Cycle 16 Abstract catalog (based on Phase I submissions)
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Proposal Category: GO
Scientific Category: COSMOLOGY
ID: 11099
Title: A "silver bullet" for the sources of reionization
PI: Marusa Bradac
PI Institution: Stanford University

Recent discoveries of z>6 galaxies have given us the first glimpse of the Universe shortly after the era of reionization. The questions arose whether these first galaxies can be made responsible for the reionization process, and how long did it last. Neither observations nor theory provide a clean answer. In particular observations give results that are barely mutually consistent and need to be further tested. Observing high redshift (z>7) sources is in general difficult, mostly due to the high luminosity distance to these objects, and partly due to the lower expected stellar masses compared to objects at moderate redshifts. We propose to use one of the most massive, merging cluster 1E0657-56 (z=0.295) as a cosmic telescopes to efficiently probe the high-redshift universe. The gravitational potential well of this cluster provides several magnitudes of magnification, enabling study of intrinsically lower luminosity galaxies.As we discuss in the proposal, due to its highly elongated mass distribution and ideal redshift the bullet cluster is a prime candidate for this study. We propose deep NICMOS and WFPC2 observations; with much reduced observing time compared to e.g. NICMOS UDF we expect an order of magnitude more (~5 candidates) z>7 objects. They will also likely be multiply imaged, and since the geometry of images depends upon the redshift, we will be able to confirm their nature, thereby not requiring (often prohibitive at these magnitudes) spectroscopic follow-up. This will enable us to count high-redshift sources and constrain their luminosity function; a task made possible with the help of gravitational lensing even in the pre-JWST era.

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Proposal Category: GO
Scientific Category: COSMOLOGY
ID: 11100
Title: Two new `bullets' for MOND: revealing the properties of dark matter in massive merging clusters
PI: Marusa Bradac
PI Institution: Stanford University

The principal objective of this proposal is to study the physical nature of dark matter by using two, massive, newly-identified merging clusters of

galaxies. As shown by the pioneering example of the ``bullet cluster'' (1E0657-56), such systems are ideal laboratories for detecting dark matter and distinguishing between cold dark matter (CDM) and other scenarios (e.g. self-interacting dark matter). Our limit on the self-interaction cross-section of dark matter relies on the assumption of a normal pre-merger mass-to-light ratios, and a small impact parameter during the collision of the two clusters. In order to mitigate any possible systematic effects, it is vital to extend this work to other, similar systems. With detailed observations of new systems, the systematic uncertainties in the dark matter cross section calculations can be improved substantially, allowing us to move from rough order of magnitude estimates to measurements with quantifiable uncertainties that can be compared usefully with the predictions from numerical simulations. Our targets are two extraordinary, high-redshift, merging galaxy clusters recently discovered by the Massive Cluster Survey (MACS). This survey is by far the best matched to this study, since it selects medium redshift (optimal for gravitational lensing studies) and X-ray luminous (hence massive) objects. We have selected the best candidates with clear evidence for considerable offsets between the hot X-ray emitting gas and optically luminous stellar material. The two most striking examples are the targets of this proposal. To pin down the position of the dark matter component we require high resolution, absolutely calibrated mass maps. The combination of weak and strong lensing measurements is needed to attain this goal. This can only be achieved with the excellent resolving power of the HST (in combination with wide-field, multicolor Subaru data already in hand). We therefore request multicolor HST/WFPC2 observations of the two merging clusters. The combination of constraints from multiply lensed images (identified via morphology and color information) and high-resolution weak lensing data will allow us to construct, self-consistently, their mass distribution from the very centers to the outskirts. Gravitational lensing thus provides a unique tool transforming these clusters into dark matter laboratories. They will supply us with answers as to the nature and properties of dark matter, and how it shapes galaxies and galaxy clusters and their evolution through cosmic time.

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Proposal Category:	GO
Scientific Category:	AGN/QUASARS
ID:	11101
Title:	The Relevance of Mergers for Fueling AGNs: Answers from QSO Host Galaxies
PI:	Gabriela Canalizo
PI Institution:	University of California - Riverside

The majority of QSOs are known to reside in centers of galaxies that look like ellipticals. Numerical simulations have shown that remnants of galaxy mergers often closely resemble elliptical galaxies. However, it is still strongly debated whether the majority of QSO host galaxies are indeed the result of relatively recent mergers or whether they are completely analogous to inactive ellipticals to which nothing interesting has happened recently. To address

this question, we recently obtained deep HST ACS images for five QSO host galaxies that were classified morphologically as ellipticals (GO-10421). This pilot study revealed striking signs of tidal interactions such as ripples, tidal tails, and warped disks that were not detected in previous studies. Our observations show that at least some "elliptical" QSO host galaxies are the products of relatively recent merger events rather than old galaxies formed at high redshift. However, the question remains whether the host galaxies of classical QSOs are truly distinct from inactive ellipticals and whether there is a connection between the merger events we detect and the current nuclear activity. We must therefore place our results into a larger statistical context. We are currently conducting an HST archival study of inactive elliptical galaxies (AR-10941) to form a control sample. We now propose to obtain deep HST/WFPC2 images of 13 QSOs whose host galaxies are classified as normal ellipticals. Comparing the results for both samples will help us determine whether classical QSOs reside in normal elliptical galaxies or not. Our recent pilot study of five QSOs indicates that we can expect exciting results and deep insights into the host galaxy morphology also for this larger sample of QSOs. A statistically meaningful sample will help us determine the true fraction of QSO hosts that suffered strong tidal interactions and thus, whether a merger is indeed a requirement to trigger nuclear activity in the most luminous AGNs.

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Proposal Category: GO
Scientific Category: SOLAR SYSTEM
ID: 11102
Title: HST as a Jovian Climate Satellite
PI: Imke de Pater
PI Institution: University of California - Berkeley

In the past year, there have been striking changes in Jupiter's atmosphere. Among these are the Oval BA's change from white to red, two new dark Disturbances in the southern hemisphere, and a 30% change (since 1997) in the aspect ratio of the potential vorticity anomaly of the GRS (not just its associated clouds), as we determined from high-accuracy velocities extracted from HST images. The determination of high-accuracy velocities requires both high-resolution imaging by HST (or flybys), and our novel adaptation of Correlation Image Velocimetry (CIV), a technique that has far greater accuracy than the traditional method (of identifying velocity tie-points by hand). Our proposed observations will test the hypothesis that these changes in Jupiter validate our 2004 prediction: that the merger of the 3 White Ovals in 1998-2000 would lead to climate change on Jupiter. The key is to determine, by indirect means, the temperature at the base of the weather layer, a quantity that cannot be observed directly at any wavelength. The new Red Oval BA's velocities will be used to test our finding that the color change is due to global temperature changes. The change in the GRS's aspect ratio suggests a large (at least 20%) change in the shear of the local velocity since 1997. The latter can be investigated only by determining Jupiter's current zonal winds.

