal Category: GO

Scientific Category: ISM AND CIRCUMSTELLAR MATTER
ID: 10896
Title: An Efficient ACS Coronagraphic Survey for Debris Disks around Nearby Stars
PI: Paul Kalas
PI Institution: University of California - Berkeley

We propose to finish our Cycle 11 optical survey for nearby debris disks using the ACS/HRC coronagraph. Out of 43 orbits originally proposed for the survey, 23 orbits were allocated, leading to a survey of 22 stars, from which two new debris disks were imaged for the first time. Our analysis of the initial survey gives an empirical estimate for the detection rate of debris disks relative to heliocentric distance and dust optical depth. Our target list for Cycle 15 is now optimized to yield more frequent disk detections. Likewise our observing strategy is improved to maximize sensitivity per telescope orbit allocated. Therefore we present the most efficient survey possible. The scientific motivation is to obtain scattered light images of previously unresolved debris disks to determine their viewing geometry and physical architecture, both of which may characterize the underlying planetary system. We choose 25 debris disk targets for which we predict a detection rate of 25% ± 5%. Four targets have extrasolar planets from which the viewing geometry revealed by a disk detection will resolve the v sin(i) ambiguity in the planet masses. These targets present the remarkable opportunity of finally seeing a debris disk in system with known planets.
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Proposal Category: GO
Scientific Category: ISM AND CIRCUMSTELLAR MATTER
ID: 10897
Title: Coronagraphic imaging of the submillimeter debris disk of a 200Myr old M-dwarf
PI: Jean-Francois Lestrade
PI Institution: Observatoire de Paris

A recent sub-millimeter survey has unambiguously discovered a new debris disk around the M0.5 dwarf GJ842.2 which is 200 Myr old. Reanalysis of the IRAS data has shown that there is also a 25 micron excess toward this star indicating warm dust close to the star. It is also only the second debris disk found among M-dwarfs that constitute 70 % of the stars in the Galaxy. Collisional and Poynting-Roberston timescale arguments indicate that the cold grains detected in the sub-mm are ``primordial'', i.e. original grains from the protoplanetary phase. The disk around GJ842.2 is thus unique in terms of the presence of dust at such a late stage of evolution and presents two conundrums: why did it retain so much primordial dust at large distances, and why does it continue to produce dust close to the star? We propose to conduct high contrast ACS coronagraphic imaging of GJ842.2 to determine the spatial distribution of the small reflecting grains and test the various scenarios which might explain the IRAS and sub-mm data e.g.resonant trapping of dust by

planets or ``sandblasting'' by interstellar medium grains working more aggressively on a low-luminosity star than on an A-type star like Beta Pic. Also, we would search for an evolutionary sequence between GJ842.2 and the only other M-dwarf with a disk resolved by HST, the 10 Myr old AU Mic system.
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Proposal Category: GO
Scientific Category: HOT STARS
ID: 10898
Title: The orbit of the most massive known astrometric binary
PI: Jesus Maiz-Apellaniz
PI Institution: Space Telescope Science Institute - ESA

We have recently used FGS and HRC observations to (a) resolve HD 93129A into two components with very similar optical/UV colors and a magnitude difference of 0.9 and to (b) detect their relative orbital motion over a span of 8 years. HD 93129Aa is the prototype O2 If* star, with an evolutionary mass near 100 M_Sun, while Ab is likely to be a very early O main-sequence star with a similar or only slightly smaller mass. Our HST astrometric measurements yield a total mass above 100 M_Sun, thus confirming the extremely high mass of the binary, and indicate that the system appears to be approaching periastron. We request new FGS and HRC observations to (a) calculate the mass ratio of the system by measuring the orbit of each of the components with respect to the nearby stars, (b) obtain the periastron epoch, and (c) start measuring the orbit in order to produce an estimate of the total mass. These measurements are crucial to shed light on the value of the stellar upper mass limit.
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Proposal Category: GO
Scientific Category: COSMOLOGY
ID: 10899
Title: Identifying z>7 galaxies from J-dropouts
PI: Matthew Malkan
PI Institution: University of California - Los Angeles

NICMOS Parallel Imaging campaigns covered enough sky (250 pointings) with enough sensitivity in the 110W and 160W filters to identify 6 extremely red resolved sources which are prime candidates for J-band dropouts. Their complete absence of detectable J band flux can be caused by an opaque Lyman cut-off at z=8--10. We propose to followup these candidates with NICMOS imaging and jointly propose Spitzer IRAC photometry. Deep F110W and Spitzer/IRAC 3.5/4.8 micron imaging will confirm if any of these candidates are indeed Lyman Break galaxies observed less than 500 Myrs after the Big Bang. Genuine LBGs will remain undetected in F110W, while being detected with flat spectra in the IRAC bands. The combined SED will provide information about the stellar mass of these galaxies, and the possible presence of evolved stars or dust reddening. The proposed observations will be sensitive enough to detect the F110W flux from galaxies as red as (J-H)=2.8 (AB mags, 5 sigma).

If any of the candidates are detected with bluer colors, they will most likely be exceptional "Distant Red Galaxies" at z of 4 to 6. The proposed data will constrain the stellar populations of these extraordinarily red galaxies, which would be candidates for the earliest, most massive galaxies which formed.
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Proposal Category: GO
Scientific Category: HOT STARS
ID: 10900
Title: Optical polarimetry of PSR B0540-69 and its synchrotron nebula.
PI: Roberto Mignani
PI Institution: Mullard Space Science Laboratory

Polarization measurements of pulsars and of their synchrotron nebulae are uniquely able to provide deep insights into the highly magnetized relativistic environment of young rotating neutron stars. Apart from the radio band, pulsar polarization is best measured in the optical, for the rare cases of detectable optical emission. One of the brightest pulsars together with Crab (PSR B0531+21) and Vela (PSR B0833-45), for which optical polarization measurements support the newly developed two-pole caustic model (TPC), is PSR B0540-69 in the Large Magellanic Clouds, often referred as the Crab Twin for their overall similarities in both age and energetics. Together with the Crab, PSR B0540-69 is also the only pulsar embedded in a synchrotron nebula visible at optical wavelengths. We plan to observe PSR B0540-69 and its compact nebula (4 arcsec diameter) with the Advanced Camera for Surveys (ACS) and the Wide Field Channel (WFC) detector using UV and visual polarization filters. Thanks to the superb angular resolution of ACS, these observations will allow us to spectacularly resolve the pulsar from its nebular background, providing the first firm measure of the pulsar polarization which will be crucial to assess, on a broader sample, the validity of the TPC model with respect to other pulsars magnetosphere models. These observations will also provide the first detailed polarization map of the nebula, including the jet and the torus seen in our previous WFPC2 images.
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Proposal Category: GO
Scientific Category: UNRESOLVED STELLAR POPULATIONS
ID: 10901
Title: UV-Luminous Globular Clusters in NGC 1399
PI: Robert O'Connell
PI Institution: The University of Virginia

Ultraviolet observations have revealed remarkable diversity among old stellar populations in globular clusters and E/S0 galaxies. We recently discovered with HST/STIS that globular clusters in the giant elliptical galaxy M87 have the most heavily populated hot horizontal branches of any stellar systems yet studied. Their far-UV/optical colors are up to 1 mag bluer than any Milky Way

globular cluster and approach the theoretical limits for production of hot-HB stars in old stellar populations. The differences among the metal-poor clusters are particularly interesting, because it is thought that these objects reflect the earliest stages of galaxy formation at high redshifts. Here we propose deep ACS far-UV imaging of a second gE galaxy, NGC 1399, with a cluster system that is well-studied at longer wavelengths, to determine whether it shares characteristics with M87. These observations bear on aspects of advanced stellar evolution, on the histories of globular clusters in different environments, and on the interpretation of the "ultraviolet upturn'' phenomenon in elliptical galaxies and its value as a population probe in distant galaxies.

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Proposal Category:	GO
Scientific Category:	UNRESOLVED STELLAR POPULATIONS
ID:	10902
Title:	The Nearest Luminous Blue Compact Galaxies: A Window on Galaxy Formation
PI:	Goran Ostlin
PI Institution:	Stockholm University

As we move to intermediate and high redshifts, Luminous Blue Compact Galaxies (LBCGs) become increasingly common. The nearest LBCGs, with their violent starbursts and rich populations of super star clusters (SSCs) and globular clusters (GCs), thus provide ideal laboratories for studying galaxy evolution. Many LBCGs appear to be involved in mergers between dwarf galaxies, triggering their starbursts. The starburst regions in LBCGs consist of numerous young star clusters, whose populations are both easily measurable with HST and easily modelled. Studying cluster populations provides a powerful probe of the starburst and merger history which is possible neither for closer objects (of which there are too few) or for those at high redshift (which are too far away). We have previously studied the closest LBCG with WFPC2 and found hundreds of bright compact SSCs and GCs. In particular, we found a population of intermediate-age (~2 Gyr) GCs, indicating a past event of massive cluster formation. We now propose a multi-wavelength study of the three other LBCGs with the highest known number of SSCs. The extinction is small in these galaxies and age estimates robust. The age distribution of GCs and SSCs will be used to study the past evolution of the galaxies. For each LBCG, we will map its cluster formation history, unveiling its merger and starburst history, and thereby shed light on some of the processes involved in galaxy evolution at high redshift.

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Proposal Category:	GO
Scientific Category:	RESOLVED STELLAR POPULATIONS
ID:	10903
Title:	Resolving the LMC Microlensing Puzzle: Where are the Lensing Objects?

PI: Armin Rest
PI Institution: National Optical Astronomy Observatories - CTIO

We are requesting 12 HST orbits to continue to investigate the nature of the population that gives rise to the microlensing seen towards the LMC. This proposal builds on the cycle 14 HST program (10583) and will complement the study with 12 yet-to-be discovered microlensing candidates from Fall 2006. Our SuperMacho project is an ongoing ground-based survey on the CTIO 4m that has demonstrated the ability to detect LMC microlensing events via frame subtraction. The combination of high angular resolution and photometric accuracy with HST will allow us to 1) confrim that the detected flux excursions arise from LMC stars, rather than background supernovae or AGN, and 2) obtain reliable baseline flux measurements for the objects in their unlensed state. This latter measurement in important in determining the microlensing optical depth towards the LMC.

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Proposal Category: GO
Scientific Category: UNRESOLVED STELLAR POPULATIONS
ID: 10904
Title: Star formation in extended UV disk (XUV-disk) galaxies
PI: David Thilker
PI Institution: The Johns Hopkins University

The Galaxy Evolution Explorer (GALEX) has discovered the existence of extended UV-disk (?XUV-disk?) galaxies. This class of intriguing spiral galaxies is distinguished by UV-bright regions of star formation located at extreme galactocentric radii, commonly reaching many times the optical extent of each target. XUV-disks represent a population of late-type galaxies still actively building, or significantly augmenting, their stellar disk in the outer, low-density environment. Prior to GALEX, such regions were considered to be far more stable against star formation than now realized. Our work on these targets has led to the recognition of the XUV phenomenon as probing a diverse population of galaxies which, although having certain commonality in terms of their present XUV star formation, have apparently experienced different star formation histories (as judged by their outer disk UV-optical colors and morphology). In ordinary spirals, disk formation occurred at a much earlier epoch, making today?s XUV-disks useful templates for commonplace, high z galaxies. The diverse XUV-disks in our sample may represent snapshots of different phases in the disk building process. We seek to characterize the demographics of star forming regions occupying this environmental range, especially in contrast to their inner disk counterparts. HST imaging is needed to accurately characterize the massive stars and clusters which have, in fact, managed to form. The GALEX observations are limited by 5" resolution. Deep ACS FUV, B, V, I, and H-alpha imaging (along with parallel WFPC2 data) will allow: (1) photometric classification of the OB star population, (2) constraint on the cluster mass function and age distribution, (3) critical accounting for possible leakage of Lyman continuum

photons in a porous ISM or an IMF change, and (4) population synthesis modeling of the field SFH on Gyr timescales. We benefit from extensive archival HST observations of our target galaxies, although the outer disk has yet to be probed.

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Proposal Category: GO
Scientific Category: COSMOLOGY
ID: 10905
Title: The Dynamic State of the Dwarf Galaxy Rich Canes Venatici I Region
PI: R. Tully
PI Institution: University of Hawaii

With accurate distances, the nearest groups of galaxies can be resolved in 3 dimensions and the radial component of the motions of galaxies due to local density perturbations can be distinquished from cosmological expansion components. Currently, with the ACS, galaxy distances within 8 Mpc can be measured effectively and efficiently by detecting the tip of the red giant branch (TRGB). Of four principal groups at high galactic latitude in this domain, the Canes Venatici I Group (a) is the least studied, (b) is the most populated, though overwhelmingly by dwarf galaxies, and (c) is likely the least dynamically evolved. It is speculated that galaxies in low mass groups may fail to retain baryons as effectively as those in high mass groups, resulting in significantly higher mass-to-light ratios. The CVn I Group is suspected to lie in the mass regime where the speculated astrophysical processes that affect baryon retention are becoming important.

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Proposal Category: GO
Scientific Category: AGN/QUASARS
ID: 10906
Title: The Fundamental Plane of Massive Gas-Rich Mergers: II. The QUEST QSOs
PI: Sylvain Veilleux
PI Institution: University of Maryland

We propose deep NICMOS H-band imaging of a carefully selected sample of 23 local QSOs. This program is the last critical element of a comprehensive investigation of the most luminous mergers in the nearby universe, the ultraluminous infrared galaxies (ULIRGs) and the quasars. This effort is called QUEST: Quasar / ULIRG Evolutionary STudy. The high-resolution HST images of the QUEST QSOs will complement an identical set of images on the ULIRG sample obtained during Cycle 12, an extensive set of ground-based data that include long-slit NIR spectra from a Large VLT Program, and a large set of mid-infrared spectra from a Cycle 1 medium-size program with Spitzer. This unique dataset will allow us to derive with unprecedented precision structual, kinematic, and activity parameters for a large unbiased sample of objects

spanning the entire ULIRG/QSO luminosity function. These data will refine the fundamental plane of massive gas-rich mergers and enable us to answer the following quesitons: (1) Do ultraluminous mergers form elliptical galaxies, and in particular, giant ellipticals? (2) Do ULIRGs evolve into optical bright QSOs? The results from this detailed study of massive mergers in the local universe will be relevant to understanding the basic physical processes involved in creating massive early-type host on the one hand, and growing/feeding embedded massive black holes on the other, in major galaxy mergers. This is an important question since 50% of cosmic star formation at high-z and most of the big BHs appear to be formed in this process.