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Proposal Category: SNAP
Scientific Category: COSMOLOGY
ID: 11103
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 SNAPshot survey of a sample of 125 very X-ray luminous clusters in the redshift range 0.3-0.7. As demonstrated by the 25 snapshots obtained so far in Cycle14 and Cycle15 these systems frequently exhibit strong gravitational lensing as well as spectacular examples of violent galaxy interactions. 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. All of our primary science goals require only the detection and characterisation of high-surface-brightness features and are thus achievable even at the reduced sensitivity of WFPC2. Because of their high redshift and thus compact angular scale our target clusters are less adversely affected by the smaller field of view of WFPC2 than more nearby systems. Acknowledging the broad community interest in this sample we waive our data rights for these observations. Due to a clerical error at STScI our approved Cycle15 SNAP program was barred from execution for 3 months and only 6 observations have been performed to date - reinstating this SNAP at Cycle16 priority is of paramount importance to reach meaningful statistics.
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Proposal Category: GO
Scientific Category: AGN/QUASARS
ID: 11104
Title: The nature of radio transients
PI: Avishay Gal-Yam
PI Institution: California Institute of Technology

We have conducted the first ever blind, wide-field survey for radio transients (Levinson et al. 2002; Gal-Yam et al. 2006). We have discovered four radio transients and explored their nature using radio and optical follow-up observations. One is a known pulsar, one is a z~0.1 AGN, and one is most probably an optically obscured radio supernova (SN) in the nearby galaxy NGC 4216 (the first such event to be discovered by a wide field radio survey). The last source appears not to be associated with a bright host galaxy (to a limit of R < 24.5 mag). We request 4 orbits of WFPC2 F606W imaging to check whether we can establish an association between this radio transient and any of three nearby faint resolved galaxies we have detected from the ground. If the source is associated with any of these galaxies it would represent a new type of extra-galactic radio bursts, more luminous than, e.g., radio afterglows of

gamma-ray bursts. Alternatively, ruling out an association with these galaxies would disfavor an extra-galactic nature of this object, and suggest instead that this is a radio outburst of a faint Galactic compact object, probably a new type of radio-flaring neutron star. If this is the case, the high luminosity (9 mJy) and relatively high galactic latitude (33 degrees) of this source may indicate it is relatively nearby. This single source represents a large population (comparable in sky density to AGN, pulsars, and radio SNe) and thus merits intensive study. A modest investment of HST time, leveraged by massive ground-based radio and optical efforts, will allow us to identify a new class of radio sources, and complete a census of the variable radio sky down to ~6 mJy, leaving no unidentifed objects. This result can be directly scaled to predict the number and type of transient sources expected to be detected by future surveys with the next generation radio arrays, such as ATA and SKA.Since our science critically requires HST's spatial resolution (rather than sensitivity) it is perfectly suited to be carried out with WFPC2.
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Proposal Category:	GO
Scientific Category:	RESOLVED STELLAR POPULATIONS
ID:	11105
Title:	The LBV progenitor of SN 2005gl - a new key to massive star evolution puzzles
PI:	Avishay Gal-Yam
PI Institution:	California Institute of Technology

The currently accepted theory regarding the last stages of massive star evolution maintains that the evolution of the envelope is coupled to that of the stellar core. For this reason, very massive stars are expected to shed their outer hydrogen envelopes before they develop large iron cores, and ultimately, explode as core-collapse supernovae (SNe). It is therefore a strict prediction of current models that massive stars (certainly those above ~40 solar mass) will explode as hydrogen-poor SNe, i.e., of Types Ib and Ic. In particular, the class of luminous blue variables (LBVs) such as eta-Carina, which are known to be very massive (up to 100 solar masses and above) are expected to lose their entire hydrogen envelopes prior to their ultimate explosions as SNe. However, using pre-explosion HST/WFPC2 imaging of the location of the recent hydrogen-rich type IIn SN 2005gl, we have identified (Gal-Yam et al. 2007) its putative progenitor as a very luminous point source (with absolute V magnitude of -10.2). If this is a single star, it must be an LBV from luminosity considerations (no other stars are as luminous). If our progenitor identification is correct, at least in some cases, massive stars explode before losing most of their hydrogen envelope, indicating the core and envelope are decoupled, and requiring revision of stellar evolution theory. Here, we propose a single-orbit HST observation of the location of SN 2005gl designed to test whether the point source we identified as its LBV progenitor has indeed disappeared (as expected from a single star) or remained unchanged (as expected, e.g., if it is a compact star cluster). These data are the last observational ingredient required to firmly establish (or refute) the explosion of an LBV as a type IIn SN, with fundamental implications for the

theory of massive star evolution. Since the new data will be compared to pre-explosion WFPC2 images, this program is perfectly suited to be carried out with the WFPC2 camera.
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Proposal Category: GO
Scientific Category: SOLAR SYSTEM
ID: 11106
Title: Target of Opportunity Imaging of an Unusual Cloud Feature on Uranus
PI: Heidi Hammel
PI Institution: Space Science Institute

The planet Uranus is demonstrating increased atmospheric activity as it approaches its 2007 equinox, perhaps in response to extreme insolation change. Convective sites in the planet's southern hemisphere reached unprecedented altitudes in 2003 (Hammel et al. 2005, Icarus 175, 284); a bright northern feature showed the highest contrast yet detected in an outer planet atmosphere (Sromovsky et al. 2007, Icarus, submitted); and a dark atmospheric feature was detected by HST for the first time (Hammel et al. 2007, in preparation). The historical record makes references to discrete structures (both bright and dark) on Uranus during previous equinoctial apparitions (the last equinox occurred in 1965). The best amateur facilities are now just able to resolve the disk of Uranus and detect such activity if it is very large or has very high contrast. Amateurs also have access to a great many nights of telescope time. If a discrete cloud feature on Uranus is reported through the amateur network, we propose to obtain follow-up images with HST's WFPC2. The proposed TOO images will permit determination of detailed structure of the feature at visible wavelengths, and will provide vertical and horizontal constraints on the feature's scattering properties. HST is the only facility that can provide such information at visible wavelengths.
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Proposal Category: GO
Scientific Category: COSMOLOGY
ID: 11107
Title: Imaging of Local Lyman Break Galaxy Analogs: New Clues to Galaxy Formation in the Early Universe
PI: Timothy Heckman
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 (LBGs). These "compact UV luminous galaxies" (UVLGs) resemble LBGs in terms of size, SFR, surface brightness, mass, metallicity, kinematics, dust, and color. The UVLG sample offers the unique opportunity of investigating some very important properties of LBGs that have remained virtually inaccessible at high redshift: their morphology

and the mechanism that drives their star formation. Therefore, in Cycle 15 we have imaged 7 UVLGs using ACS in order to 1) characterize their morphology and look for signs of interactions and mergers, and 2) probe their star formation histories over a variety of timescales. The images show a striking trend of small-scale mergers turning large amounts of gas into vigorous starbursts (a process referred to as dissipational or "wet" merging). Here, we propose to complete our sample of 31 LBG analogs using the ACS/SBC F150LP (FUV) and WFPC2 F606W (R) filters in order to create a statistical sample to study the mechanism that triggers star formation in UVLGs and its implications for the nature of LBGs. Specifically, we will 1) study the trend between galaxy merging and SFR in UVLGs, 2) artificially redshift the FUV images to z=1-4 and compare morphologies with those in similarly sized samples of LBGs at the same rest-frame wavelenghts in e.g. GOODS, UDF, and COSMOS, 3) determine the presence and morphology of significant stellar mass in "pre-burst" stars, and 4) study their immediate environment. Together with our Spitzer (IRAC+MIPS), GALEX, SDSS and radio data, the HST observations will form a unique union of data that may for the first time shed light on how the earliest major episodes of star formation in high redshift galaxies came about. This proposal was adapted from an ACS HRC+WFC proposal to meet the new Cycle 16 observing constraints, and can be carried out using the ACS/SBC and WFPC2 without compromising our original science goals.

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Proposal Category: GO
Scientific Category: COSMOLOGY
ID: 11108
Title: Near Infrared Observations of a Sample of z~6.5-6.7 Galaxies
PI: Esther Hu
PI Institution: University of Hawaii

The majority of the most distant galaxies discovered to date have been found by strong Lyman alpha emission at red optical wavelengths. An accurate estimate of the star formation rates for these objects requires a measurement of the line-free UV continuum, which must be taken at infrared wavelengths. Here we propose to obtain imaging with NICMOS in the F160W filter for a sample of 9 Lyman alpha galaxies with redshifts z~6.5 up to z=6.740 from a complete, flux-limited widefield narrowband and multi-color survey conducted on the 8-m Subaru Telescope. This program will investigate galaxy morphologies and star formation for a uniform sample of the highest redshift galaxies now known.

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Proposal Category: GO
Scientific Category: SOLAR SYSTEM
ID: 11109
Title: Characterization of the UV absorption feature in asteroid (1) Ceres
PI: Jianyang Li
PI Institution: University of Maryland

We propose to obtain the UV spectrum of asteroid (1) Ceres from 120 nm to 200 nm with ACS/SBC objective prism to characterize the broad and deep absorption feature within this wavelength range as reported recently. Our scientific goals include, 1) to characterize the absorption band, 2) to determine the origin of this spectral feature and constrain the surface compositions of Ceres, and 3) to understand the albedo and color features on Ceres. HST is the only observatory currently capable of obtaining spectroscopy in this wavelength range. This observation will help improve our knowledge about this largest and oldest asteroid, and support the planning of the upcoming NASA Discovery Program mission, Dawn, orbiting asteroids Vesta and Ceres.

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Proposal Category: GO
Scientific Category: ISM IN EXTERNAL GALAXIES
ID: 11110
Title: Searching for Lyman alpha Emission from FUSE Lyman Continuum Candidates
PI: Stephan McCandliss
PI Institution: The Johns Hopkins University

We have recently been granted time on FUSE to characterize the escape fraction of hydrogen Lyman continuum (Lyc) photons from a morphologically diverse set of star forming galaxies. The FUSE program is designed to provide ~ 5 sigma detections of Lyc photons emitted from star forming galaxies with escape fractions ~5%. With this proposal we seek hydrogen Lyman alpha (Lya) observations of a representative subset of the FUSE program targets to constrain the observational relationship between Lyc, Lya, and hydrogen Balmer line emission in these systems. Such observations explore the detailed balance between the simple optically thin (Case A) and optically thick (Case B) limits in recombination theory. The ultimate goal of this program is to quantify the relationship between escaping Lya and Lyc emission and the first structures that form in the early universe.

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Proposal Category: GO
Scientific Category: RESOLVED STELLAR POPULATIONS
ID: 11111
Title: A Search for an Intermediate Mass Black Hole in the Globular Cluster NGC 6266
PI: Bernard McNamara
PI Institution: New Mexico State University

We propose to search for an intermediate mass black hole (IMBH) in the core of the galactic globular cluster NGC 6266. Based on a comparison between the observed central surface brightness profiles of 38 globular clusters and state-of-the art N-body simultations, NGC 6266 offers the best hope of detecting an IMBH among these objects. This detection would be significnat for at least two reasons. It would be the first concrete discovery of an IMBH, revealing unique information about the environment in which these objects form, and second, its discovery would provide a powerful validation on the N-

body simultations used to track the dynamical evolution of globular clusters.
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Proposal Category: GO
Scientific Category: UNRESOLVED STELLAR POPULATIONS
ID: 11112
Title: The Collisional Ring Galaxy NGC922
PI: Gerhardt Meurer
PI Institution: The Johns Hopkins University

We request WFPC2 images of the newly recognized collisional ring galaxy NGC922 which will become the nearest such system observed by HST. These will be used to get a clear understanding of the geometry of the interaction and the induced star formation in this system. Quantitive modeling of the colors of the star clusters and stellar populations will be used to constrain the star formation history of the system. They will also be used to test the "infant mortality" scenario for star cluster evolution. The derived population ages will test predictions of how star formation evolves in the various components (ring, core, spokes) of collisional rings, and will improve our own simulations of this system. These will be used to determine the final fate of the stars formed in the present burst - some will end up in a central bar or bulge while others will become part of a thickened disk. By analogy this will tell us how similar collisions enrich stellar populations in the early universe. This is especially relevant since the number density of collisional rings increases rapidly with redshift.
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Proposal Category: SNAP
Scientific Category: SOLAR SYSTEM
ID: 11113
Title: Binaries in the Kuiper Belt: Probes of Solar System Formation and Evolution
PI: Keith Noll
PI Institution: Space Telescope Science Institute

The discovery of binaries in the Kuiper Belt and related small body populations is powering a revolutionary step forward in the study of this remote region. Three quarters of the known binaries in the Kuiper Belt have been discovered with HST, most by our snapshot surveys. The statistics derived from this work are beginning to yield surprising and unexpected results. We have found a strong concentration of binaries among low-inclination Classicals, a possible size cutoff to binaries among the Centaurs, an apparent preference for nearly equal mass binaries, and a strong increase in the number of binaries at small separations. We propose to continue this successful program in Cycle 16; we expect to discover at least 13 new binary systems, targeted to subgroups where these discoveries can have the greatest impact.
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Proposal Category: GO
Scientific Category: ISM AND CIRCUMSTELLAR MATTER
ID: 11114
Title: Improving proper motion measurements of the stars in the field of SN 1572 with WFPC2
PI: Pilar Ruiz-Lapuente
PI Institution: Universidad de Barcelona

We propose to complete the spatial velocity measurements of the stars in the central region of the remnant of SN 1572, one of the historical Galactic Type Ia supernovae. A new visit with WFPC2 would allow us to significantly improve the accuracy of the proper motion measurements of the stars in the field, since we would benefit from a long temporal baseline by using the WFPC2 images previously taken. This unique legacy would complement the high-precision ground-based observations made for the stars in the SN 1572 field during the past ten years. The search for the companion star of Galactic Type Ia supernovae, based on their high peculiar velocity as a salient feature, has already pointed to a good candidate for SN 1572. The current uncertainties in the tangential velocity of the candidate star and the other stars in the field can be reduced to less than a half with a visit in Cycle 16. This would lead to a precise determination of the parameters of the binary system that gave rise to the supernova. If not done during Cycle 16, the long temporal baseline for SN 1572 with WFPC2 would be lost.
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Proposal Category: GO
Scientific Category: SOLAR SYSTEM
ID: 11115
Title: Photometric Imaging of Asteroid 2 Pallas
PI: Christopher Russell
PI Institution: University of California - Los Angeles

We propose to conduct the first HST imaging of Asteroid 2 Pallas with WFPC2-PC over 8 HST orbits. We will image the asteroid in five filters: F336w, F439w, F555w, F675w and F814w. We will utilize these observations to drastically improve the knowledge of Pallas' shape, spin pole position and surface properties, including roughness and albedo, parameters that are poorly determined by previous study. These observations will result in high signal-to-noise, high resolution surface maps from the visible to the UV. A satellite search will also be conducted for objects within the stability field of up to 21st magnitude, or about 900m in diameter. It is demonstrated in our proposal that significant scientific opportunity exists in Cycle 16 because Pallas is at both a low-phase, 3.9 degree opposition and near its closest approach to Earth, conditions that do not occur simultaneously in the next twenty years. This window represents the best chance to answer long standing, fundamental questions about Pallas, the main asteroid belt, and the formation of the solar system.
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Proposal Category: GO
Scientific Category: COOL STARS
ID: 11116
Title: Exploring the Early FUV History of Cool Stars: Transition Regions at 30 Myr
PI: Steven Saar
PI Institution: Smithsonian Institution Astrophysical Observatory

Stellar magnetic activity derives from the so-called "dynamo," a hydromagnetic interplay between overturning plasma motions and differential rotation in stars cool enough to support significant surface convection zones. The magnetic fields resulting from dynamo action are in turn are responsible for a wide range of high-energy emissions, including the spectacular outbursts called flares. Dynamo powered magnetic activity is not confined solely to stars, but also must occur, for example, in accretion disks of all descriptions, and in some planets. A great deal is known about magnetic activity in middle-aged G dwarfs like our Sun, thanks to its proximity. Less is known, however, about the much younger stars, newly emerged from the T-Tauri stage. Yet, it is during this phase that they reach the peak of their magnetic activity, and subsidiary influences, such as the impact of ionizing radiation and strong coronal winds on developing solar systems, also are maximum. One of the key missing ingredients in our current understanding are measurements of FUV emissions of such stars, to complement the extensive collections of coronal (1-10 MK) X-ray measurements, particularly from recent ROSAT, Chandra and XMM-Newton surveys. We propose to conduct sensitive ACS/SBC prism ultraviolet spectroscopy of selected fields in two young (30 Myr) Galactic clusters--IC 2391 and IC 2602--to inventory the key C IV emission index (~0.1 MK) over a much larger and more diverse sample of coeval objects than has been possible hitherto. A key question is whether the FUV emissions also suffer the "saturation" and "super-saturation" at short rotation periods seen in coronal X-rays, or whether they continue to rise in the fastest rotating stars. The saturation behavior of the different temperature regimes holds important clues to the organization of the surface active regions on these very young stars, and should allow us to distinguish among several competing models.
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Proposal Category: GO
Scientific Category: STAR FORMATION
ID: 11117
Title: The Search for Atmospheric Water in the Transiting Planet HD189733b
PI: David Sing
PI Institution: CNRS, Institut d'Astrophysique de Paris

We propose to use the NICMOS camera to search for transit NIR signatures of atmospheric water in HD189733b. While water absorption bands exist in the optical and IR, space-based NIR signatures are uniquely positioned to offer the best chance at detection. Using narrow band photometric filters, we will

be able to detect absorption signatures while the planet is in primary transit. A positive detection would be the first proof of water on an extrasolar planet. Furthermore, it would provide invaluable planetary information, constraining the entire chemistry. As a byproduct of the high SNR required for our primary science goal, we will be able to improve on the value of the planetary radius, a result independent of our primary science objective. The accurate radius estimate, together with planet structure models, will allow constraining the planet interior and its relationship with formation models and stellar metallicity.