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Proposal Category: GO
Scientific Category: QUASAR ABSORPTION LINES AND IGM
ID: 10907
Title: New Sightlines for the Study of Intergalactic Helium: A Dozen High-Confidence, UV-Bright Quasars from SDSS/GALEX
PI: Scott Anderson
PI Institution: University of Washington

The reionization of intergalactic helium is thought to have occurred between redshifts of about 3 and 4. Detailed study of HeII Lyman-alpha absorption toward a handful quasars at 2.7<z<3.3 demonstrates the great potential of such probes of the IGM, but the current critically-small sample limits confidence in resulting cosmological inferences. The requisite unobscured quasar sightlines to high-redshift are extremely rare, especially due to severe absorption in random intervening Lyman-limit systems, but SDSS provides thousands of z>3.1 quasars potentially suitable for HeII studies. We have cross-correlated SDSS quasars with GALEX UV sources to obtain a dozen new, very high-confidence, candidate quasars/sightlines (z=3.1 to 4.1) potentially useful for detailed HeII studies even with current HST instruments. We propose brief, 2-orbit per target, reconnaissance spectral exposures with the ACS SBC prism to definitively verify UV flux down to the HeII break. Our combined SDSS/GALEX selection insures a very high-yield of confirmations, as the quasars are already known to be UV-bright from broadband GALEX images. The additional sightlines, extending to very high-redshift, will directly enable ensemble spectral stacks, as well as long exposure follow-up spectra, at high S/N with the ACS/SBC ultraviolet prisms (or perhaps STIS or COS later), to confidently measure the spectrum and evolution of the ionizing background radiation, the evolution of HeII opacity, and the density of intergalactic baryons.

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Proposal Category: GO
Scientific Category: COSMOLOGY
ID: 10908
Title: Gotcha
PI: Using Swift GRBs to Pinpoint the Highest Redshift

Galaxies Edo
PI Institution: Berger

Carnegie Institution of Washington
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Proposal Category: GO
Scientific Category: HOT STARS
ID: 10909
Title: Exploring the diversity of cosmic explosions: The supernovae of gamma-ray bursts
PI: David Bersier
PI Institution: Liverpool John Moores University

While the connection between gamma-ray bursts (GRBs) and supernovae (SNe) is now clearly established, there is a large variety of observational properties among these SNe and the physical parameters of these explosions are poorly known. As part of a comprehensive program, we propose to use HST in order to obtain basic information about the supernovae associated with gamma-ray bursts. HST offers the means to cleanly separate the light curves of the GRB afterglow from the supernova, and to remove the contamination from the host galaxy, opening a clear route to the fundamental parameters of the SN. From these observations, we will determine the absolute magnitude at maximum, the shape of the spectral energy distribution, and any change over time of the energy distribution. We will also measure the rate of decay of the exponential tail. Merged with the ground-based data that we will obtain for each event, we will be able to compare our data set to models and constrain the energy of the explosion, the mass of the ejecta and the mass of Nickel synthesized during the explosion. These results will shed light on the apparent variety of supernovae associated with gamma-ray bursts and X-ray flashes, and on the relation between these SNe and other, more common varieties of core-collapse explosions.
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Proposal Category: GO
Scientific Category: AGN/QUASARS
ID: 10910
Title: HST / Chandra Monitoring of a Dramatic Flare in the M87 Jet
PI: John Biretta
PI Institution: Space Telescope Science Institute

As the nearest galaxy with an optical jet, M87 affords an unparalleled opportunity to study extragalactic jet phenomena at the highest resolution. During 2002, HST and Chandra monitoring of the M87 jet detected a dramatic flare in knot HST-1 located ~1" from the nucleus. Its optical brightness eventually increased seventy-fold and peaked in 2005; the X-rays show a similarly dramatic outburst. In both bands HST-1 is still extremely bright and

greatly outshines the galaxy nucleus. To our knowledge this is the first incidence of an optical or X-ray outburst from a jet region which is spatially distinct from the core source -- this presents an unprecedented opportunity to study the processes responsible for non-thermal variability and the X-ray emission. We propose five epochs of HST/ACS flux monitoring during Cycle 15, as well as seven epochs of Chandra/ACIS observation (5ksec each, five Chandra epochs contemporary with HST). At two of the HST/ACS epochs we also gather spectral information and map the magnetic field structure. The results of this investigation are of key importance not only for understanding the nature of the X-ray emission of the M87 jet, but also for understanding flares in blazar jets, which are highly variable, but where we have never before been able to resolve the flaring region in the optical or X-rays. These observations will allow us to test synchrotron emission models for the X-ray outburst, constrain particle acceleration and loss timescales, and study the jet dynamics associated with this flaring component.

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Proposal Category: GO
Scientific Category: UNRESOLVED STELLAR POPULATIONS
ID: 10911
Title: Calibration of ACS F814W Surface Brightness Fluctuations
PI: John Blakeslee
PI Institution: Washington State University

The surface brightness fluctuations (SBF) method has emerged as the primary distance indicator for mapping local large-scale structures (Virgo, Fornax), as well as the velocity field out to nearly 15,000 km/s ($z < 0.05$). This is because other precision distance indicators either lack the requisite depth (Cepheids, TRGB) or are too rare for adequate sampling (supernovae), while more traditional methods (Tully-Fisher, fundamental plane) lack the necessary precision. The SBF method is now being used with great success in several major ACS Wide Field Camera programs. However, whereas the band of choice for the nearby structure studies has been F850LP, for the distant large-scale flow studies it is F814W because of its much greater throughput. As a result, the current calibration for the more distant studies is inadequate. We propose to establish the first systematic calibration of the SBF method in the important F814W ACS WFC bandpass. We will do this by measuring SBF in an optimized sample of galaxies in the nearby compact Fornax cluster. Given the large amount of effort and HST time being dedicated to F814W SBF measurements, it is imperative that we correct this outstanding calibration problem while time remains. For an extremely modest expenditure of orbits, we will remove a significant systematic error and vastly improve the overall accuracy of the ongoing ACS F814W SBF work. These data will also greatly enhance the legacy value of the HST archive for future SBF studies.

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Proposal Category: GO
Scientific Category: HOT STARS

ID: 10912
Title: Trigonometric Calibration of the Distance Scale for Classical Novae
PI: Howard Bond
PI Institution: Space Telescope Science Institute

The distance scale for classical novae is important for understanding the stellar physics of their thermonuclear runaways, their contribution to Galactic nucleosynthesis, and their use as extragalactic standard candles. Although it is known that there is a relationship between their absolute magnitudes at maximum light and their subsequent rates of decline--the well-known maximum-magnitude rate-of-decline (MMRD) relation--it is difficult to set the zero-point for the MMRD because of the very uncertain distances of Galactic novae. We propose to measure precise trigonometric parallaxes for the quiescent remnants of the four nearest classical novae. We will use the Fine Guidance Sensors, which are proven to be capable of measuring parallaxes with errors of ~0.2 mas, well below what is possible from the ground.
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Proposal Category: GO
Scientific Category: ISM AND CIRCUMSTELLAR MATTER
ID: 10913
Title: The Light Echoes around V838 Monocerotis
PI: Howard Bond
PI Institution: Space Telescope Science Institute

V838 Monocerotis, which burst upon the astronomical scene in early 2002, is a completely unanticipated new object. It underwent a large-amplitude and very luminous outburst, during which its spectrum remained that of an extremely cool supergiant. A rapidly evolving set of light echoes around V838 Mon was discovered soon after the outburst, and quickly became the most spectacular display of the phenomenon ever seen. These light echoes provide the means to accomplish four unique types of measurements based on continued HST imaging during the event: (1) Study effects of MHD turbulence at high resolution and in 3 dimensions; (2) Construct the first unambiguous and fully 3-D map of a circumstellar dust envelope in the Milky Way; (3) Study dust physics in a unique setting where the spectrum and light curve of the illumination, and the scattering angle, are unambiguously known; and (4) Determine the distance to V838 Mon through direct geometric techniques. Because of the extreme rarity of light echoes, this is almost certainly the only opportunity to achieve such results during the lifetime of HST. We propose two visits during Cycle 15, in order to continue the mapping of the circumstellar dust and to achieve the other goals listed above.
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Proposal Category: GO
Scientific Category: HOT STARS
ID: 10914

Title: HST Observations of Astrophysically Important Visual Binaries
PI: Howard Bond
PI Institution: Space Telescope Science Institute

This is a continuation of a project begun in Cycle 7 and continued up through Cycle 14. The program consists of annual FGS or WFPC2 observations of three visual binary stars that will yield fundamental astrophysical results, once their orbits and masses are determined. Our targets are the following: (1) Procyon (P = 40.9 yr), for which our first WFPC2 images yielded an extremely accurate angular separation of the bright F star and its much fainter white-dwarf companion. Combined with ground-based astrometry of the bright star, our observation significantly revised downward the derived masses, and brought Procyon A into much better agreement with theoretical evolutionary masses for the first time. With the continued monitoring proposed here, we will obtain masses to an accuracy of better than 1%, providing a testbed for theories of both Sun-like stars and white dwarfs. (2) G 107-70, a close double white dwarf (P = 18.5 yr) that promises to add two accurate masses to the tiny handful of white-dwarf masses that are directly known from dynamical measurements. (3) Mu Cas (P = 20.8 yr), a famous nearby metal-deficient G dwarf for which accurate masses will lead to the stars' helium contents, with cosmological implications. For all three stars, we will also be setting increasingly stringent limits on the presence of planetary-mass bodies in the systems.
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Proposal Category: GO
Scientific Category: RESOLVED STELLAR POPULATIONS
ID: 10915
Title: ACS Nearby Galaxy Survey
PI: Julianne Dalcanton
PI Institution: University of Washington

Existing HST observations of nearby galaxies comprise a sparse and highly non-uniform archive, making comprehensive comparative studies among galaxies essentially impossible. We propose to secure HST's lasting impact on the study of nearby galaxies by undertaking a systematic, complete, and carefully crafted imaging survey of ALL galaxies in the Local Universe outside the Local Group. The resulting images will allow unprecedented measurements of: (1) the star formation history (SFH) of a >100 Mpc^3 volume of the Universe with a time resolution of Delta[log(t)]=0.25; (2) correlations between spatially resolved SFHs and environment; (3) the structure and properties of thick disks and stellar halos; and (4) the color distributions, sizes, and specific frequencies of globular and disk clusters as a function of galaxy mass and environment. To reach these goals, we will use a combination of wide-field tiling and pointed deep imaging to obtain uniform data on all 72 galaxies within a volume-limited sample extending to ~3.5 Mpc, with an extension to the M81 group. For each galaxy, the wide-field imaging will cover out to ~1.5 times the optical radius and will reach photometric depths of at least 2

magnitudes below the tip of the red giant branch throughout the limits of the survey volume. One additional deep pointing per galaxy will reach SNR~10 for red clump stars, sufficient to recover the ancient SFH from the color-magnitude diagram. This proposal will produce photometric information for ~100 million stars (comparable to the number in the SDSS survey) and uniform multi-color images of half a square degree of sky. The resulting archive will establish the fundamental optical database for nearby galaxies, in preparation for the shift of high-resolution imaging to the near-infrared.

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Proposal Category: GO
Scientific Category: ISM AND CIRCUMSTELLAR MATTER
ID: 10916
Title: A Study of SN Ejecta in the Core-Collapse Supernova Remnant G292.0+1.8: Cas A's Older Cousin
PI: Robert Fesen
PI Institution: Dartmouth College

Recent studies of the southern oxygen-rich supernova remnant (SNR) G292.0+1.8 have shown it to be the only Galactic SNR to exhibit all the features we expect in young remnants of core-collapse supernovae: an outer shell behind an expanding primary shock, high-velocity fragments of undiluted metal-rich ejecta, and a central pulsar surrounded by a pulsar-wind nebula. G292.0+1.8's optical emission consists of numerous knots and filaments of O- and S-rich ejecta spread throughout much of the remnant shell, many with radially oriented pencil-like geometries that may trace their origins to Rayleigh-Taylor instabilities during the SN event.
The evolution and fine-scale structure of SN debris in young remnants is poorly understood and largely uncharted territory. For testing models for the distribution of metal-rich ejecta from core-collapse SNe, how the ejecta evolve and clump, and how SN shocks interact with the local circumstellar medium, the 3000-yr-old G292.0+1.8 remnant rivals the 320-yr-old Cas A remnant in importance. We therefore propose the first HST images of G292.0+1.8 in order to characterize the fine-scale spatial distribution of the ejecta, their sub-arcsecond chemical make-up, and the detailed structure and scale lengths for metal-rich SN ejecta clumps.
The proposed HST images of G292.0+1.8 will be used in conjunction with existing Spitzer Cycle 1 infrared data and an upcoming 0.5 Msec Chandra X-ray image. We expect to achieve the same kind of results for G292 that have already been obtained for Cas A. High-resolution HST images of this remnant, combined with Spitzer and Chandra data and contrasted with a similar data set on Cas A, will provide superb multiwavelength benchmarks for both very young and older core-collapse SNRs.

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Proposal Category: GO
Scientific Category: UNRESOLVED STELLAR POPULATIONS
ID: 10917

Title: Afterglows and Environments of Short-Hard Gamma-Ray Bursts
PI: Derek Fox
PI Institution: The Pennsylvania State University

Discovery of the first afterglows of short-hard bursts (SHBs) has led to a revolution in our understanding of these events, strongly suggesting that they originate in the mergers of compact-object binaries. Capitalizing on this progress, we propose to pursue the next generation of SHB observations with HST, tracking the decay of all accessible SHB afterglows to late times and pinpointing the location of several more within the context of their host galaxies. These observations will allow quantitative analysis of progenitor lifetimes and short burst environments, enable direct confrontation with population synthesis models, and provide updated event rate estimates for the LIGO and VIRGO gravitational-wave detectors that are now coming on-line.

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Proposal Category: GO
Scientific Category: COSMOLOGY
ID: 10918
Title: Reducing Systematic Errors on the Hubble Constant: Metallicity Calibration of the Cepheid PL Relation
PI: Wendy Freedman
PI Institution: Carnegie Institution of Washington

Reducing the systematic errors on the Hubble constant is still of significance and of immediate importance to modern cosmology. One of the largest remaining uncertainties in the Cepheid-based distance scale (which itself is at the foundation of the HST Key Project determination of H_o) which can now be addressed directly by HST, is the effect of metallicity on the Cepheid Period-Luminosity relation. Three chemically distinct regions in M101 will be used to directly measure and thereby calibrate the change in zero point of the Cepheid PL relation over a range of metallicities that run from SMC-like, through Solar, to metallicities as high as the most metal-enriched galaxies in the pure Hubble flow. ACS for the first time offers the opportunity to make a precise calibration of this effect which currently accounts for at least a third of the total systematic uncertainty on Ho. The calibration will be made in the V and I bandpasses so as to be immediately and directly applicable to the entire HST Cepheid-based distance scale sample, and most especially to the highest-metallicity galaxies that were hosts to the Type Ia supernovae, which were then used to extend the the distance scale calibration out to cosmologically significant distances.