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Proposal Category: GO
Scientific Category: SOLAR SYSTEM
ID: 11118
Title: Investigating Near-Equinox Atmospheric Change on Uranus
PI: Lawrence Sromovsky
PI Institution: University of Wisconsin - Madison

Uranus is approaching its 7 December 2007 equinox, when we will be able to observe the entire northern hemisphere for the first time with modern cameras. The large seasonal phase shift expected from its long radiative time constant implies that it should now exhibit nearly maximal hemispheric contrast, and should be in the process of reversing. Many changes already observed, such as the development of the first visible-wavelength dark spot, discovered in Cycle 15, and the fading of the south polar cap may be indicative of the expected reversal. We propose a detailed characterization of Uranus' current seasonal response with a 7-orbit program consisting of 1 orbit of NICMOS imaging of cloud bands and 6 orbits of WFPC2 imaging using both broadband and narrow-band filters capable of tracking dark and bright discrete cloud features. Filters between 0.467 and 1.87 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 contributions and parent gas mixing ratios. These observations have unique combinations of spectral range and resolution with needed temporal and spatial resolution not available from groundbased observations. Only HST is capable of investigating the Uranus dark spot.

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Proposal Category: GO
Scientific Category: HOT STARS
ID: 11119
Title: The Stellar Origins of Supernovae
PI: Schuyler Van Dyk
PI Institution: Jet Propulsion Laboratory

Supernovae (SNe) have a profound effect on galaxies, and have been used recently as precise cosmological probes, resulting in the discovery of the accelerating Universe. They are clearly very important events deserving of

intense study. Yet, even with nearly 4000 known SNe, we know relatively little about the stars which give rise to these powerful explosions. The main limitation has been the lack of spatial resolution in pre-SN imaging data. However, since 1999 our team has been at the vanguard of directly identifying SN progenitor stars in HST images. From this exciting new line of study, the emerging trend from 5 detections for Type II-Plateau SNe is that their progenitors appear to be relatively low mass (8 to 20 Msun) red supergiants, although more cases are needed. Nonetheless, the nature of the progenitors of Type Ib/c SNe, a subset of which are associated with the amazing gamma-ray bursts, remains ambiguous. Furthermore, we remain in the continually embarrassing situation that we still do not yet know which progenitor systems explode as Type Ia SNe, which are currently being used for precision cosmology. We propose to confirm the identities of the progenitors of 4 SNe within 17 Mpc, which we expect to occur during Cycle 16, through ToO observations using WFPC2/PC.

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Proposal Category: GO
Scientific Category: HOT STARS
ID: 11120
Title: A Paschen-Alpha Study of Massive Stars and the ISM in the Galactic Center
PI: Daniel Wang
PI Institution: University of Massachusetts

The Galactic center (GC) is a unique site for a detailed study of a multitude of complex astrophysical phenomena, which may be common to nuclear regions of many galaxies. Observable at resolutions unapproachable in other galaxies, the GC provides an unparalleled opportunity to improve our understanding of the interrelationships of massive stars, young stellar clusters, warm and hot ionized gases, molecular clouds, large scale magnetic fields, and black holes. We propose the first large-scale hydrogen Paschen alpha line survey of the GC using NICMOS on the Hubble Space Telescope. This survey will lead to a high resolution and high sensitivity map of the Paschen alpha line emission in addition to a map of foreground extinction, made by comparing Paschen alpha to radio emission. This survey of the inner 75 pc of the Galaxy will provide an unprecedented and complete search for sites of massive star formation. In particular, we will be able to (1) uncover the distribution of young massive stars in this region, (2) locate the surfaces of adjacent molecular clouds, (3) determine important physical parameters of the ionized gas, (4) identify compact and ultra-compact HII regions throughout the GC. When combined with existing Chandra and Spitzer surveys as well as a wealth of other multi-wavelength observations, the results will allow us to address such questions as where and how massive stars form, how stellar clusters are disrupted, how massive stars shape and heat the surrounding medium, and how various phases of this medium are interspersed.

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Proposal Category: GO

Scientific Category: ISM AND CIRCUMSTELLAR MATTER
ID: 11121
Title: Proper Motion of the Remarkable Irradiated Jet HH399 in the Trifid Nebula
PI: Farhad Yusef-Zadeh
PI Institution: Northwestern University

The Trifid nebula has recently been of much interest because of its identification with a large number of massive protostars, as well as young stellar objects. HH 399 is one of the most spectacular Herbig-Haro flows recognized to be irradiated by the UV flux of the massive O7.5 star in the Trifid nebula. The irradiated jet, which is propagating in a fully ionized medium, contains numerous knots along the jet and also shows evidence for a number of isolated knots running immediately outside the jet. Two different HST observations of the nebula, with different scientific goals, were carried out in 1997 and 2002, having sensitivities that differed by a factor of 10. We performed preliminary proper motion measurements of the jet based on these observations and discovered a continuous velocity structure of the bright knots of about 230 km/sec. Here we propose four WFPC2 orbits to reobserve HH 399 in order to carry out accurate proper motion measurements over the full extent of the jet, based on observations spanning more than 10 years and having equally deep sensitivity. The proposed observations are not simply a repeat of previous measurements, as this will be the first highly accurate proper motion measurement of an irradiated jet based on two identical epochs of WFPC2 observations. The observations will improve the accuracy of proper motion measurements for HH 399 by more than a factor of five and will address important questions beyond our preliminary result. Currently measured velocity differences between the jet features are barely significant. The factor of 5 increase in accuracy will establish the evidence for deceleration along the jet and the lateral motion of the jet. In addition, these measurements will address the kinematics of individual entrained and isolated blobs of the jet as it propagates into an HII region associated with the nebula. This is the last opportunity to perform this experiment before WFPC2 is removed from HST.
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Proposal Category: GO
Scientific Category: ISM AND CIRCUMSTELLAR MATTER
ID: 11122
Title: Expanding PNe: Distances and Hydro Models
PI: Bruce Balick
PI Institution: University of Washington

We propose to obtain repeat narrowband images of a sample of eighteen planetary nebulae (PNe) which have HST/WFPC2 archival data spanning time baselines of a decade. All of these targets have previous high signal-to-noise WFPC2/PC observations and are sufficiently nearby to have readily detectable expansion signatures after a few years. Our main scientific objectives are (a) to determine precise distances to these PNe based on their angular expansions, (b) to test detailed and highly successful hydrodynamic

models that predict nebular morphologies and expansions for subsamples of round/elliptical and axisymmetric PNe, and (c) to monitor the proper motions of nebular microstructures in an effort to learn more about their physical nature and formation mechanisms. The proposed observations will result in high-precision distances to a healthy subsample of PNe, and from this their expansion ages, luminosities, CSPN properties, and masses of their ionized cores. With good distances and our hydro models, we will be able to determine fundamental parameters (such as nebular and central star masses, luminosity, age). The same images allow us to monitor the changing overall ionization state and to search for the surprisingly non-homologous growth patterns to bright elliptical PNe of the same sort seen by Balick & Hajian (2004) in NGC 6543. Non-uniform growth is a sure sign of active pressure imbalances within the nebula that require careful hydro models to understand.
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Proposal Category: GO
Scientific Category: STAR FORMATION
ID: 11123
Title: A NICMOS Survey for Proplyds in the RCW 38 Massive Embedded Cluster
PI: Tyler Bourke
PI Institution: Smithsonian Institution Astrophysical Observatory