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Proposal Category: GO
Scientific Category: HOT STARS
ID: 10919
Title: Eclipsing Binaries in the Local Group: II - Calibration

of the Zeropoint of the Cosmic Distance Scale and Fundamental Properties of Stars in M33

PI: Edward Guinan

PI Institution: Villanova University

The Great Spiral Galaxy in Triangulum (M33) is potentially a crucial calibrator for the Cosmic Distance Scale, and thus for determining the age and evolution of the Universe. M33 is viewed face-on, has a simple geometry, large and diverse stellar populations, and morphologies similar to our Galaxy and other more distant galaxies used for distance determinations. Yet currently the M33 distance (d ~ 830 +/- 110 kpc) still has measurement dispersions of 10-15%. We have demonstrated, in our work on the LMC and M31 distances, that double-line eclipsing binaries can serve as excellent "standard candles." Distances derived from eclipsing binaries are basically geometric and essentially free from many assumptions and uncertainties that plague other less direct methods, such as metallicity differences and calibration zeropoints. The absolute radii of the component stars of eclipsing binaries can be determined to better than a few percent from the time-tested analyses of their light and radial velocity curves. With accurate determinations of radii, temperatures, and ISM absorption it is possible to determine reliable distances. We are extending our program of using eclipsing binaries as standard candles to determine an accurate distance to M33. As a first step, we are proposing to carry out HST/ACS spectrophotometry of a well suited ~19th mag ~O7 + ~O7 eclipsing binary system in M33 that has been previously observed from the ground. HST/ACS prism/grism low-resolution spectrophotometry (118-850 nm) is the only missing key element of this program and is used to determine more reliable values for T_eff, [Fe/H], and ISM extinction. These quantities, when combined with the results from existing light and radial velocity curves for the target, yield the stellar masses, radii, luminosities and, importantly, the distance. The proposed HST/ACS program can be carried out effectively with only 1 HST orbit. Based on our previous experience, we expect to reduce the uncertainty of the M33 distance to better than 5-7%, thereby leading to a firmer calibration of the Cosmic Distance Scale and the zeropoint of the Hubble Constant (Ho).

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Proposal Category: GO

Scientific Category: UNRESOLVED STELLAR POPULATIONS

ID: 10920

Title: High-Resolution Imaging of Nearby Lyman Break Galaxy Analogs in the GALEX All-Sky Survey

PI: Charles Hoopes

PI Institution: The Johns Hopkins University

We have used the ultraviolet all-sky imaging survey currently being conducted by the Galaxy Evolution Explorer (GALEX) to identify for the first time a rare population of low-redshift starbursts with properties remarkably similar to high-redshift Lyman Break Galaxies. These compact UV luminous galaxies (UVLGs)

resemble Lyman Break Galaxies in terms of size, UV luminosity, star-formation rate, surface brightness, mass, metallicity, kinematics, dust content, and color. They have characteristic ``ages'' (stellar mass/SFR) of only a few hundred Myr. This population of galaxies is thus worthy of study in its own right and as a sample of local analogs of Lyman Break Galaxies. We propose to image a sample of the 9 nearest and brightest compact UVLGs in the near-ultraviolet, near-infrared, and H-alpha using ACS. With these images we will 1) characterize their structure and morphology, 2) look for signs of interactions and mergers, 3) investigate the distribution and propogation of star formation over varying time scales, and 4) quantify the stellar populations and star formation history, in order to determine whether a previous generation of stars formed long before the current burst. These data will perfectly complement our existing Spitzer, GALEX, and SDSS data, and will provide important information on star-formation in the present-day universe as well as shed light on the earliest major episodes of star formation in high-redshift galaxies.

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Proposal Category: GO
Scientific Category: ISM AND CIRCUMSTELLAR MATTER
ID: 10921
Title: Tangential Velocities of Objects in the Orion Nebula and Locating the Embedded Outflow Sources.
PI: C. O'Dell
PI Institution: Vanderbilt University

The Orion Nebula is arguably the Rosetta Stone for studying a very young star cluster and how the radiation and outflowing plasma from its stars interact with ambient material. It has been the subject of numerous HST imaging studies, which means that there is good opportunity for determining tangential velocities by obtaining second epoch images during Cycle 15, which may be the last cycle for which the WFPC2 is available. These velocities in the plane-of-the-sky will allow us to determine the patterns of outflow from micro-jets smaller than the Solar System to jet driven shocks more than a parsec from their sources. Combined with radial velocities, we'll obtain spatial velocities, which are critical to determining where the embedded sources are located that produce the numerous HH objects coming from the Orion-S and BN-KL regions. We'll also be able to determine the physics that is operating in the LL Ori type of outflows (where a bipolar jet is being distorted by a slow wind coming from the nebula). We will also be able to search for runaway stars caused by the disintegration of young multiple-star systems. All of this is possible because the long-time base of the WFPC2 and ACS observations allow a new level of astrometric precision to be obtained and to be done efficiently by making coordinated parallel observations with all images.

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Proposal Category: GO
Scientific Category: RESOLVED STELLAR POPULATIONS

ID: 10922
Title: Searching for Signs of a Double Generation of Stars in Galactic Globular Clusters
PI: Giampaolo Piotto
PI Institution: Universita di Padova

This proposal has been stimulated by new findings of ours that may have a strong impact on the interpretation of globular cluster (GC) stellar populations. In 2004, based on HST data, we have found that the main sequence of the Galactic globular cluster Omega Centauri is split into two sequences; spectroscopic analysis has shown that the only isochrones which are able to fit the combination of color and metallicity of the bluest of the two sequences were younger and greatly enriched in helium. A number of observational facts, and theoretical evidence suggest that our results on Omega Centauri might represent an extreme case of a phenomenon which has also been at work in other GCs. We have selected the most promising GCs to find out whether this hypothesis is correct, and make a strong case for its likelihood and the value of pursuing it.

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Proposal Category: GO
Scientific Category: COOL STARS
ID: 10923
Title: Measuring the size of the close-in transiting extrasolar planet HD 189733b
PI: Frederic Pont
PI Institution: Observatoire de Geneve

A new transiting exoplanet was found by our radial velocity search around the bright K dwarf HD 189733. With an apparent V magnitude of 7.67 and a distance of 19 pc, it is the closest star known with a transiting extrasolar planet. Moreover, the high radius ratio (Rpl/R ~ 0.17) makes it a uniquely favorable target for exoplanet studies. This planet is set to become the most observed hot Jupiter and a landmark in the understanding of hot Jupiter structure and formation. We propose a fundamental observations with the HST: to measure precisely the size of the transiting planet around HD189733 and the inclination angle of its orbit. The radius is an important characteristic of the planet in itself. A precise, model-independent radius determination is also a necessary prerequisite for further observations of the system with ground-based large telescopes and Spitzer (e.g. to detect reflected light and intrinsic infrared light from the planet, to measure the Rossiter-McLaughlin effect). This observation requires a high-accuracy spectrophotometry light curve with ACS in the visible. Similar observations for the formerly closest transiting planet, HD 209458b, have revealed that the planet was much larger than accounted for by any model, and undergoing strong evaporation, two observations that have had a profound impact on our understanding of the structure of close-in exoplanets and the migration process.

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Proposal Category: GO
Scientific Category: COSMOLOGY
ID: 10924
Title: Constraints on the Assembly and Dynamical Masses of z~2 Galaxies
PI: Alice Shapley
PI Institution: Princeton University

We propose deep NICMOS/NIC2 F160W imaging of seven star-forming galaxies at z~2. These galaxies comprise an entirely unique sample, with not only redshifts measured from optical and near-IR spectra, but also SINFONI/VLT near-IR integral field spectroscopic measurements providing kinematic maps of H-alpha emission out to radii of >=10 kpc. We aim to determine the dynamical masses and evolutionary states of these systems, as part of the larger goal of understanding how mass is assembled in distant galaxies. In order to interpret our novel H-alpha integral field maps in terms of mass, we require detailed knowledge of the structural parameters of our target objects at rest-frame optical wavelengths and on ~1 kpc scales. We want to establish if the mass is distributed in a disk, bulge, or merging sub-units, and if we can detect tidal features associated with a merger. F160W imaging with NICMOS/NIC2 provides the perfect combination of sensitivity and resolution to address these questions, and arrive at the fundamental quantity: the dynamical mass.
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Proposal Category: GO
Scientific Category: QUASAR ABSORPTION LINES AND IGM
ID: 10925
Title: Imaging the Nearest Damped Lyman Alpha Absorbers
PI: John Stocke
PI Institution: University of Colorado at Boulder

We propose to acquire broad-band and H-alpha imaging of three bright, very nearby host galaxies for damped Ly-alpha absorbers (DLAs). Our targets are the only DLA hosts at z < 0.03 (i.e., spatial resolutions of < 1.2 kpc). The purpose of these observations is to discover the detailed morphology and kinematics and thus the origins of the gas giving rise to DLAs. While ground-based spectroscopy of DLAs is used to infer indirectly the evolution of galaxy metallicity and thick disk kinematics out to z > 4, only with HST imaging of the very lowest redshift DLA galaxies can we discover these relationships directly. In conjunction with H I 21-cm VLA emission maps, broad-band and H-alpha images of these DLAs will allow us to determine: (1) the sites of active star formation in the host galaxies and their relationship to the QSO sightline, (2) the presence of stellar streams, supernova shells, or bipolar "superwind" outflows in DLA host galaxies, and (3) the detailed spiral structure of the host galaxies, which will allow us to use the lower resolution H I 21-cm emission line images to determine unambiguous DLA kinematics with respect to the host galaxy (i.e., is the DLA rotating with the

disk?). Thus, the high resolution imaging will allow us to correctly interpret the kinematics and metallicity information provided by the H I 21-cm VLA maps and HST UV spectroscopy to better inform the high-z results.
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Proposal Category: GO
Scientific Category: COSMOLOGY
ID: 10926
Title: GRB afterglows and host galaxies at very high redshifts
PI: Nial Tanvir
PI Institution: University of Hertfordshire

Cosmology is beginning to constrain the nature of the earliest stars and galaxies to form in the universe, but direct observation of galaxies at z>6 remains highly challenging due to their scarcity, intrinsically small size, and high luminosity distance. GRB afterglows, thanks to their extreme luminosities, offer the possibility of circumventing these normal constraints by providing redshifts and spectral information which couldn't be obtained by direct observation of the host galaxies themselves. In addition, the association of GRBs with massive stars means that they are a tracer of star formation, and that their hosts are likely responsible for a large proportion of the ionizing radiation during that era. Our collaboration is conducting a campaign to rapidly identify and study candidate very high redshift bursts, bringing to bear a network of 2, 4 and 8m telescopes with near-IR instrumentation. Swift has proven capable of detecting faint, distant GRBs, and reporting accurate positions for many bursts in near real-time. Here we propose to continue our HST program of targeting z>6 GRBs. HST is crucial to this endeavour, allowing us (a) to characterise the basic properties, such as luminosity and colour, and in some cases morphologies, of the hosts, which is essential to understanding these primordial galaxies and their relationship to other galaxy populations; and (b) to monitor the late time afterglows and hence compare them to lower-z bursts and test the use of GRBs as standard candles
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Proposal Category: GO
Scientific Category: COOL STARS
ID: 10927
Title: The Weight-Watcher Program for Subdwarfs
PI: Wei-Chun Jao
PI Institution: Georgia State University Research Foundation

We propose to use HST/FGS1r to measure five subdwarf spectroscopic binaries to determine masses for the components. Their metallicities, [Fe/H], range from -0.5 to -2.5, and their projected minimum separations range from 9 to 24 mas. These binaries are resolvable with HST/FGS1r but not any ground-based technique. Currently, there are only two subdwarf systems having any mass measurements. The proposed work will boost the total number of subdwarf

systems with masses from two to seven, and allow us to construct the first mass-luminosity relation for low-metallicity stars.

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Proposal Category: GO
Scientific Category: COOL STARS
ID: 10928
Title: Calibrating Cosmological Chronometers: White Dwarf Masses
PI: John Subasavage
PI Institution: Georgia State University Research Foundation

We propose to use HST/FGS1R to determine White Dwarf (WD) masses. The unmatched resolving power of HST/FGS1R will be utilized to follow up four selected WD binary pairs. This high precision obtained with HST/FGS1R simply cannot be equaled by any ground based technique. This proposed effort complements that done by CoI Nelan in which a sample of WDs is being observed with HST/FGS1R. This proposal will dramatically increase the number of WDs for which dynamical mass measurements are possible, enabling a better calibration of the WD mass-radius relation, cooling curves, initial to final mass relations, and ultimately giving important clues to the star formation history of our Galaxy and the age of its disk as well as in other galaxies. (This project is part of Subasavage's PhD thesis work at Georgia State University.)

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Proposal Category: GO
Scientific Category: COOL STARS
ID: 10929
Title: Calibrating the Mass-Luminosity Relation at the End of the Main Sequence
PI: Todd Henry
PI Institution: Georgia State University Research Foundation

We propose to use HST-FGS1R to finish calibrating the mass-luminosity relation for stars less massive than 0.5 Msun, with special emphasis on objects near the stellar/substellar border. Our goals are to determine Mv values to 0.05 magnitude and masses to 5%, and thereby build the fundamental database of stellar masses that we will use to test theoretical models as never before. This program uses the combination of HST-FGS3/FGS1R at optical wavelengths, historical infrared speckle data, ground-based parallax work, metallicity studies, and radial velocity monitoring to examine nearby, subarcsecond binary systems. The high precision separation and position angle measurements with HST-FGS3/FGS1R (to 1 mas in the separations) for these faint (V = 10-15) targets simply cannot be equaled by any ground-based technique. As a result of these measurements, we are deriving high quality luminosities and masses for the components in the systems, and characterizing their spectral energy distributions from 0.5 to 2.2 microns. One of the objects, GJ 1245 C with mass 0.074 +/- 0.002 Msun, is the only object known with an accurate dynamical mass less than 0.10 Msun. The payoff of this proposal is high

because the six systems selected for final observations in Cycles 15 and 16 have already been resolved during Cycles 5-13 with HST FGS3/FGS1R and contain most of the reddest objects for which accurate dynamical masses can be determined.

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Proposal Category: GO
Scientific Category: HOT STARS
ID: 10930
Title: Mass and Radius of a Near-Chandrasekhar-limit magnetic white dwarf
PI: Stefan Jordan
PI Institution: Universitat Tubingen, Institut fur Astronomie & Astrophysik

REJ0317-853 is a unique object. According to our analyses it is the most massive white dwarf ever found, with a mass of 1.35 solar masses, approaching the Chandrasekhar limit. With a period of just 725 seconds it is the most rapidly rotating isolated white dwarf ever found. Moreover, RE J0317-853 is the hottest magnetic white dwarf discovered so far and has a strong magnetic field varying from about 180 to more than 700 MG over the stellar surface. Due to its strong polarization and high mass it has been used to test gravitational theories predicting gravitational birefringence. However, the existing mass and radius determination is indirect and still uncertain and would greatly profit from a high-precision parallax determination with the HST FGS.

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Proposal Category: GO
Scientific Category: HOT STARS
ID: 10931
Title: Dynamical Masses for Four White Dwarf Stars
PI: Edmund Nelan
PI Institution: Space Telescope Science Institute

We propose to continue our observations of 2 double degenerate (DD) binary systems with the FGS, which we began in Cycle 12, to derive precise dynamical masses for these four white dwarf stars. Considering that dynamical masses are currently available for only five WDs, our measurements alone will significantly add four more to this tiny sample. We have already established preliminary orbital elements for WD1639+153, which we find to have a period of only 3.86 years, making it the shortest period, visually resolved DD known. The period of the other DD, WD 1818+126, is likely to be about 15 to 20 years. Our ultimate objective, for which we are on track, is to derive masses and radii accurate to 1% to test the theoretical WD mass radius relation.

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Proposal Category: AR

Scientific Category: AGN/QUASARS
ID: 10932
Title: Hard Ionizing Photons at High Redshift --- A New Method for Measuring the QSO Continuum Shape
PI: Jack Baldwin
PI Institution: Michigan State University

We wish to test and calibrate a new method for measuring the far-UV continuum shapes of AGN. Knowledge of this continuum shape bears on several key questions about the high-redshift universe: What is the shape and intensity of the ionizing background radiation for the IGM, as a function of lookback time? How and at what rate do massive black holes grow at the centers of galaxy halos? How do the chemical abundances in the central regions of massive proto-galaxies evolve with lookback time at redshifts z > 6? A well-established way to measure the far- to near-UV continuum shape of AGN is to compare the intensities of high- and low-ionization emission lines from the gas that is photoionized by that radiation. The highest ionization gas is expected to be in a hard-to-observe hot phase, emitted by gas at nearly a million degrees. There are to date only a few detections of this gas, using x-ray telescopes to measure the L-alpha equivalent emission line from ions such as O VII, Ne IX and Mg XI. Such measurements are only possible for the brightest nearby AGN. We show here that these same ions are expected to also emit other lines in the rest-UV with about the same strength. For high-redshift QSOs, these will be redshifted into the optical region, where they can be studied using the large collecting area of ground-based telescopes. The strengths of these lines will then tie down the far-UV continuum shape of high-redshift AGN. But the method needs to be tested and calibrated by searching for these lines in the observed-UV spectra of the same nearby AGN for which the L-alpha equivalent lines have been detected at x-ray wavelengths. This is only possible using archival HST spectra, as we propose to do here.
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Proposal Category: AR
Scientific Category: ISM AND CIRCUMSTELLAR MATTER
ID: 10933
Title: Planetary Nebula Image Catalogue: HST data
PI: Bruce Balick
PI Institution: University of Washington

We have constructed the largest image catalogue of planetary nebulae, PNe, containing images of half of the 1143 "real" PNe in the official compilation of Acker 1996. These digital multi-band images, which come from heterogeneous ground-based sources, will be used to develop morphological classification schemes, develop statistics of class memberships, and develop empirical "pathways" that may elucidate general patterns of growth and the physical precesses that account for the shapes of PNe. We propose to add all extant images of PNe and protoPNe as a scientifically vital extension to PNIC. The images will be downloaded from the HST archives by a team of undergraduates

and attached to their parent imge in the Catalog. These will be used to map critical dynamical boundaries (shocks, ionization fronts, etc.) and to study the morphologies of clumps and the tails that are often found behind them. This and the ionization structure will help to reveal the types of boundaries between zones of very different pressures and photoionization. The catalogue will be published on line. Funds are requested for undergraduate support to process the archival data, for P-I/co-I travel to coordinate the statistical studies, to support undergraduate research activities. presentations, and publications.

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Proposal Category:	AR
Scientific Category:	ISM AND CIRCUMSTELLAR MATTER
ID:	10934
Title:	The Interaction of Supernova Remnant Shocks with Interstellar Clouds
PI:	Dinshaw Balsara
PI Institution:	University of Notre Dame

The feedback of energy and matter from stars to the interstellar medium (ISM) plays a crucial role in the evolution of the ISM within galaxies and in the evolution of the galaxies themselves. Supernovae (SNe) are arguably the most important contributors to energetic feedback in galaxies. The interfaces between the newly-ejected material from SNe and the surrounding ISM of a galaxy are supernova remnants (SNRs), which dictate the time and length scales over which matter from a SN is deposited into the ISM. We understand how highly idealized SNRs evolve, the interaction of an SNR with an inhomogeneous ambient ISM is not well understood. The regions where SN blast waves encounter density clumps, i.e. clouds, in the CSM/ISM are among the most interesting observationally, since they give rise to a plethora of diagnostic emission lines and complicated geometries. The Hubble Space Telescope, the Far Ultraviolet Spectroscopic Explorer, and an array of other instruments have been used to identify many such cloud-shock regions along the periphery of the nearby Cygnus Loop. This SNR is particularly interesting for studies of such interactions: the SN giving rise to this remnant exploded in a very low density cavity, and its blast wave has only encountered the cloudy walls of this cavity in the last ~1000 years. The archival HST and FUSE observations of this remnant are among the best available and can be used to constrain models of SNR-cloud interactions. We propose to carry out numerical simulations of SN shocks engulfing small, optically thin interstellar clouds. Our 3D adaptive mesh refinement (AMR) magnetohydrodynamic (MHD) simulations will incorporate an array of physics never before included in such models, such as non-equilibrium cooling, molecular hydrogen chemistry, and anisotropic thermal conduction (important in the presence of a magnetic field). Among the questions we hope to answer with these simulations are: 1) Can these models predict ionic emissivities that agree with HST and other observations? 2) Can they reproduce the observed distribution of shock velocities around an engulfed cloud? 3) Do the clouds fragment or are there other means of mixing

their contents into the centers of SNRs? 4) Does such mixing adequately explain the presence of ñmixed-morphologyî remnants? An important aspect of our work will be the direct comparison of predictions from our proposed simulations with HST imaging and spectroscopy of the Cygnus Loop. This comparison will allow us to test the numerical simulations so that they may be used to interpret observations of other SNRs.

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Proposal Category: AR
Scientific Category: AGN/QUASARS
ID: 10935
Title: Resolving the Critical Ambiguities of the M-Sigma Relation
PI: Dan Batcheldor
PI Institution: Rochester Institute of Technology

Determining the best estimates of the masses of supermassive black holes (SMBHs) and their uncertainties is crucial for constraining the slope and scatter of the SMBH mass vs. stellar velocity dispersion (M-sigma) relation and for understanding the relation between SMBHs and their host galaxies. We propose to critically evaluate the values of the SMBH masses in a sample of 23 galaxies using data derived from STIS long-slit spectroscopy. This study will directly achieve three significant and fundamental improvements to the M-sigma relation. First, we will use all suitable STIS long-slit data to analyze SMBH masses in an entirely homogeneous fashion. Second, we will substantially increase the SMBH sample size with new estimates. Finally, we will use our state-of-the-art Schwarzschild code, which will, for the first time and independently of the modelling parameters, explore the full range of SMBH masses that give statistically acceptable fits to a given data set. These analyses can be carried out with unrivaled efficiency using the cutting-edge computing facilities available at RIT. This work will result in the most accurate and reliable estimate of the form (slope and scatter) of the M-sigma relation; to date improvements have only been somewhat incremental. Such a study will place important constraints on some of the most fundamental problems remaining in contemporary astrophysics.

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Proposal Category: AR
Scientific Category: HOT STARS
ID: 10936
Title: Be Stars and Circumstellar Disks in NGC 346
PI: Karen Bjorkman
PI Institution: University of Toledo

We propose to analyze the HST ACS and NICMOS images of the young star cluster NGC 346 in the Small Magellanic Cloud. These data will complement our ongoing investigation of the role of age and metallicity in the formation of circumstellar disks around near-main-sequence classical Be stars. The

superior spatial resolution of the ACS images will allow us to investigate stars in the inner core of the cluster, where our existing ground-based images did not provide sufficient resolution to adequately separate the individual stars. Ground-based investigations have shown that a number of classical Be stars are present in this cluster, even though the cluster would seem to be too young to have a substantial population of such systems based on current ideas of Be star disk formation. The ACS and NICMOS observations will allow us to better characterize the number of Be stars by probing the inner cluster region, and will allow us to look for differences in the relative fraction of Be stars in the inner cluster compared with the outer regions. We will also compare these data with ground-based survey data to look for temporal changes in disk systems in the outer part of the cluster.

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Proposal Category: AR
Scientific Category: COSMOLOGY
ID: 10937
Title: Probing the Galaxy Population at z~7-10 Using Archival ACS + NICMOS data
PI: Rychard Bouwens
PI Institution: University of California - Santa Cruz

Recent searches for galaxies at z>=7 have placed a great deal of emphasis on obtaining ultra deep infrared observations to probe down to extremely faint luminosities, either through gravitational lensing or by extremely deep observations with NICMOS. However, to fully understand the evolution of a galaxy population, it is important to cover significant areas as well, both to probe evolution at the bright end of the luminosity function and to locate objects capable for follow-up in other wavebands. We propose to complement current deep studies of the high redshift universe by conducting a comprehensive search for z>=7 objects in all HST fields in the archive with deep ACS and NICMOS data. Particular emphasis will be given to the NICMOS data over the GOODS fields. With current data, we expect to more than quadruple the sizes of current z>=7 samples. In addition to the clear science objectives of this search, the legacy of this program will be a homogeneous reduction of all NICMOS data (~1500 orbits) over the two GOODS fields.

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Proposal Category: AR
Scientific Category: COSMOLOGY
ID: 10938
Title: HAGGLeRS: HST Archive Galaxy-Galaxy Lensing at high Resolution with Simulations
PI: Marusa Bradac
PI Institution: Stanford University

Galaxy-galaxy weak lensing is a powerful technique for probing (statistically) the mass distributions of galaxies. By correlating the signal with the

properties of the visible matter, and comparing these results directly with high resolution, large scale numerical simulations, we can begin to fill in some of the gaps in our understanding of the physics of galaxy formation and evolution within the context of the LCDM model. The ground-based studies in this field undertaken so far have been limited by their resolution and depth, with relatively few distorted background galaxies per lens. With the high resolution imaging afforded by ACS on HST, a much higher source density is available, with sources visible near the centers of galaxies where the signal is stronger. The ground-based studies have recovered their precision by increasing the number of lenses: we propose to do likewise and measure the galaxy-galaxy lensing signal in all suitable ACS images taken to date. The repository of observations defined by the HAGGLeS Strong Lens Survey (Cycle 14 Legacy Archive proposal 10676; PI Marshall) is well-matched to this project: its legacy of high level science products for all deep multi-filter pointings, covering some 1.6 square degrees of sky, can be used directly here. The archive provides a range of lens galaxy environments, from underdense voids to overdense clusters, in which the galaxy-galaxy lensing signal may be investigated. The high satellite distribution of the lenses themselves may be probed using measurements of the higher order shape moments measurable with ACS; compiling results from the impressive sky area observed to date makes for a galaxy-galaxy lensing survey competitive with, yet complementary to, the wide-field surveys from the ground.

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Proposal Category: AR
Scientific Category: RESOLVED STELLAR POPULATIONS
ID: 10939
Title: Binary Burning in Globular Clusters
PI: Joel Bregman
PI Institution: University of Michigan

In globular cluster evolution, binary stars are destroyed (?burned?) through close stellar encounters over several dynamical relaxation times, a process that delays the onset of core collapse. Dynamical interactions plus mass segregation causes the binary fraction to rise in the core but fall at larger radii. These changes in the binary fraction properties with time can be tested because some clusters have undergone only a few relaxation times while others are core collapse systems. The presence of binaries thickens the Main Sequence in a color-magnitude diagram, a technique used to measure the binary fraction in 4 globular clusters, with surprising results. For example, one core collapse system has a large binary fraction (25%) while the other has only a upper limit (< 5%). We propose to use the archival data of about two dozen clusters to determine their binary properties and test whether they evolve as models predict.

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Proposal Category: AR
Scientific Category: SOLAR SYSTEM

ID: 10940
Title: Constraints on the Formation and Evolution of the Pluto System
PI: Marc Buie
PI Institution: Lowell Observatory

We propose a detailed program of analysis based on archival HST data and mutual event photometry to address several goals related to the Pluto system. A new analysis of HST images of Pluto from 1992 and 1993 should reveal the two new satellites recently discovered, with the longer temporal baseline greatly improving their orbital periods. Application of the new Pluto surface maps derived from HST data obtained in 2002 and 2003 to the astrometry extracted from the HST images from 1992 and 1993 will remove the center-of-light to center-of-body offset, thereby improving the orbit of Charon, especially after being combined with the more recent astrometry. With these new constraints on the orbit of Charon and the new stellar occultation constraint on the radius of Charon, we intend to derive a new radius for Pluto by imposing these values on the mutual event photometry.

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Proposal Category: AR
Scientific Category: AGN/QUASARS
ID: 10941
Title: Are Classical QSO Host Galaxies Bona Fide Elliptical Galaxies?
PI: Gabriela Canalizo
PI Institution: University of California - Riverside

Recent studies of QSO host galaxies have renewed old claims that most, if not all, classical QSOs reside in seemingly undisturbed elliptical hosts with ancient stellar populations. However, our deep ACS images of a sample of these objects (GO-10421) show dramatic shell structure indicative of past major merger events, and our deep Keck spectroscopy indicates that they were involved in major starburst episodes within the last 2 Gyr. Are these host galaxies truly distinct from bona fide ellipticals? There are now enough archival ACS data that we are able to find a large sample of elliptical galaxies in fields with observations approximately as deep (5 orbits) as those of our QSO host galaxies. Here we propose to carry out a matching study of a control sample of early type galaxies from the archive. We will perform the same analysis on the images and will obtain ground based spectroscopy that will enable us to study their interaction and star formation histories and thus make a meaningful comparison with the QSO host galaxies. We will then determine whether the latter are truly a distinct population. This project can also significantly contribute to our knowledge and understanding of the origin and evolution of early type galaxies.