We propose a search for line emission from photoevaporating protoplanetary disks in the Massive Embedded Cluster RCW 38. These disks would be analogous to the "proplyds" discovered in the Orion Nebula: disks around young low mass stars which are being photoionized by a nearby O star. We will search for these disks in RCW 38 using narrowband imaging in the lines of Paschen alpha and molecular hydrogen (1-0) S(1) with NICMOS. The RCW 38 region is an excellent target for determining whether proplyds are observable in large numbers outside of Orion. It is a young embedded cluster hosting a few hundred low mass young stars with a large percentage showing infrared excess indicating the presence of disks. About 100 of these stars are found within 0.1 pc of the central O5 star, and the cluster is located within a cleared cavity 0.2 pc in size, embedded within a molecular cloud, exposing the cluster members directly to the UV radiation from the O star. Unlike Orion, but like many other young clusters, RCW 38 is not seen in visible light, and infrared imaging is needed. The best line in the infrared for revealing proplyds is the Paschen alpha line, which is not detectable from the ground. Only HST is able to perform these observations. From these observations we will estimate the lifetime of the evaporating disks, and ascertain whether these disks will survive long enough to form planets.
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Proposal Category: GO
Scientific Category: QUASAR ABSORPTION LINES AND IGM
ID: 11124
Title: The Origin of QSO Absorption Lines from QSOs
PI: David Bowen

PI Institution: Princeton University

We propose using WFPC2 to image the fields of 10 redshift z ~ 0.7 foreground (FG) QSOs which lie within ~29-151 kpc of the sightlines to high-z background (BG) QSOs. A surprisingly high fraction of the BG QSO spectra show strong MgII (2796,2803) absorption lines at precisely the same redshifts as the FG QSOs. The high resolution capabilities of WFPC2 are needed to understand the origin of these absorption systems, in two ways. First, we wish to explore the FG QSO environment as close as possible to the position of the BG QSO, to search for interloping group or cluster galaxies which might be responsible for the absorption, or irregularly shaped post-merger debris between the FG and BG QSO which may indicate the presence of large amount of disrupted gas along a sightline. Similarly, high resolution images are needed to search for signs of tidal interactions between any galaxies which might be found close to the FG QSO. Such features might provide evidence of young merging events causing the start of QSO duty cycles and producing outflows from the central AGN. Such winds may be responsible for the observed absorption lines. Second, we seek to measure the intrinsic parameters of the FG QSO host galaxy, such as luminosity and morphology, to correlate with the properties of the MgII absorption lines. We wish to observe each field through the F814W filter, close to the rest-frame B-band of the FG QSO. These blue data can reveal enhanced star formation regions close to the nucleus of the host galaxy, which may be indicative of galaxy mergers with the FG QSO host. The FG QSO environment offers quite a different set of phenomena which might be responsible for MgII absorption, providing an important comparison to studies of MgII absorption from regular field galaxies.

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Proposal Category: GO
Scientific Category: RESOLVED STELLAR POPULATIONS
ID: 11125
Title: The Dynamical Evolution of Globular Clusters
PI: Joel Bregman
PI Institution: University of Michigan

Globular clusters evolve through dynamical interactions, with primordial binaries extending the time until core collapse by up to an order of magnitude, depending on the initial binary fraction. These dynamical interactions plus mass segregation causes the binary fraction to rise in the core but fall at larger radii. We hope to eventually test these broad predictions by comparing them to the binary properties for globular clusters at different states of evolution, defined by the ratio of their age to the dynamical relaxation time at the half-light radius. The most important unknown aspects in the modeling process are the initial conditions of binaries in the cluster. Here we propose to determine the initial binary fraction as a function of radius by studying three of the dynamically youngest globular clusters (NGC 5053, NGC 5466, and NGC 5897). The presence of binaries thickens the Main Sequence in a color-magnitude diagram, which can be detected

with deep multicolor images.
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Proposal Category: GO
Scientific Category: RESOLVED STELLAR POPULATIONS
ID: 11126
Title: Resolving the Smallest Galaxies
PI: Kristin Chiboucas
PI Institution: University of Hawaii

An order of magnitude more dwarf galaxies are expected to inhabit the Local Group, based on currently accepted galaxy formation models, than have been observed. This discrepancy has been noted in environments ranging from the field to rich clusters, with evidence emerging that lower density regions contain fewer dwarfs per giant than higher density regions, in further contrast to model predictions. One possible explanation for this involves the effects of reionization on the forming galaxies and naturally explains both the dearth of dwarf galaxies and the apparent environmental dependence. However, before such theories can be fully tested, we require a better understanding of the distribution of dwarf galaxies. Currently, there is no complete census of the faintest dwarf galaxies in any environment. The discovery of the smallest and faintest dwarfs is hampered by the limitations in detecting such faint and low surface brightness galaxies, and this is compounded by the great difficulty in determining accurate distances to, or ascertaining group membership for, such faint objects. The M81 group provides a unique means for establishing membership for galaxies in a low density region complete to magnitudes as faint as M_R ~ -7. With a distance modulus of 27.8, the tip of the red giant branch (TRGB) appears at I ~ 24, just within the reach of ground based surveys. We currently have surveyed a 30 square degree region around M81 with the CFHT/Megacam. From these images we have detected 15 new candidate dwarf galaxies. We propose to use the HST with WFPC2 to image these 15 galaxies in F606W and F814W bands in order to construct a color-magnitude diagram down to I = 25.5 from which to measure accurate TRGB distances to these candidate galaxies and determine star formation and metallicity histories. The overall project will provide a survey of the dwarf galaxies in the M81 group environment with unprecedented completeness to a limit of M_R < -7.
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Proposal Category: GO
Scientific Category: HOT STARS
ID: 11127
Title: Mapping the nebula surrounding the enigmatic X-ray source at the center of the Vela Jr SNR
PI: Andrea De Luca
PI Institution: CNR, Istituto di Astrofisica Spaziale

A compact X-ray source, showing nothing but steady unpulsed thermal emission,

lies close to the center of the young and nearby supernova remnant dubbed "Vela Jr". It is a typical member of a class of enigmatic sources, supposed to be the youngest members of the radio-quiet neutron star family. Quite surprisingly, we discovered in ground-based optical observations a small Halpha nebula spatially coincident with the X-ray source. Such a nebula potentially carries very important information on the nature of the X-ray source, which remains elusive in spite of large observational efforts. We propose to use the WFPC2 to collect high resolution Halpha images of the nebula in order to resolve its structure, to understand its nature, and to identify its connection with the X-ray source. Addressing all these points will also have important implications for our interpretation of the compact X-ray source and on of other objects of the same class.