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Proposal Category: AR

Scientific Category: STAR FORMATION
ID: 10942
Title: Archival Imaging Survey of the Formation and Energy Feedback of Massive Protostars in the LMC
PI: You-Hua Chu
PI Institution: University of Illinois at Urbana - Champaign

The formation of massive stars has a significant impact on the structure and evolution of the interstellar medium (ISM). After their birth, the energy feedback from the massive stars erodes the ambient medium and makes it impossible to reconstruct the physical conditions of the massive stars' natal environment; however, the energy feedback also produces conditions that lead to subsequent star formation. The ``second generation'' protostars, not having altered their large-scale environment, provide an excellent opportunity to link the initial interstellar conditions to the final star formation product. Spitzer Space Telescope observations of the Large Magellanic Cloud have detected a large number of massive protostars; most of them are in HII complexes and correspond to second-generation star formation. We propose to use H-alpha and continuum images in the HST archive to examine the natal interstellar environments of massive protostars and assess whether the star formation was spontaneous or triggered. We will also search for compact HII regions and circumstellar ouflow interaction features of these massive protostars, and use their geometries to constrain the model fits of the protostars' spectral energy distributions.
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Proposal Category: AR
Scientific Category: SOLAR SYSTEM
ID: 10943
Title: Flat Field Calibration of ACS and STIS UV Images
PI: John Clarke
PI Institution: Boston University

This short archive calibration proposal has resulted from the discovery that existing ACS and STIS UV flat fields are not appropriate for diffuse H Ly alpha emissions. The proposal is to attempt to produce new UV flat fields for each mode using data that presently resides in the archive, rather than to propose for new observations of geocoronal H Ly alpha emission.
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Proposal Category: AR
Scientific Category: ISM AND CIRCUMSTELLAR MATTER
ID: 10944
Title: Dust Formation and Evolution in SN 1987A
PI: Geoffrey Clayton
PI Institution: Louisiana State University and A & M College

SN 1987A is, by far, the best observed SN in history. The HST spectra and

images of SN 1987A comprise a unique dataset which follows the development of a Type II SN, continuously for a longer period of time, and follows the ejecta to a later time than any other SN. In particular, these data can be used to help better understand the formation and evolution of dust in SN ejecta. The dust formation can be seen in the development of asymmetric blueshifted emission line profiles and is caused by dust forming, and preferentially extinguishing redshifted emission from the far side of the expanding ejecta. Galaxies at high redshift, less than 1 Gyr after their formation, have been observed to contain abundant amounts of dust In these early galaxies, dust production may fall completely to the Type II SNe. The study of dust formation in SN 1987A may be a Rosetta Stone for SNe in high redshift galaxies.

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Proposal Category: AR
Scientific Category: RESOLVED STELLAR POPULATIONS
ID: 10945
Title: Archive of Nearby Galaxies: Reduce, Reuse, Recycle (ANGRRR)
PI: Julianne Dalcanton
PI Institution: University of Washington

We propose to reduce the entire ACS and WFPC2 imaging archive for all 202 non-Local Group galaxies within 5 Mpc. We will produce calibrated, time-stamped photometry for the millions of stars resolved in the reduced images. The resulting catalogs can be used for studies of variable stars, recent star formation, metallicity and spatial distributions of old stellar populations, galaxy distances, stellar clusters, and optical counterparts of X-ray sources. As part of this Legacy program, we will release: (1) all reduced imaging; (2) catalogs of stellar photometry; (3) a pipeline for measuring fluxes of sources detected with multiple cameras with varying imaging conditions; (4) calibrated color-dependent filter transformations among all possible HST filter + instrument combinations; and (5) revised stellar isochrones in both WFPC2 and ACS systems.

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Proposal Category: AR
Scientific Category: QUASAR ABSORPTION LINES AND IGM
ID: 10946
Title: The Evolution of Metals in the Intergalactic Medium
PI: Romeel Dave
PI Institution: University of Arizona

We propose to study the impact of metal and energy deposition from galactic winds on the diffuse IGM at $z<2$, by comparing cosmological hydrodynamic simulations with UV quasar absorption line data from the STIS archives. Metal enrichment provides a unique probe into the cumulative star formation history of the cosmos, and the ubiquitous presence of metals in the intergalactic medium should yield important constraints on models of galaxy formation and

feedback. We have incorporated galactic winds into hydrodynamic simulations in order to properly model the complex interactions of infalling and outflowing gas within a full hierarchical structure formation scenario, employing parameterizations based on locally-observed correlations of outflows with galaxy properties. Our preliminary comparisons with z>2 IGM and galaxy observations are surprisingly promising. To fully test our model and understand the metal history of the universe, we propose to extend our comparisons to z=0, thereby probing the bulk of the Universe's age. STIS echelle spectra uniquely provide the resolution and data quality needed to constrain metal absorption in the diffuse IGM, and we have identified over 30 archived quasar spectra suitable for this purpose. We will engage in careful comparisons of these versus simulated spectra, for which we already have the tools in-hand, in order to test and tune our feedback models. A self-consistent model of galactic feedback would open up new avenues for understanding such puzzles as the missing metals problem, the existence of highly enriched objects at early times, the presence of metals in quiescent and diffuse intergalactic gas, and the source and epoch of intracluster gas enrichment.

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Proposal Category: AR
Scientific Category: UNRESOLVED STELLAR POPULATIONS
ID: 10947
Title: Galaxy Environments and Evolution in the GOODS-N Field
PI: Marc Davis
PI Institution: University of California - Berkeley

In the spirit of a Legacy archival program, we propose to develop a publicly-available, non-proprietary tool allowing the measurement of the local density of galaxies (i.e., the "environment") for any object in the GOODS-N field with 0.2<z<1.4, provided only RA, dec, and redshift. Recent studies have shown that the properties and formation histories of galaxies depend strongly on the environment in which they are located. By adding environment information to the uniquely deep multiwavelength dataset available in the GOODS-N field, it will be possible to uncover many new pieces of the galaxy evolution puzzle. Measuring environments over the entire GOODS-N field will require a small amount of additional Keck/DEIMOS spectroscopy surrounding the field; we will make all Keck data and redshifts public as soon as they are reduced. We can use the resulting 3d environment measurements to calibrate the use of neighbor counts from the deep GOODS-N (original + SN search) imaging as a second measure of environment. We will use the environment tool ourselves for two projects that utilize the nearly-unique GOODS-N HST/ACS and Chandra/ACIS data: (1) studying the morphology-density relation at z=0.5-1 down to faint luminosities; and (2) determining the typical environments of low-level AGN and testing for relationships with host galaxy properties.

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Proposal Category: AR

Scientific Category: UNRESOLVED STELLAR POPULATIONS
ID: 10948
Title: Exploring the Center of M31
PI: Rosanne Di Stefano
PI Institution: Smithsonian Institution Astrophysical Observatory

Supermassive black holes (BHs) in the centers of galaxies interact with nearby stars, e.g., stripping giants of their gaseous envelopes. High nuclear stellar densities can foster interactions among stars. These processes lead to the creation of X-ray sources (XRSs), such as the hot cores of stripped giants, or X-ray binaries. Chandra has identified more than 100 XRSs in the central 8' x 8' of M31. This region has also been the subject of numerous HST observations. We propose to use archival HST data to study correlations between the XRSs and both nearby stars and ionization features. We will find counterparts or to place significant limits on the flux of possible counterparts for a significant fraction (1/3-1/2) of the XRSs in these fields. We will estimate the ages of the X-ray active systems, search for differences between them and stars in their immediate neighborhood, study the results as a function of distance from the nucleus, and compare the bulge and disk populations. This detailed work, possible only in M31, will shed light on the interactions that occur in the centers of galaxies. XRSs created near the center emit copious amounts of X-ray and UV radiation, with a reasonably steady average greater than 10^{39}-10^{40} erg s^{-1}, independent of direct emission from the BH. This is a form of feedback that has not yet been well studied, and which can be better understood through the work we propose. A second important focus of the archival work is to illuminate the nature of the still poorly understood classes of supersoft sources (SSSs) and quasisoft sources (QSSs). Some SSSs may be progenitors of Type Ia supernovae; some may be accreting intermediate-mass BHs. Appropriate models for QSSs have not yet been developed. The bulge of M31 has a high density of these sources. Work with the HST archive will provide unique insight into the possible natures of these enigmatic and potentially important sources.
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Proposal Category: AR
Scientific Category: ISM AND CIRCUMSTELLAR MATTER
ID: 10949
Title: Chemical Abundances in Young Supernova Remnants: Connecting Observations with Hydrodynamics
PI: Kristoffer Eriksen
PI Institution: University of Arizona

HST has provided high quality images and spectra of many oxygen-rich supernova remnants. However, the theoretical framework for interpreting this data has lagged behind. We are developing a new code that integrates nebular non-equilibrium ionization and cooling with multi-dimensional hydrodynamics and radiative transfer in order to model the spectra and morphology of young supernova remnants. Our models will provide the best abundances to date for

this important class of object, and will serve as a primary diagnostic of massive star evolution and supernova hydrodynamics. This proposal will partially support the Ph.D. dissertation of the PI.

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Proposal Category: AR
Scientific Category: COSMOLOGY
ID: 10950
Title: The Extragalactic Background, the Zodiacal Foreground, and the Integrated Light of Faint Galaxies
PI: Harry Ferguson
PI Institution: Space Telescope Science Institute

Measurements of the extragalactic background light (EBL) are controversial, in large part because they are difficult to understand in the context of current theories of galaxy evolution. In both the optical and NIR bands, the reported EBL is a factor of 3-10 higher than the integrated light from galaxies. The energy in the EBL is comparable to or greater than the energy produced in nucleosynthesis of all known stars. However, theoretical misgivings are not a good reason to discount careful measurements. We propose to measure the background in HST observations as a function of viewing geometry through the zodiacal cloud to assess uncertainties in the models of the zodiacal foreground, and, if these are found to be small, to improve constraints on the EBL. We will also use deep surveys to improve estimates of the integrated light from galaxies.

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Proposal Category: AR
Scientific Category: QUASAR ABSORPTION LINES AND IGM
ID: 10951
Title: Understanding HST observations of IGM and ISM clouds
PI: Gary Ferland
PI Institution: University of Kentucky

We propose extending the geometry and radiative transport methods used by the spectral simulation code Cloudy to better simulate conditions within IGM and ISM clouds. The gas in these clouds is far from equilibrium and the message in their spectra is best interpreted by reference to numerical simulations of their properties. HST observations reveal their chemical composition, the gas pressure, the shape and intensity of the background source of ionizing radiation, and so probe the chemical and star formation history of the universe. Cloudy is widely used by others to interpret their HST observations of such clouds. The geometry is now 1D spherical, a point source of ionization is assumed, and line transport is done with escape probabilities. The clouds are actually ionized by the cosmic or galactic background, a continuum produced by a combination of quasar, starburst, and other emission. This continuum strikes the gas from all directions rather than as a single ray. The ionization of the gas is strongly affected by line transport,

especially the Lyman lines of helium. The project will upgrade the radiative transfer to do continuum transport with explicit angle averages with short characteristics so that cloud illumination by background radiation can be treated. Line transport will be done with accelerated lambda operator, a method with known convergence and stability properties. The result will be better simulations and deeper insights into the nature of IGM and ISM clouds.
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Proposal Category: AR
Scientific Category: RESOLVED STELLAR POPULATIONS
ID: 10952
Title: The Local Environments of Supernovae
PI: Alex Filippenko
PI Institution: University of California - Berkeley

The locations of supernovae (SNe) in the local stellar and gaseous environment in galaxies, as measured in high spatial resolution WFPC2 and ACS images, contain important clues to their progenitor stars. They provide accurate determinations of any association of SNe with H II regions or star clusters. Since multi-filter observations are generally available, we can determine the local stellar population, setting constraints on the mass of the progenitor; we can also search for possible attenuation of the SN by dust in the host galaxy by studying the colors of the stars in its environment. By checking the fields for background sources, we can correct the existing SN light curves and luminosities if necessary. When a SN has been observed incidentally, information can be gained on its optical and UV emission. Deep HST images can be used to find light echoes of SNe, as well as recover SNe interacting with circumstellar material at very late times. A direct search for the progenitor stars of SNe can be made in pre-existing HST images of their locations; as the number of archival HST images steadily increases, along with the number of newly discovered SNe, positive identifications become progressively more likely. In Cycle 15, we plan to extend our successful work from previous cycles. This proposal is complementary to our Cycle 15 snapshot proposal for an ACS imaging survey of the sites of nearby, relatively recent supernovae, whose primary purpose is to obtain late-time photometry of SNe and to pinpoint their locations (to help in the hunt for their progenitor stars).
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Proposal Category: AR
Scientific Category: COSMOLOGY
ID: 10953
Title: Absolute Spectrophotometric Calibration to 1% from the FUV through the near-IR
PI: David Finley
PI Institution: Eureka Scientific Inc.

We are requesting additional support to complete the work now being carried out under the Cycle 14 archive program, HST-AR-10654. The most critical

component of that effort is an accurate determination of the STIS spectrometer LSF, so that we may correctly model the infill of the Balmer line cores by light redistributed from the wings and adjacent continuum. That is the essential input for obtaining accurate and unbiased effective temperatures and gravities, and hence calibrated fluxes, via line profile fitting of the WD calibration standards. To evaluate the published STIS LSF, we investigated the spectral images of the calibration targets, yielding several significant results: a) the STIS LSF varies significantly; b) existing observation-based spectroscopic LSFs or imaging PSFs are inadequate for deriving suitable spectroscopic LSFs; c) accounting for the PSF/LSF variability will improve spectrophotometric accuracy; d) the LSFs used for model fits must be consistent with the extraction process details; and, e) TinyTim-generated PSFs, with some modifications, provide the most suitable basis for producing the required LSFs that are tailored to each individual spectral observation. Based on our current (greatly improved) state of knowlege of the instrumental effects, we are now requesting additional support to complete the work needed to generate correct LSFs, and then carry out the analyses that were the subject of the original proposal. Our goal is the same: to produce a significant improvement to the existing HST calibration. The current calibration is based on three primary DA white dwarf standards, GD 71, GD 153,and G 191-B2B. The standard fluxes are calculated using NLTE models, with effective temperatures and gravities that were derived from Balmer line fits using LTE models. We propose to improve the accuracy and internal consistency of the calibration by deriving corrected effective temperatures and gravities based on fitting the observed line profiles with updated NLTE models, and including the fit results from multiple STIS spectra, rather than the (usually) 1 or 2 ground-based spectra used previously. We will also determine the fluxes for 5 new, fainter primary or secondary standards, extending the standard V magnitude lower limit from 13.4 to 16.5, and extending the wavelength coverage from 0.1 to 2.5 micron. The goal is to achieve an overall flux accuracy of 1%, which will be needed, for example, for the upcoming supernova survey missions to measure the equation of state of the dark energy that is accelerating the expansion of the universe.