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Proposal Category: GO
Scientific Category: UNRESOLVED STELLAR POPULATIONS
ID: 11128
Title: Time Scales Of Bulge Formation In Nearby Galaxies
PI: David Fisher
PI Institution: University of Texas at Austin

Traditionally, bulges are thought to fit well into galaxy formation models of hierarchical merging. However, it is now becoming well established that many bulges formed through internal, secular evolution of the disk rather than through mergers. We call these objects pseudobulges. Much is still unknown about pseudobulges, the most pressing questions being: How, exactly, do they build up their mass? How long does it take? And, how many exist? We are after an answer to these questions. If pseudobulges form and evolve over longer periods than the time between mergers, then a significant population of pseudobulges is hard to explain within current galaxy formation theories. A pseudobulge indicates that a galaxy has most likely not undergone a major merger since the formation of the disk. The ages of pseudobulges give us an estimate for the time scale of this quiescent evolution. We propose to use 21.4 orbits of HST time to complete UBVIH imaging on a sample of 33 nearby galaxies that we have observed with Spitzer in the mid-IR. These data will be used to measure spatially resolved stellar population parameters (mean stellar age, metallicity, and star formation history); comparing ages to star formation rates allows us to accurately constrain the time scale of pseudobulge formation. Our sample of bulges includes both pseudo- and classical bulges, and evenly samples barred and unbarred galaxies. Most of our sample is imaged, 13 have complete UBVIH coverage; we merely ask to complete missing observations so that we may construct a uniform sample for studying bulge formation. We also wish to compare the stellar population parameters to a variety of bulge and global galaxy properties including star formation rates, dynamics, internal bulge morphology, structure from bulge-disk decompositions, and gas content. Much of this data set is already or is being assembled. This will allow us to derive methods of pseudobulge identification that can be used to accurately count pseudobulges in large surveys. Aside from

our own science goals, we will present this broad set of data to the community. Thus, we waive proprietary periods for all observations.
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Proposal Category: GO
Scientific Category: RESOLVED STELLAR POPULATIONS
ID: 11129
Title: The Star Formation History of the Fornax Dwarf Spheroidal Galaxy
PI: Enrico Held
PI Institution: Osservatorio Astronomico di Padova

The Fornax dwarf spheroidal galaxy is one of the most luminous dwarf satellites of the Milky Way. It is unusual in many ways: it hosts 5 globular clusters, shows some relatively young stars, and has faint sub-structures which have been interpreted as signs of recent interactions. It is thus of great interest to learn the complete star formation history (SFH) of Fornax to establish a link between its evolutionary path and the predictions from numerical simulations, as a test of our understanding of dwarf galaxy evolution. Yet many questions remain open. Is the old stellar population made up of stars formed in a very early burst, perhaps before the epoch of reionisation, or the result of a more continuous star formation between 13 and 9 Gyr ago ? How quickly did Fornax increase its metallicity during its initial assembly and during subsequent episodes of star formation ? Are accretion episodes required to explain the age-metallicity history of Fornax ? However, there has never been a comprehensive study of the global SFH of the Fornax field based on data of sufficient depth to unambiguously measure the age mixture of the stellar populations and their spatial variation. We propose to use the WFPC2 to obtain very deep images in several fields across the central region of Fornax in order to reach the oldest main-sequence turnoffs. The number of fields is determined by the need to measure the SFH over different regions with distinct kinematics and metallicity. The resolution achievable with HST is crucial to answer these questions because, to derive the age distribution of the oldest stars, we are interested in I magnitude differences of the order 0.2 mag in crowded fields at V=24.5. We will directly measure the time variation in star-formation rate over the entire galaxy history, from first stars coeval with the Milky Way halo to the youngest populations 200 Myr ago. The combination of detailed CMD analysis with WFPC2 with our existing metallicity and kinematic information will allow us to trace out the early phases of its evolution.
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Proposal Category: GO
Scientific Category: AGN/QUASARS
ID: 11130
Title: AGNs with Intermediate-mass Black Holes: Testing the Black Hole-Bulge Paradigm, Part II
PI: Luis Ho
PI Institution: Carnegie Institution of Washington

The recent progress in the study of central black holes in galactic nuclei has led to a general consensus that supermassive (10^6-10^9 solar mass) black holes are closely connected with the formation and evolutionary history of large galaxies, especially their bulge component. Two outstanding issues, however, remain unresolved. Can central black holes form in the absence of a bulge? And does the mass function of central black holes extend below 10^6 solar masses? Intermediate-mass black holes (<10^6 solar masses), if they exist, may offer important clues to the nature of the seeds of supermassive black holes. Using the SDSS, our group has successfully uncovered a new population of AGNs with intermediate-mass black holes that reside in low-luminosity galaxies. However, very little is known about the detailed morphologies or structural parameters of the host galaxies themselves, including the crucial question of whether they have bulges or not. Surprisingly, the majority of the targets of our Cycle 14 pilot program have structural properties similar to dwarf elliptical galaxies. The statistics from this initial study, however, are really too sparse to reach definitive conclusions on this important new class of black holes. We wish to extend this study to a larger sample, by using the Survey mode to obtain WFPC2 F814W images of 85 (from a parent sample of 175) AGNs with intermediate-mass black holes selected from our final SDSS search. We are particularly keen to determine whether the hosts contain bulges, and if so, how the fundamental plane properties of the host depend on the mass of their central black holes. We will also investigate the environment of this unique class of AGNs.
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Proposal Category: GO
Scientific Category: ISM IN EXTERNAL GALAXIES
ID: 11131
Title: Star formation at large radii in cooling flow brightest cluster galaxies
PI: Walter Jaffe
PI Institution: Sterrewacht Leiden

We propose to take deep ACS FUV images of the bright central galaxies in two powerful cooling flow clusters for which we have VLT UBR images, with the object of determining whether the UV excesses we observe at large radii (>15kpc) are caused by young stars, ultrahot (WR) stars, or an as yet unknown source. Current models of excess UV light at the AGN-dominated centers of these galaxies cannot easily be extended to large radii. New understanding of star formation in these clusters will be directly applicable to scenarios of galaxy formation in the early universe.
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Proposal Category: GO
Scientific Category: COOL STARS
ID: 11132
Title: Constraining the age of the AB Dor system
PI: Markus Janson

PI Institution: Max-Planck-Institut fur Astronomie, Heidelberg

The zero-age main sequence K-type star AB Dor, with an age of 25 to 125 Myr, is the most active young star in the solar neighbourhood. It is part of a quadruple system of young stars. The mass of AB Dor C, the closest and lowest mass companion, has been derived from astrometric observations (with the VLA and adaptive optics at the VLT) to 94+-3 times the mass of Jupiter. The low mass (close to the hydrogen burning limit) combined with the young age makes AB Dor C a unique calibration source for evolutionary tracks for very low-mass stars and brown dwarfs, provided that a precise age estimate can be derived for the system. We propose to use the HST planetary camera to obtain resolved component photometry of the M-type pre-main sequence star AB Dor Ba and Bb in order to derive individual spectral types and luminosities, which will enable us to age-date the AB Dor system to better than +-20 Myr. In addition, the observations will help to constrain the Ba/Bb orbit, and hence to derive dynamical mass estimates as well.

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Proposal Category: GO
Scientific Category: HOT STARS
ID: 11133
Title: Late-Time Photometry of SN 2005hk: A New Kind of Type Ia Supernova
PI: Saurabh Jha
PI Institution: Rutgers the State University of New Jersey

Our lack of understanding of Type Ia supernova (SN Ia) explosions limits our confidence in their use for cosmology. While there is broad agreement that these objects represent the explosions of white dwarfs, the details of the explosion mechanism are not well-understood. Recent observations have detected a previously unacknowledged variant class of SNe Ia whose photometric and spectroscopic peculiarities make them quite distinct from normal SNe Ia. These objects represent a challenge for thermonuclear supernova models, as a complete theory of exploding white dwarfs must allow for their existence. A particularly well-studied example of this class of objects is the recent SN 2005hk, whose properties in some respects resemble those of models which invoke a subsonic burning front, called a deflagration. We propose to test SN Ia models by obtaining late-time photometry for this extreme SN Ia using WFPC2 and NICMOS on HST. We will accurately measure the late-time photometric decline rate and spectral energy distribution (SED). These observations will allow us to test whether the ejecta contain the large amount of oxygen predicted by certain models, the efficiency of energy deposition by gamma rays and positrons, and possibly detect major evolution of the SED expected due to a change in the dominant cooling mechanism of the ejecta.