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Proposal Category:	AR
Scientific Category:	UNRESOLVED STELLAR POPULATIONS
ID:	10954
Title:	Probing the nature and local environments of Ultraluminous X-ray sources
PI:	Kajal Ghosh
PI Institution:	Universities Space Research Association

We have demonstrated that: (1) the positional errors of ULXs between the Chandra and HST images can be achieved better than 0."2, (2) comparison of colors and magnitudes with the evolutionary tracks and isochrones can be used to study the starformation history of the local environments of ULXs, and (3) our irradiation model of the donor star and accretion disk in ULX binaries

will be able to constrain the binary parameters of ULXs. Based on these techniques, we propose a pilot study to determine the nature and local environments of thirty ULXs in nearby galaxies, for which high signal-to-noise ratio HST data with broadest photometric coverage are available in the archive. Analysis of high-resolution radio and infrared images of most of these galaxies are in progress, which will be used to search for the counterparts of ULXs and mainly for the starformation studies of the local environments of ULXs. This program will strongly support our new Chandra survey of ULXs for distance-limited complete sample of 147 galaxies, approved in Cycle 7. In addition, the results of this program will generate large number of sources with multiwavelength properties, for a complete sample of galaxies, which can be used in future to address many other challenging issues of astronomy and astrophysics.
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Proposal Category: AR
Scientific Category: ISM AND CIRCUMSTELLAR MATTER
ID: 10955
Title: Chemical Abundances in the Ejecta of Eta Carinae
PI: Theodore Gull
PI Institution: NASA Goddard Space Flight Center

The massive (>100 solar masses) stellar system, Eta Carinae, is immersed in its own CNO-processed material thrown out over the past 170 years. These nitrogen-rich, carbon- and oxygen-poor ejecta have enriched metal abundances and peculiar dust properties, most likely due to chemical processes and photo-excitation, not pre-ejection nuclear processes. The outermost ejecta, the Homunculus, is a well-defined warm, dusty neutral shell including at least ten solar masses of material. We propose to expand the STIS narrow line absorption studies to include VLT/UVES measures and obtain relative abundances of metals, some of which are not seen in the ISM due to dust formation. We thereby will provide information to dust experts on the differences of dust around Eta Carinae compared to normal ISM dust.
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Proposal Category: AR
Scientific Category: COOL STARS
ID: 10956
Title: Molecular Envelopes of M supergiants
PI: Graham Harper
PI Institution: University of Colorado at Boulder

M supergiants have long been known to possess discrete shells of molecules, gas and most likely dust. These stars are now thought to possess quasi-static reservoirs of warm (1500K) molecules levitated above, but detached from, their photospheres, and are known as MOLspheres. This intriguing atmospheric component may be the site of material for future shell ejections or it may provide an environment in which hot, clean dust can form. Ultraviolet

molecular electronic transitions are extremely sensitive diagnostics of warm circumstellar envelopes, and we propose a detailed non-LTE study of the UV signatures of CO and OH in HST spectra of the M supergiant Betelgeuse. This study will also be extended to a larger sample of stars observed with IUE. The results of this program will constrain the dynamic, thermodynamic and spatial properties of these molecules. We will test the hypothesis that the CO responsible for the observed GHRS UV absorption is part of the MOLsphere, and help complete the inventory of circumstellar molecules.

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Proposal Category: AR
Scientific Category: HOT STARS
ID: 10957
Title: Eta Carinae and its Extended Wind
PI: John Hillier
PI Institution: University of Pittsburgh

Using spectroscopic archival data we plan to study the spectacular luminous blue variable Eta Carinae and its extended wind. The principal objective is to place rigorous constraints on the primary star and its wind. Such constraints are essential if we are to determine the cause of the gigantic explosion that occurred in the 1840's. To achieve our objectives we will study the geometry of Eta Carinae and its wind by viewing it from different directions (through the use of reflected spectra), by studying the spatial extent and properties of the wind which is resolved (at some wavelengths) by HST, and by studying the spectroscopic and spatial time variability.

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Proposal Category: AR
Scientific Category: COSMOLOGY
ID: 10958
Title: Quantifying Observed Timescales in Galaxy Mergers using Simulations
PI: Patrik Jonsson
PI Institution: University of California - Santa Cruz

We propose a study which will quantify the timescales during which merging galaxies of different mass ratios are observed to be morphologically disturbed, have enhanced star formation, or have close companions. This information is necessary for converting observed fractions of interacting galaxies or close pairs in high-redshift HST observations into physical merger rates. The results will constrain the amount of merger-driven star formation that can be "hidden" in the morphologically-normal spiral galaxies which seem to dominate star formation at redshifts around 1. We will also study how merger-driven AGN activity correlates with the evolution of the merging galaxies. The study will be based on simulated images of merging galaxies, generated using hydrodynamic simulations along with a radiative-transfer model. We will also develop an automated merger classification method, based

on morphological statistics and colors, which can be applied to high-redshift galaxies in ACS surveys. This method will be able not only to identify merging galaxies but also to tell how far the merger has progressed and make predictions for the timescales of individual merger stages.
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Proposal Category: AR
Scientific Category: COSMOLOGY
ID: 10959
Title: Constraining the Small-scale Clustering: Towards better understanding of Galaxy-light and Dark-matter connection
PI: Kyoung-Soo Lee
PI Institution: The Johns Hopkins University

We propose an HST archival research to study the spatial clustering of Lyman-break galaxies at z ~ 4-5 at small scales (angular separation theta<30 arcsec, corresponding to spatial scales of about 1 Mpc comoving). Taking advantage of archival deep multi-wavelength images taken with the ACS, we will investigate the statistical association between the galaxy properties (e.g. star formation rate and morphology) and the dark matter properties (halo mass) by comparing the observed small-scale clustering and luminosity funtion to theoretical predictions. The existing ACS images, particularly those obtained as part of the GTO program, are an ideal resource for this research because of their depth, angular resolution and multi-wavelength coverage, which are crucial to identifying close galaxy pairs at high redshifts. Recent works, at both low and high redshifts, from deep, large-area surveys (e.g. SDSS, 2DF, GOODS, COSMOS) have discovered that there is a characteristic scale in the galaxy correlation function at which a transition of the correlation slope occurs. The steeper slope at small scales is interpreted as evidence of galaxy multiplicity, that is of the fact that massive halos develop substrucures in the form of "subhalos" which are themselves capable of hosting visible galaxies. At large scale, the shallower slope is determined by the halo-halo clustering, which reflects the power spectrum at linear scales. By comparing the observed distribution of separations and the luminosity function of close pairs of Lyman-break galaxies with those predicted by the theory we will test the validity of the models adopted to describe the physical association between halo and galaxy propeties, thus providing very powerful constraints to the theory. From this research, we will gain invaluable insights into what halo properties govern the physical processes of galaxy formation.
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Proposal Category: AR
Scientific Category: UNRESOLVED STELLAR POPULATIONS
ID: 10960
Title: Anatomy of the Nuclear Starburst in M83 from Integral Field Spectroscopy
PI: Claus Leitherer
PI Institution: Space Telescope Science Institute

The metal-rich nuclear starburst galaxy M83 is the closest example of a hot-spot galaxy, whose characterizing property is its complex optical structure. This morphology is most likely caused by a combination of spatially irregular star formation and a patchy interstellar medium. STIS in its slitless mode has the capability to perform multiple-object spectroscopy of point-like star clusters and HII regions within 25" (or 450 pc at M83's distance) of the galaxy center. We propose to analyze archival slitless ultraviolet spectroscopy and imagery to characterize the stellar and interstellar properties of the starburst. The data will be combined with available ground-based and space-ultraviolet spectroscopy obtained by us with the FUSE and HUT satellites. We will (i) contrast the cluster and field population, (ii) investigate age gradients, (iii) measure outflows of the ionized gas, and (iv) study the behavior of the dust reddening from local (pc) to global (kpc) scales.

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Proposal Category: AR
Scientific Category: STAR FORMATION
ID: 10961
Title: Scattering and Absorption Properties of Porous Dust Grains: A Library for Modeling the HST Optical and near-Infrared Scattered Light Images of Protoplanetary and Debris Disks
PI: Aigen Li
PI Institution: University of Missouri - Columbia

We propose a theoretical program to calculate the scattering and absorption properties of porous dust grains grown by coagulation in protoplanetary disks, using the powerful discrete dipole approximation code DDSCAT which can accurately calculate the scattering properties of porous aggregates. This program will create a web-based library of scattering and absorption cross sections, and albedos, asymmetry parameters and phase functions for porous dust as a function of grain size, porosity and wavelength. This library will be made publicly available via the WWW at http://www.missouri.edu/~lia/. These scattering parameters are essential for interpreting the scattered light images of protoplanetary and debris disks in the visible and near-infrared wavelengths obtained with HST, allowing us to reliably determine the disk geometry and dust size distribution. The latter is of particular astrophysical significance since it can tell us whether grain growth -- the first stage of planet formation -- has indeed occurred in protoplanetary disks.

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Proposal Category: AR
Scientific Category: UNRESOLVED STELLAR POPULATIONS
ID: 10962
Title: Searching the optical counterparts for ultraluminous X-ray sources

PI: Jifeng Liu
PI Institution: Harvard University

Ultraluminous X-ray sources are one of our best chances to discover intermediate mass black holes of 100-100,000 solar masses. Optical studies are essential to shed light on their nature by looking into their environments and identfiying the seceondaries, which can be monitored spectroscopically to detect orbital motions, measure the radial velocity curves, and determine the black hole mass beyond doubt. Here we propose to search for the optical counterparts of ULXs by comparing the HST archive and the Chandra archive. We expect at least a few dozens of counterparts from this archive study.

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Proposal Category: AR
Scientific Category: UNRESOLVED STELLAR POPULATIONS
ID: 10963
Title: A High Resolution alpha-enhanced Stellar Library for Evolutionary Population Synthesis
PI: Lucimara Martins
PI Institution: Space Telescope Science Institute

Libraries of stellar spectra are fundamental tools for the study of stellar populations. We propose to create a high-resolution stellar library with alpha-enhanced compositions, computed with the latest improvements in stellar atmospheres, ranging from near-UV to the near-IR. The library will span all stellar types that are relevant for evolutionary models. The atomic and molecular line list will be calibrated with unprecedented accuracy by using the new NGSL, an empirical stellar library created with STIS HST observations. The library will be implemented on evolutionary synthesis codes to create for the first time an appropriate tool to study and model stellar systems that have undergone different star formation histories than that of our local universe.

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Proposal Category: AR
Scientific Category: COSMOLOGY
ID: 10964
Title: Correcting effects of Charge Transfer Inefficiency in the ACS Wide Field Camera
PI: Richard Massey
PI Institution: California Institute of Technology

During CCD readout, charge transfer inefficiency creates trails across an image and spuriously elongates faint sources. The effect is steadily getting worse in the ACS Wide Field Camera. In data from cycles 12-14, it is the dominant systematic in weak lensing analysis. The trails insidiously mimic a lensing signal, and primarily affect the faintest galaxies, which potentially contain the most valuable signal. We propose to develop a model for the ACS

readout process, and code to correct charge trailing during data reduction. This algorithm will be motivated to increase the number density of galaxies useful for weak lensing and ultimately improve the resolution of weak lensing maps, but it will be of general interest to the wider community. Since lensing analysis is the most sensitive test of charge trailing, any correction meeting its rigorous demands will be of immediate use in other fields requiring accurate measurement of shape, astrometry or photometry. We will publicly release our code so that it can be used in other data reduction pipelines, to increase the scientific return from existing ACS data and support future observing programs.

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Proposal Category:	AR
Scientific Category:	UNRESOLVED STELLAR POPULATIONS
ID:	10965
Title:	The Sites and Triggers of Star Formation in Large Disk Galaxies Since z=1.
PI:	Jason Melbourne
PI Institution:	University of California - Santa Cruz

Luminous Infrared Galaxies (LIRGs) are the sites of significant, dusty star formation out to z=1. Above z=0.5, roughly half of all LIRGS exhibit undisturbed spiral morphology. Today LIRGS are dominated by merging (peculiar) systems and spiral LIRGS are exceedingly rare. Thus the star formation rate of large spirals apears to have evolved over that time. We have identified populations of both LIRG and normal disks in the GOODS and GEMS Hubble Treasury Fields (Melbourne et al. 2005), and propose to study the stellar populations of their substructures to identify both the major sites and triggers of star formation in large disk galaxies to z=1. To accomplish this, we will combine the high resolution optical HST data with equally high resolution near infrared imaging from Keck adaptive optics to measure the stellar populations of the substructures in LIRG and non-LIRG disks.

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Proposal Category:	AR
Scientific Category:	AGN/QUASARS
ID:	10966
Title:	Simulation Study of Diffusive Synchrotron Radiation from Hot Spots in Relativistic Jets such as M87
PI:	Ken-Ichi Nishikawa
PI Institution:	University of Alabama in Huntsville

We propose to apply numerical simulations and modeling to obtain emission spectrum from relativistic shocks and to compare the emission spectrum with observed optical-X-ray spectra from the M87 jet and 3C273. In particular, the project involves the study of relativistic collisionless shocks associated with knots and other optical structures (synchrotron spectrum models and break frequencies) observed in the kpc scale jet from knot HST-1 to knot A. Recent

PIC simulations have revealed that in collisionless shocks, plasma waves and their associated instabilities (e.g., the Weibel, Buneman and other two-stream instabilities) are responsible for particle (electron, positron, and ion) acceleration and magnetic field generation. A 3-D relativistic electromagnetic particle (REMP) code will be used to investigate the shock processes in unmagnetized and magnetized electron-ion and electron-positron plasmas in order to obtain self-consistent spectra based on the trajectories of electrons in inhomogeneous magnetic fields. The diffusive synchrotron radiation (DSR) (jitter radiation) theory (Fleishman 2006; Medvedev 2006) shows that the synchrotron radiation spectrum produced by relativistic electrons in the jet is modified by the presence of small-scale random magnetic fields assumed to be generated by the Weibel instability. A high-frequency power-law component to the spectrum is yielded by taking account of the perturbations to the electron trajectories as a result of small-scale magnetic fields, which deviate from the standard synchrotron spectrum, especially at the high frequency. In our investigations, the density of the plasmas, the ambient magnetic field strength and direction, and jet Lorentz factor will be varied in order to evaluate the effect of changes in macroscopic properties (deceleration in jet velocity) that might be expected along the M87 jet. Emission spectra calculated based on electron trajectories in collisionless relativistic shocks (hot spots) generated by the Weibel instability in our simulations and its comparison with observations will enable us to address the radio-optical-X-ray spectra and its variability in M87 and other relativistic sources.