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Proposal Category: GO
Scientific Category: UNRESOLVED STELLAR POPULATIONS
ID: 11134

Title: WFPC2 Tidal Tail Survey: Probing Star Cluster Formation on the Edge
PI: Karen Knierman
PI Institution: University of Arizona

The spectacular HST images of the interiors of merging galaxies such as the Antennae and NGC 7252 have revealed rich and diverse populations of star clusters created over the course of the interaction. Intriguingly, our WFPC2 study of tidal tails in these and other interacting pairs has shown that star cluster birth in the tails does not follow a similarly straightforward evolution. In fact, cluster formation in these relatively sparse environments is not guaranteed -- only one of six tails in our initial study showed evidence for a significant population of young star clusters. The tail environment thus offers the opportunity to probe star cluster formation on the edge of the physical parameter space (e.g., of stellar and gas mass, density, and pressure) that permits it to occur. We propose to signficantly extend our pilot sample of optically bright, gas-rich tidal tails by a factor of 4 in number to include a more diverse population of tails, encompassing major and minor mergers, gas-rich and gas-poor tails, as well as early, late, and merged interaction stages. With 21 orbits of HST WFPC2 imaging in the F606W and F814W filters, we can identify, roughly age-date, and measure sizes of star clusters to determine what physical parameters affect star cluster formation. WFPC2 imaging has been used effectively in our initial study of four mergers, and it will be possible in this program to reach similar limits of Mv=-8.5 for each of 16 more tails. With the much larger sample we expect to isolate which factors, such as merger stage, HI content, and merger mass ratio, drive the formation of star clusters.

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Proposal Category: GO
Scientific Category: COSMOLOGY
ID: 11135
Title: Extreme makeovers: Tracing the transformation of massive galaxies at z~2.5
PI: Mariska Kriek
PI Institution: Universiteit Leiden

To obtain a full spectroscopic census of the universe at z~2.5 we have conducted a near-infrared spectroscopic survey for K-selected galaxies. We found that, in contrast to the local universe, massive high-redshift galaxies span a wide range of properties, varying from (dusty) star burst to "red and dead" galaxies. This may imply that massive galaxies transform from star-forming to quiescent galaxies in the targeted redshift range. To understand whether the 9 quiescent galaxies in our sample are the progenitors of local elliptical, we are observing them in the current cycle with NIC2. For cycle 16 we propose to complete our sample of massive z~2.5 galaxies and image the remaining 10 galaxies, which all have emission lines. Based on emission-line diagnostics, 6 of these galaxies are identified as star-forming objects and 4 harbor an active galactic nucleus. The goals are to 1) determine whether star formation in massive z~2.5 galaxies takes place in disks or is triggered by

merger activity, 2) derive the contribution of AGNs to the rest-frame optical emission, and 3) test whether the morphologies are consistent with the idea that the star-forming galaxies, AGNs, and quiescent galaxies represent subsequent phases of an evolutionary sequence. The combination of both programs will provide the first morphological study of a spectroscopically confirmed massive galaxy sample at z~2.5.
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Proposal Category: GO
Scientific Category: COOL STARS
ID: 11136
Title: Resolving Ultracool Astrophysics with Brown Dwarf Binaries
PI: Michael Liu
PI Institution: University of Hawaii

We propose to obtain resolved far-red and near-IR photometry of 14 brown dwarf binaries with HST/NICMOS in order to study one of the long-standing puzzles in ultracool astrophysics, namely the rapid change in spectra from L dwarfs to T dwarfs at nearly constant effective temperature (a.k.a. the ``L/T transition''). While many nearby brown dwarfs have been studied, use of such samples is inevitably hindered by the unknown ages, masses, and metallicities of the field population. Characterization of resolved ultracool binaries is a promising avenue for addressing this problem, by providing coeval systems of the same composition with comparable masses and temperatures. Our proposed HST/NICMOS (0.9-1.6 micron) observations will be combined with longer wavelength ground-based photometry and spectroscopy from Keck laser guide star adaptive optics. The resulting multi-band (0.9-2.5 micron) dataset will be a unique resource for measuring the evolution of spectral energy distributions across the L/T transition, to test state-of-the-art atmospheric models, and to determine the physical process(es) that dominate the L/T transition. Understanding the L/T transition is important not only for testing brown dwarf atmospheres, but also provides a key pathway for understanding the same physical effects, namely the formation and removal of clouds, in the atmospheres of the extrasolar planets.
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Proposal Category: GO
Scientific Category: HOT STARS
ID: 11137
Title: First Accurate Geometric Distance to a Galactic Wolf-Rayet Star: Knots in the Ejecta M1-67
PI: Anthony Moffat
PI Institution: Universite de Montreal

M 1-67 is the youngest known ejection nebula surrounding a Population I Wolf-Rayet star, in this case the WN8 star WR 124. Our deep H-alpha HST/WFPC2 image of this object in March 1997 revealed, for the first time in such a nebula, numerous bright, mostly unresolved knots (typical diameters 0.1-0.2")

often surrounded by what appear to be their own local spherical diffuse 'wind' bubbles. We propose to obtain a second epoch H-alpha image of M 1-67, essentially repeating the Epoch1 instrumental set-up. By measuring the proper motions of the knots, we will derive a relatively precise and assumption-free geometric distance (thus also a luminosity) to a Galactic Wolf-Rayet star, the first of its kind. This will help to confirm the suspected runaway status of WR 124 and shed new light on the nature of progenitors of gamma-ray bursts. Moreover, we intend to document and measure the anticipated morphology/brightness changes in the fine-stucture features of the nebula over the 11-year interval, as they relate to wind-embedded shocks. This will provide important input for interaction models of a stellar wind with circumstellar matter.

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Proposal Category: GO
Scientific Category: AGN/QUASARS
ID: 11138
Title: The Physics of the Jets of Powerful Radio Galaxies and Quasars
PI: Eric Perlman
PI Institution: Florida Institute of Technology

We propose to obtain HST polarimetry of the jets of the quasars 1150+497 and PKS 1136-135. Our goal is to solve the riddle of their high-energy emission mechanism, and tackle issues such as particle acceleration and jet dynamics. Our targets are the optically brightest quasar jets, and they span the range of luminosities and beaming parameters seen in these objects. Recent observations with Spitzer, HST and Chandra have shed new light on the spectral morphology of quasar jets, throwing wide open the question of the nature of their optical and X-ray emission. Three mechanisms are possible, including synchrotron emission as well as two Comptonization processes. Polarimetry can uniquely determine which of these mechanisms operates in the optical. We will compare the optical polarimetry to in-hand radio polarimetry as well as in-hand and new Spitzer, HST and Chandra imaging to gain new insights on the structure of these jets, as well as particle acceleration mechanisms and jet dynamics.

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Proposal Category: GO
Scientific Category: HOT STARS
ID: 11139
Title: NICMOS Observations of the Microquasar GRS 1758-258
PI: Ian Smith
PI Institution: Rice University

The galactic black hole candidate GRS 1758-258 is normally one of the brightest persistent gamma-ray sources in the vicinity of the galactic center. It is a microquasar with relativistic radio jets emanating from a central variable source. Microquasars are excellent nearby test laboratories for

studying the complex accretion and outflow processes that take place near black hole horizons. Despite an accurate location provided by Chandra and the VLA and over a decade of careful ground-based studies, the optical/infrared counterpart to GRS 1758-258 remains unknown. A stellar counterpart is expected, but the current candidates are all more than 2 sigma from the center of the error circle. The ground-based infrared flux limits are also right at the values expected for the synchrotron emission from the outflow from the black hole, and possibly for the emission from the accretion disk. This leaves open the question as to what is powering this very energetic persistent source. Here we propose to use NICMOS to perform broad-band imaging of the GRS 1758-258 error box. These images will be more than three magnitudes more sensitive than the current ground-based ones. The resulting spectra will reveal the thermal/non-thermal nature of the sources in the region of the error box, and the high spatial resolution images may reveal a jet structure. We propose to perform three visits of two orbits each spanning the suggested 18.45 day binary orbital period of the system: a correct counterpart identification should be confirmed by its variability. We will also aim to support the HST observations with X- and gamma-ray observations using Swift or INTEGRAL, and with longer wavelength observations from the ground.