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Proposal Category:	AR
Scientific Category:	ISM AND CIRCUMSTELLAR MATTER
ID:	10967
Title:	A Compilation, Analysis, and Distribution of HST Orion Nebula Data.
PI:	C. O'Dell
PI Institution:	Vanderbilt University

As the closest HII region and center of star formation that includes massive stars, the Orion Nebula and its associated young cluster have been the subject of numerous imaging studies with the HST. Each study targeted a region driven by its goals. This piecemeal approach has resulted in a vast body of material. The primary goal of this archive study is to compile all of the HST imaging data and combine the images whenever possible, using the total field of the Orion Heritage program (GO 10246) for reference, thus producing high S/N images in many areas. The combined images will be searched for high proper motion objects, new proplyds, jets, shocks, and other outflows from young-stellar-objects and a comprehensive inventory will be created, with the patterns of appearance identified and the most interesting objects subjected to detailed interpretation. These data will become the core of a website for distribution of HST and related Orion information. Very specific questions to be addressed include "How far does the high velocity wind from theta one Ori C

extend?", "What is the explanation of the distribution of proplyds?", and "Can we use the Orion Nebula and its cluster to test the idea of propagated star formation?".

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Proposal Category: AR
Scientific Category: RESOLVED STELLAR POPULATIONS
ID: 10968
Title: Catching Dissolving Clusters: the Resolved Stellar Populations Approach
PI: Anne Pellerin
PI Institution: Space Telescope Science Institute

We propose a novel approach to directly detect and study stellar clusters in their later stages of dissolution by using a clustering algorithm on resolved stars in nearby galaxies. Traditional studies of stellar clusters focus on young clusters which are still bright and compact enough to be separated from the background field population. The new approach presented here is to use a clustering algorithm on spatial maps of individual stars to study dissolving clusters. In this study, we will use the exceptional spatial resolution and field of view of ACS to resolve individual stars in three nearby galaxies. Using color-magnitude diagrams, we will isolate and spatially map stars more likely to be part of dissolving clusters (A-type stars and earlier). A clustering algorithm, adapted here for these stellar maps, will reveal and quantify the properties of all star clusters (compactness, shape). Then, even the less compact clusters will be revealed while they are being destroyed. For the first time, this study will bring a gold mine of information on the faintest and dissolving clusters in various environments (morphology and potential well of the host galaxy) and over a timescale of about 100 Myr, revealing fundamental clues on the dynamical evolution of stellar clusters. In particular, we will explore and quantify, for the first time, stellar clusters in their advanced stages of evolution.

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Proposal Category: AR
Scientific Category: AGN/QUASARS
ID: 10969
Title: An Accurate Determination of the Black Hole Mass vs. Bulge Luminosity Relation for Nearby AGNs
PI: Chien Peng
PI Institution: Space Telescope Science Institute

Supermassive black holes today play a central role in nearly all aspects of extragalactic astronomy, from AGN physics to galaxy formation and evolution. The empirical foundation on which much of the recent progress lies came from the tight correlations found between black hole mass and the properties of the host galaxy, particularly the luminosity or velocity dispersion of the bulge. Because of the relative ease with which AGN host galaxies can be measured with

HST images, the black hole mass-bulge luminosity relation provides an effective, powerful tool to study the coevolution of black holes and their host galaxies, even out to high redshifts. To this end, it is imperative that we thoroughly understand the local (low-redshift) black hole mass-bulge luminosity relation. What is its true intrinsic scatter and zeropoint? Do they depend on the properties of the host galaxy (morphology, color, environment) or the AGN (level of activity, radio-loudness)? To explore these issues, we propose to systematically analyze a sample of 142 low-z (< 0.35) broad-line AGNs (Type 1 Seyferts and quasars) that have usable broad-band images (most have multiple filters) from the HST archives. This sample spans a broad range in black hole mass, AGN luminosity, Eddington ratio, and degree of radio-loudness. The images will be analyzed using a powerful new version of the 2-D image analysis code GALFIT, which can now fit both traditional (bulge, disk, bar) and more complex substructures (spiral arms, tidal features, lopsidedness, asymmetry). This ability to fit images in 2-D to high fidelity will permit the most meaningful and accurate extraction of the bulge component to date, a critical step in calibrating the local black hole mass-bulge luminosity relation. In addition, the multi-component decomposition will yield unprecedented information concerning the detailed morphologies (bulge-to-disk ratios, bars, spiral arms) and local environment of the host galaxies. The multi-color images will also provide rudimentary, though important, constraints on the stellar population of the host galaxies, and hence on the possible connection between AGN activity and star formation.

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Proposal Category:	AR
Scientific Category:	RESOLVED STELLAR POPULATIONS
ID:	10970
Title:	Germanium Abundances for Stars with Near-Solar Metallicities
PI:	Ruth Peterson
PI Institution:	Astrophysical Advances

Which nucleosynthesis process or processes produce the element germanium remains obscure. The element falls in the periodic table just beyond the iron peak, where several production mechanisms are possible that vary in timescale. We propose to determine the abundance of germanium and related elements in stars of near-solar metallicity, to constrain the mechanism and perhaps the timescale of Ge formation at these metallicities. We will use our updated line list to synthesize line blends, yielding abundances for two dozen dwarfs and subgiants of metallicities ranging from 1/200 solar to greater-than-solar that have high-quality archival STIS echelle spectra. This will clarify the synthesis of germanium and its relationship to other elements; show if the germanium abundance ratio tracks parameters such as stellar age, and assist the interpretation of the abundance patterns of high-redshift damped Lyman alpha absorption-line systems and planetary nebulae.

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Proposal Category: AR
Scientific Category: RESOLVED STELLAR POPULATIONS
ID: 10971
Title: The Proper Motion of the Sagittarius Dwarf Spheroidal Galaxy
PI: Slawomir Piatek
PI Institution: New Jersey Institute of Technology

We propose to measure the proper motion for the Sagittarius dwarf spheroidal galaxy using archival WFPC2 images for three fields, each with three epochs covering a time baseline of four years. The relative proper motion of Sagittarius with respect to the mean motion of bulge stars will have an accuracy of 0.1 mas/yr. The absolute proper motion with respect to galaxies in the fields will have an accuracy of no worse than 0.9 mas/yr and most likely better -- approaching the 0.2 mas/yr accuracy of the best ground-based measurement. Our measurement will provide an independent check of the ground-based measurement and better determine the Galactic orbit of Sagittarius. The latter will help to determine, for example, the evolution of the orbit with time, the relation of the orbit to the star-formation history of Sagittarius, and the shape of the Galactic dark-matter halo.
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Proposal Category: AR
Scientific Category: ISM AND CIRCUMSTELLAR MATTER
ID: 10972
Title: The structure of HD100546's self-shadowed circumstellar disk
PI: Alice Quillen
PI Institution: University of Rochester

HD100546 presents a unique opportunity to constrain the vertical structure of a 10Myr old circumstellar disk. The infrared spectral energy distribution (SED), peaking in the mid-infrared, implies that almost half of the star light is absorbed by a puffed up inner disk at about 10 AU that shadows the outer disk. Spiral structure in the outer disk at 200 AU is most likely caused by the shadow of the inner disk projected onto a warped outer disk. We propose to simultaneously model both the infrared SED and the scattered light multi-band images observed with the ACS coronagraph. This work will provide unique constraints on both inner and outer disk structure, including on the angular structure of the inner disk and on the geometry of the outer disk. The vertical disk structure is particularly interesting as at 10 Myr, HD100546?s disk is likely to contain and be forming planetesimals and planetary embryos. The disk geometry and azimuthal structure will provide information on the mass distribution and so on planetesimals and planets residing in this system.
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Proposal Category: AR
Scientific Category: ISM AND CIRCUMSTELLAR MATTER

ID: 10973
Title: Using Archival Data to Improve Atomic Data and Address the Nebular Iron Problem
PI: Robert Rubin
PI Institution: NASA Ames Research Center

Ever since the first detection of an [Fe IV] line in an H II region (in the Orion Nebula about 10 years ago), it has been recognized that there is a serious problem with the iron abundance derived from the observations. The initial detection was made with HST/GHRS of the UV line at 2836.57 A, which is expected to be the brightest [Fe IV] line under all nebular conditions. The measurement of the flux is not in question. However when the gas-phase iron abundance is inferred using photoionization models, it is found to be much smaller than those derived from lines of other iron ions. This dilemma, which has acquired the name "[Fe IV] problem", persists even with the measurement of a few more [Fe IV] lines that also include ones from a few planetary nebulae (PNs) and galaxies. With our best modeling efforts, the discrepancy is smaller but still goes up to a factor of ~4. Under a program to enlarge the very meager dataset for [Fe IV], we found several PNs in the IUE archives with a possible 2836.57 A line blended with an O III line 0.57 A redward. We propose to use archival HST spectra of the extremely rich emission line sources RR Tel and eta Car to (1) test new state-of-the-art calculations of transition probabilities (A-values) for the pertinent lines of [Fe IV] and O III; (2) derive the ionic iron abundances for these objects; (3) use the results of step 1 to deblend the IUE emission feature in ~25 PNs. We are confident we will enlarge the slim existing set of [Fe IV] emission lines. This is a crucial step in the hope to resolve the [Fe IV] problem. The new quantum mechanical A-value calculations will provide a legacy for future astrophysical spectroscopic applications.
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Proposal Category: AR
Scientific Category: UNRESOLVED STELLAR POPULATIONS
ID: 10974
Title: The Unresolved Stellar Populations of Galaxies in the HUDF: Constraints on Hierarchical Formation
PI: Russell Ryan
PI Institution: Arizona State University

We propose a systematic Archival study of the stellar populations of >200, well-resolved galaxies with spectroscopic redshifts in the Hubble Ultra-Deep Field (HUDF). By fitting stellar population synthesis models to the six-filter (BVi'z'JH) HST observations on a pixel-to-pixel basis, we can measure their stellar masses, star formation rates, ages, and internal extinction on sub-kiloparsec scales within each of the galaxies. This proposal has TWO major science goals: (1) Measure the stellar population parameters on a pixel-to-pixel basis within well-resolved galaxies at z<2. For reliable the SED fitting, we will concentrate on the ~200 galaxies with i'(AB)<26 mag and

spectroscopic redshifts from the Very Large Telescope. For an extended sample of ~50 bright galaxies without spectroscopic redshifts, we will allow the redshift to be a fifth free parameter and generate an additional map of best-fit photometric redshifts. This project will significantly improve upon previous work by extending it to higher redshift for a much larger sample and wider wavelength coverage --- ensuring more reliable statistics; (2) Use the stellar population maps resulting from (1) to understand observed color gradients and strongly constrain galaxy assembly as a function of Hubble type and redshift. Given the broad spectral coverage provided by ACS and NICMOS, we will break the infamous age-extinction-metallicity degeneracy which has plagued more common single or two color observations. Only the HUDF data provide the sufficiently high resolution and S/N per pixel at the critical wavelengths necessary to robustly measure the stellar SEDs on sub-kpc scales and constrain galaxy formation scenarios.

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Proposal Category:	AR
Scientific Category:	COSMOLOGY
ID:	10975
Title:	Central mass concentrations of disk galaxies: the nuclear spiral connection
PI:	Marc Seigar
PI Institution:	University of California - Irvine

The currently favored cosmological model, Lambda+ Cold Dark Matter (LCDM), is remarkably successful at reproducing the large scale structure of the Universe. However, small-scale observations have proven harder to explain. N-body simulations of LCDM structure formation predict that the central density profiles of dark matter halos should be very cuspy. Yet observations of rotation curves of late-type galaxies are consistent with a constant density core. This could be due to a fundamental problem with LCDM (which may be solved using warm dark matter), or late-type galaxies may be biased due to their late epoch of formation, whereas more typical galaxies will conform to the expectations of LCDM. Recent theoretical work has shown that the structure of nuclear spirals is directly connected with galaxy mass distributions on sub-kpc scales. Simulations by Maciejewski (2004a, b) demonstrate that the pitch angle of nuclear spirals is determined by the central mass concentration of a galaxy. Also, within ~100 pc the nature of the spiral depends upon whether the density profile has a cusp or a constant density core. These simulations open up the possibility that nuclear spiral structure can be used as a novel and unique diagnotsic of the mass distributions and concentrations in the inner regions of disk galaxies. The goal of this proposal is to quantify the morphology of the nuclear spiral structure in a large sample of disk galaxies over a wide range of Hubble types (from Sa to Sm), and to apply the models to derive the very central mass concentrations and constrain the types of density profiles found in disk galaxies.

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Proposal Category: AR
Scientific Category: AGN/QUASARS
ID: 10976
Title: The Obscuring Tori of AGN: Merging Disk Wind With Radiative Transfer
PI: Isaac Shlosman
PI Institution: University of Kentucky

The last decade has established beyond reasonable doubt that a significant fraction of AGN is surrounded by a toroidal structure, which is likely to consist of a large number of individually very optically thick dusty clouds. Much of the observed diversity of AGN is simply explained as the result of viewing this axisymmetric geometry from different angles. A still unresolved fundamental question is how the clouds assemble into a toroidal structure and what is providing for its vertical support. The originally proposed hydrostatic support model through cloud-cloud collisions has run into insurmountable fundamental difficulties. Our recent calculations of the IR emission from a clumpy torus indicate that it could have a size of only ~10 pc. This compact size lends support to the dynamical approach in which the obscuring torus is simply the optically thick region of a dusty/molecular wind coming off the AGN disk. We propose to construct AGN torus models consistent with both theoretical requirements and observations. The program is comprised of two coupled components, combining dynamic structure calculations for clumpy winds with detailed IR radiative transfer. We shall conduct a thorough investigation of disk hybrid (i.e., radiatively/hybromagnetically-driven) wind models, to determine the kinematic and geometric structure of the obscuring torus they produce. The results of the dynamics calculations will be examined in radiative transfer calculations that will determine the IR emission produced by the wind/torus, placing observational constraints on the underlying dynamics. The outcome will be the first self-consistent model construction of the AGN obscuring torus. The proposed project addresses one of the most pressing needs of current AGN research and will develop critical tests for observations by existing and next generation of space observatories.
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Proposal Category: AR
Scientific Category: SOLAR SYSTEM
ID: 10977
Title: Orbital Evolution and Chaos Among the Inner Moons of Uranus
PI: Mark Showalter
PI Institution: SETI Institute

Uranus has a family of thirteen satellites orbiting interior to the innermost classical moon, Miranda. Nine of these comprise the Portia group, a closely-packed dynamical system that has recently been found to show significant orbital variations over time scales of 1-2 decades. This result supports inferences that the system is chaotic, with collisions expected over time

scales of less than one million years. No analogous orbital system has been seen elsewhere in the Solar System. With these new results, it becomes much more important to understand the orbital history of the inner moons of Uranus. The HST archive contains numerous detections of these moons, from WFPC2, NICMOS and ACS, that have never been used for orbital determinations. Many observations fill a gap between 1994 and 2003, during which the orbits have never been measured. This is a proposal to use all the available data from the HST archive to derive the orbital variations of the larger moons in the Portia group from 1994 to 2005. This investigation will provide unique new information about the time scales over which the variations occur and the nature of the hypothesized chaos. For example, this study will enable us to test the prediction that the two adjacent moons Cressida and Desdemona have closely coupled variations, and it may reveal whether the surprisingly large orbital deviations of Belinda are related to its resonance with the nearby, but much smaller moon Perdita.

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Proposal Category:	AR
Scientific Category:	UNRESOLVED STELLAR POPULATIONS
ID:	10978
Title:	Modeling the Transition from Pop III to Pop II Star Formation in the Early Universe
PI:	Steinn Sigurdsson
PI Institution:	The Pennsylvania State University

We will study the physical conditions necessary to shift from very high-mass, population III star formation to low-mass, population II star formation. We will model the critical chemical abundances needed to enhance radiative cooling efficiency at temperatures below 10000 K. This added cooling will allow the collapsing protostar to fragment, thereby forming multiple low-mass stars, as opposed to the metal-free case where a single star of a few hundred solar masses is formed. This will be accomplished by adding the treatment of metal cooling to an established cosmological hydrodynamic simulation code. Our technique allows us freely vary abundance patterns for all elemental species up through Zinc, giving us the ability to identify the specific elements responsible for the transition to modern-day star formation. We will, then, be able to predict the initial mass function for stars formed in the wake of population III supernova, as well as the evolution to the currently observed stellar mass function. This information will be highly beneficial to those who will use the HST to study star formation at high redshift. In addition, this study will be of particular use to those who will use the JWST to observe the environment of population III stars, their supernovae, and the stars that form after their deaths. The JWST will be able to directly observe the period in the history of the universe when population II stars are formed for the very first time, verifying the predictions made by our study.

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Proposal Category: AR
Scientific Category: ISM AND CIRCUMSTELLAR MATTER
ID: 10979
Title: Relating Extinction to Specific Grain Types in Individual Sight Lines
PI: Ulysses Sofia
PI Institution: Whitman College

We propose to use abundance constraints derived from archival GHRS and STIS data to relate directly extinction to specific grain types. This will be the first attempt to constrain dust models with extinction curves and full complements of important abundances in individual sight lines. To this point, averaged interstellar abundances have been used to constrain models of dust and their resulting extinction effects. By using average abundances, any details concerning the relationship between the grain composition and extinction is lost. The main reason that individual sight lines have not been modeled in the past is the lack of an appropriate data set, specifically sight lines where all of the most abundant elements in dust, C, O, Si, Mg, and Fe, have been observed, and where extinction curves are measured. We have identified seven sight lines that have recently met those abundance and extinction criteria. For these sight lines we propose to determine the abundances most important to dust composition. We will use the sight line specific abundances to constrain model fits to the measured extinction toward each star. The results of this study will help us to determine 1) the composition of dust, 2) which grains types are responsible for extinction at various wavelengths, 3) the grain-size distribution of dust among sight lines, 4) the appropriate abundance standard that represents the interstellar medium, and 5) how to estimate more reliably reddening along sight lines.
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Proposal Category: AR
Scientific Category: COSMOLOGY
ID: 10980
Title: Revisiting the Supernova Ia Rate at z>1
PI: John Tonry
PI Institution: University of Hawaii

Type Ia Supernovae (SNIa) are an extremely useful tool for astronomers, contributing important information for the determination of extragalactic distances, studies of stellar evolution and galactic chemical evolution, and providing the only direct evidence for cosmic acceleration. Despite this wide-ranging importance, the origins of SNIa are fundamentally mysterious. We have good reasons to believe that all SNIa are the product of a Carbon-Oxygen White Dwarf that reaches the Chandrasekhar mass limit and ignites carbon burning explosively. However, the precise nature of the explosion mechanism, the stellar type of the binary companion, and the physical requirements to reach the critical explosion point are still unclear. We cannot yet even be sure of whether all SNIa result from a single progenitor track or if there are

multiple ways to set off the explosion. One extremely important constraint on theoretical models of SNIa progenitors is the evolution of the SNIa rate (SNR) as a function of redshift. The SNR(z) can distinguish between competing progenitor models and help to unveil the mystery of these important objects. The most important (and difficult) component of this measurement is in the highest redshift bins, at z>1, which requires the unique observing tools of the Hubble Space Telescope (HST). We propose to revisit the Hubble Space Telescope's Great Observatories Origins Deep Survey (GOODS) data to dramatically improve the accuracy and precision of the high-z SNIa rate measurement. We will utilize large numbers of synthetic transients, fully automated detection techniques, and an improved difference photometry algorithm to exploit the full potential of this important dataset. Our primary result will be a strong constraint on SNIa progenitor models from the SNR(z), and along the way we will also improve the value of this data for future SN studies by determining more complete and more precise light-curves for the highest redshift SNIa.

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Proposal Category:	AR
Scientific Category:	RESOLVED STELLAR POPULATIONS
ID:	10981
Title:	Continuum and Monochromatic L-Flats for the ACS Ramp Filters
PI:	Laurence Trafton
PI Institution:	University of Texas at Austin

Currently, the pipeline reduction of ACS observations taken with the HRC and WFC cameras using the ramp filters inadequately corrects the lower spatial-frequency distortions of the field intensity because the present flat fields do not take into account the variation in transmitted intensity vs wavelength (and hence, sensitivity) with position within the ramp aperture. Ramp filter transmission varies by as much as 10% and more across the filter monochromatic FOV; this cannot be corrected by the present preliminary complement of surrogate flat fields that interpolate effective wavelengths of fields which are cut and pasted from the ACS broadband filters, which are coarsely sampled in wavelength. We propose to analyze the data ftom two ACS calibration programs, 10057 and 10741 taken of well-calibrated fields of the globular cluster 47 TUC and a emission-line region of the Orion Nebula to extract both continuum and monochromatic L-flats for the ACS ramp filters at specific wavelengths, for both HRC and WFC. Priority will be given to frequently used ramp filters, including the two primary Cycle 14 filter wavelengths. This will support 40 GO/GTO programs from Cycles 11-14. Absolute calibration, relative comparison of stars within a population, and analysis of extended emission-line sources/objects will benefit from this work. The availability of ramp filter flatfielding will encourage the use of ramp filters in the future, which would partially compensate for the loss of the HST major spectroscopic capabilities after the failure of the STIS.

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Proposal Category: AR
Scientific Category: UNRESOLVED STELLAR POPULATIONS
ID: 10982
Title: Dynamical evolution of galaxy bulges: harassment, tidal streams and interactions with globular clusters
PI: Michele Trenti
PI Institution: Space Telescope Science Institute

Galaxy bulges represent fundamental components of today's galaxies. Spirals living in clusters and groups are harassed by their neighbors on a typical timescale of one Gigayear: some may lose their gas to become lenticulars while others may lose their entire disk component with the leftover bulges evolving into dwarf elliptical galaxies. Our previous HST WFPC2, NICMOS and ACS surveys of spiral bulges have highlighted that bulges cannot be represented as members of a single family but rather exhibit a broad range of features in their stellar populations and dynamical profiles. Here we aim at understanding the origin and the consequences of this diversity by studying the dynamical evolution of bulges in their complex envinronment by means of high resolution N-body simulations with live galactic components (stellar populations and dark matter particles). We will investigate not only how the properties of the bulges evolve due to tidal interaction with neighboring galaxies but also what is the fate of the tidally stripped stellar population and globular clusters during these interactions.

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Proposal Category: AR
Scientific Category: UNRESOLVED STELLAR POPULATIONS
ID: 10983
Title: Galaxy Bulges in Clusters: formation and evolution to z ~ 1
PI: Yogesh Wadadekar
PI Institution: Space Telescope Science Institute

The likely existence of two fundamentally distinct classes of galactic bulges - old, metal-enriched, and following a R^1/4 profile, vs. young, exponential, and possibly less metal-enriched - has recently emerged as a very important clue to the formation history of nearby galaxies of different Hubble types and luminosities. We propose to take advantage of archival HST data to extend the study of the duality in bulge properties beyond the local Universe, specifically to a sample of about 40 galaxy clusters at $0.2 < z < 0.9$ with deep WFPC2 or ACS observations. Understanding how - and when - bulges and ellipticals formed in clusters, and how their properties relate to those of galaxies in the local Universe, will help answer fundamental questions about galaxy formation in clusters and in the field. If exponential bulges form through secular evolution, they should be rarer and fainter at higher redshifts; if R^1/4 bulges form in burst at high redshift, their number, size, and color should evolve accordingly. We will address this question by

quantitatively estimating structural parameters for the bulge and disk using analytic 2-D fits to the galaxy images using a bulge-disk decomposition code independently developed by the PI. We expect to obtain these measurements for about 1000 bulges and ellipticals to I=23 in about 40 available clusters with deep high resolution HST observations. We will also be able to understand the impact on bulge evolution of mergers, through the incidence of disturbed morphologies, and of the local environment, via correlations with cluster richness and position within the cluster. A companion project, recently started by two co-investigators (and for which no funding is requested), will address similar questions for field galaxies in the GOODS survey.

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Proposal Category: AR
Scientific Category: ISM AND CIRCUMSTELLAR MATTER
ID: 10984
Title: Characterizing Lyman Spitzer's Galactic Corona
PI: Bart Wakker
PI Institution: University of Wisconsin - Madison

Hot gas plays a fundamental role in regulating the structure and evolution of the ISM in galaxies, as first proposed by Spitzer in 1956. In order to understand the processes regulating the hot gas, we propose to measure and characterize the physical conditions in our Galaxy's Halo. We will do this using a sample of 26 sightlines to extra-galactic targets for which an S/N>7 per resolution element near OVI, NV and CIV has been achieved with both FUSE and the STIS-E140M on HST. We will also include the 40 other sightlines for which only two of these three species can be measured well. Using this data, we will: a) try to determine the relative roles of photoionization and collisional ionization; b) compare the properties of the high ions in the Milky Way Thick Disk to those in other environments; c) measure ionic ratios and compare these with the predictions of many different models for Galactic Halo gas; d) compare the kinematical properties of the high-, intermediate- and low-ionization species; e) search for associations of unusual ionic ratios with known structures.

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Proposal Category: AR
Scientific Category: COSMOLOGY
ID: 10985
Title: Mapping Out Subtructure in Galaxy Clusters using Strong Lensing
PI: Liliya Williams
PI Institution: University of Minnesota - Twin Cities

In the last fifteen years Hubble Space Telescope has observed many galaxy clusters that host multiple images of background strongly lensed galaxies. The precision of HST's astrometry and the depth of its photometry are often necessary to identify and characterize the faint images of galaxy sources.

These data have been used by many workers to model the projected mass distribution in clusters with the goal of deducing the properties of dark matter based on its observed clumping. However, most of the mass reconstruction work has been done using parametric mass models. Such models presuppose a close relationship between the distribution of the dark matter and that of light. The upshot is that the parameter space of solutions is not fully explored, and also, the observed image positions need not be well fit by the model. In order to utilize the high precision of HST data, I propose to use a free-form, or non-parametric mass modeling technique to reconstruct the detailed mass distribution in two clusters, SDSS J1004+4112 (14 images; z=0.68), and Abell 1689 (106 images; z=0.18), both observed with the HST in the last few years. The method fits the observed image positions exactly, does not impose restrictive assumptions on the mass, and explores the whole parameter space of mass models that are consistent with the observed lensing data. The method is thus able to see variable mass-to-light ratios of cluster galaxies, sizes of dark matter halos of galaxies, variations of the galaxy halo properties with the distance from the cluster center, and misalignments between mass and light centroids of clusters. In order to characterize the uncertainties of the method I will perform reconstructions on synthetic lenses whose mass distribution is known.

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Proposal Category:	AR
Scientific Category:	AGN/QUASARS
ID:	10986
Title:	Testing the coevolution of black holes and massive host galaxies to z=1.5
PI:	Jong-Hak Woo
PI Institution:	University of California - Santa Barbara

Investigating the nature of the black hole-galaxy connection is essential for understanding galaxy formation and evolution. We propose to test co-evolutionary models by studying the scaling relations between black hole mass and stellar velocity dispersion (sigma; BHS) or luminosity (BHL) out to z=1.5. To this aim, we will perform two complementary investigations combining black hole masses of broad-line quasars (from ground-based spectroscopy) with their host galaxy properties (from HST images). On the one hand, for all 32 luminous quasars with massive host galaxies at z~0.4 in the HST archive, we will measure effective radius and surface brightness. This will provide an estimate of sigma via the Fundamental Plane (FP) correlation, and thus the BHS relation. The nuclei of these objects are too bright to measure sigma directly and therefore this methodology is required to extend the BHS to black-hole masses above 10^9 solar masses. In combination with our direct determination at smaller masses this study will be used to investigate mass dependent evolution. On the other hand, at higher redshift (out to 1.5) -- where it is not known if the hosts of bright QSOs obey the FP -- we will determine the BHL relation by measuring luminosities for a sample of 75 broad-line AGNs selected from GOODS-N/S fields.

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Proposal Category: AR
Scientific Category: UNRESOLVED STELLAR POPULATIONS
ID: 10987
Title: Novel Analysis of Stellar Populations and Constraints on Galaxy Evolution
PI: Dennis Zaritsky
PI Institution: University of Arizona

We propose to utilize HST archival data to develop a new method for the reconstruction of star formation histories of galaxies at all redshifts. In particular, using ground-based and HST archival data we will develop a method that is based on the distribution of pixel values rather than stellar photometry. This new conceptual appropach accesses data below an image's limiting magnitude and does not introduce many of the uncertainties inherrent in crowded-field photometry. Both will lead to significantly tighter constraints on the ancient star formation history. Comparing the results of this technique applied to the ground-based images with the results of the standard method on HST color-magnitude diagrams will validate (or not) the specific algorithms we develop. Once we have developed a succcessful technique it can be applied to HST data of galaxies in the nearby universe (for example, HST images of M 33 are comparable to our ground-based images of the LMC). By varying the angular pixel scale in the analysis we will be able to produce internally self-consistent analyses of star formation histories at all redshifts. For the nearby universe this technique maximizes the information extracted from the existing imaging - for the distant universe in enables direct comparison to the local star formation histories. We will make the algorithm(s) public, as we have done with our more classical star formation reconstruction code, StarFISH.
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Proposal Category: AR
Scientific Category: UNRESOLVED STELLAR POPULATIONS
ID: 10988
Title: Classification of X-ray sources in M82
PI: Andreas Zezas
PI Institution: Smithsonian Institution Astrophysical Observatory

We propose to analyze the data from the Heritage observation of the nearby star-forming galaxy M~82, together with supporting archival NICMOS data. Our primary goal is to study the association of the star-clusters with X-ray sources detected in the deep \chandra~ observations of M~82. This will allow us to address the nature of the X-ray sources, and their connection with star-formation and star-cluster properties.
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