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Proposal Category:	GO
Scientific Category:	HOT STARS
ID:	11140
Title:	Can mass-ejections from late He-shell flash stars constrain convective/reactive flow modeling of stellar interiors?
PI:	Klaus Werner
PI Institution:	Universitat Tubingen, Institut fur Astronomie & Astrophysik

The existence of H-deficient knots around the central stars of the planetary nebulae Abell 30 and Abell 78 is still unexplained. We hypothesize that these knots were ejected during a very late helium-shell flash (= very late thermal pulse, VLTP) suffered by the precursor white dwarf stars. If this is true, then the characteristics of these knots (mass, velocity, density, spatial distribution) allow to draw conclusions on the course of the hydrogen-ingestion flash detonation that is triggered by the He-shell flash. This provides important, otherwise inaccessible constraints for the hydrodynamical modeling of convective/reactive flows in stellar interiors. Understanding the physics of these flows is not only important for the understanding of these particular central stars, but also for the frequent, very similar convective/reactive events that determine the nucleosynthesis in Pop. III stars. With this proposal we want to proof or discard the idea that the H-deficient knots are resulting from a VLTP. If true, then they can be exploited for flash-physics diagnostics. We propose a simple test. We search for such knots around five H-deficient central stars (PG1159 stars). Our models predict, that only those stars with residual nitrogen in the atmosphere have suffered a VLTP and, hence, should have expelled knots. We therefore want to take [O III] images of stars which have photospheric N and those which do not.

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Proposal Category: GO
Scientific Category: RESOLVED STELLAR POPULATIONS
ID: 11141
Title: White dwarfs in the open star cluster NGC 188
PI: Kurtis Williams
PI Institution: University of Texas at Austin

White dwarf cooling sequences represent the only ways in which we can determine ages of Galactic components such as the disk and the halo, and they are an independent check on main sequence ages of globular star clusters. These age measurements rely heavily on theoretical cooling models, many of which disagree by as much as a few gigayears for the coolest white dwarfs. Further, observations of the white dwarf sequence in the super metal-rich open cluster NGC 6791 have found a white dwarf age several gigayears younger than the accepted cluster age determined by main-sequence fitting. The white dwarf sequence of the solar-metallicity, 7-Gyr old open cluster NGC 188 can provide some much-needed insight into these uncertainties, but previous HST observations were too shallow to detect the oldest, faintest white dwarfs in the cluster. We propose deep imaging of two fields at the center of the cluster with the following goals: (1) To detect the end of the white dwarf cooling sequence, providing a much-needed empirical data point for cool white dwarf evolutionary models, (2) to compare the white dwarf luminosity function of NGC 188 with that of NGC 6791 to determine if the odd white dwarf sequence in the latter cluster is due to the cluster's high metallicity or due to a shortcoming in theoretical models, and (3) to determine via photometry the masses of white dwarfs formed by solar-mass stars, a quantity not yet empirically measured.
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Proposal Category: GO
Scientific Category: ISM IN EXTERNAL GALAXIES
ID: 11142
Title: Revealing the Physical Nature of Infrared Luminous Galaxies at 0.3<z<2.7 Using HST and Spitzer
PI: Lin Yan
PI Institution: California Institute of Technology

We aim to determine physical properties of IR luminous galaxies at 0.3<z<2.7 by requesting coordinated HST/NIC2 and MIPS 70um observations of a unique, 24um flux-limited sample with complete Spitzer mid-IR spectroscopy. The 150 sources investigated in this program have S(24um) > 0.8mJy and their mid-IR spectra have already provided the majority targets with spectroscopic redshifts (0.3<z<2.7). The proposed 150~orbits of NIC2 and 66~hours of MIPS 70um will provide the physical measurements of the light distribution at the rest-frame ~8000A and better estimates of the bolometric luminosity. Combining these parameters together with the rich suite of spectral diagnostics from the

mid-IR spectra, we will (1) measure how common mergers are among LIRGs and ULIRGs at 0.3<z<2.7, and establish if major mergers are the drivers of z>1 ULIRGs, as in the local Universe. (2) study the co-evolution of star formation and blackhole accretion by investigating the relations between the fraction of starburst/AGN measured from mid-IR spectra vs. HST morphologies, L(bol) and z. (3) obtain the current best estimates of the far-IR emission, thus L(bol) for this sample, and establish if the relative contribtuion of mid-to-far IR dust emission is correlated with morphology (resolved vs. unresolved).

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Proposal Category: GO
Scientific Category: UNRESOLVED STELLAR POPULATIONS
ID: 11143
Title: NICMOS imaging of submillimeter galaxies with CO and PAH redshifts
PI: Andrew Baker
PI Institution: Rutgers the State University of New Jersey

We propose to obtain F110W and F160W imaging of 10 z~2.4 submillimeter galaxies (SMGs) whose optical redshifts have been confirmed by the detection of millimeter CO and/or mid-infrared PAH emission. With the 4000A break falling within/between the two imaging filters, we will be able to study these sources' spatially resolved stellar populations (modulo extinction) in the rest-frame optical. SMGs' large luminosities appear to be due largely to merger-triggered starbursts; high-resolution NICMOS imaging will help us understand the stellar masses, mass ratios, and other properties of the merger progenitors, valuable information in the effort to model the mass assembly history of the universe.

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Proposal Category: GO
Scientific Category: COSMOLOGY
ID: 11144
Title: Building on the Significant NICMOS Investment in GOODS: A Bright, Wide-Area Search for z>=7 Galaxies
PI: Rychard Bouwens
PI Institution: University of California - Santa Cruz

One of the most exciting frontiers in observational cosmology has been to trace the buildup and evolution of galaxies from very early times. While hierarchical theory teaches us that star formation in galaxies likely starts out small and builds up gradually, only recently has it been possible to see evidence for this observationally through the evolution of the LF from z~6 to z~3. Establishing that this build up occurs from even earlier times (z~7-8) has been difficult, however, due to the small size of current high-redshift z~7-8 samples -- now numbering in the range of ~4-10 sources. Expanding the size of these samples is paramount, if we are to push current studies of galaxy buildup back to even earlier times. Fortunately, we should soon be able to do so, thanks to ~50 arcmin**2 of deep (26.9 AB mag at 5 sigma) NICMOS

1.6 micron data that will be available over the two ACS GOODS fields as a result of one recent 180-orbit ACS backup program and a smaller program. These data will nearly triple the deep near-IR imaging currently available over these fields and therefore represent a significant resource for finding and characterizing the brightest and likely most massive high-redshift sources (which can be found in no other way but with wide-area searches). To make maximal use of these data, we will first isolate a small sample of the most interesting, candidate z>=7 galaxies from this survey through their z-H colours. We then propose to follow-up each of these candidates with NICMOS imaging at 1.1 microns ('J'-band) to determine which of these sources are at z>=7 and thus significantly expand our sample of luminous, z>=7 galaxies. Since preliminary studies indicate that these candidates occur in only 30% of the NIC3 fields, our follow-up strategy is ~3 times as efficient as without this preselection and 9 times as efficient as a search in a field with no pre-existing data. We expect to identify ~8 luminous z-dropouts and possibly ~2 z~10 J-dropouts as a result of this program, more than tripling the number currently known. The increased sample sizes are important if we are to solidify current conclusions about galaxy buildup and the evolution of the LF from z~8. In addition to the high redshift science, these deep 1.1 micron data would have significant value for many diverse endeavors, including (1) improving our constraints on the stellar mass density at z~7-10 and (2) doubling the number of galaxies at z~6 for which we can estimate dust obscuration.

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Proposal Category: GO
Scientific Category: STAR FORMATION
ID: 11145
Title: Probing the Planet Forming Region of T Tauri Stars in Chamaeleon
PI: Nuria Calvet
PI Institution: University of Michigan

By studying the inner, planet-forming regions of circumstellar disks around low-mass pre-main sequence stars we can refine theories of giant planet formation and develop timescales for the evolution of disks and their planets. Spitzer infrared observations of T Tauri stars in the Chamaeleon star-forming region have given us an unprecedented look at dust evolution in young objects. However, despite this ground breaking progress in studying the dust in young disks, the gas properties of the inner disk remain essentially unknown. Using ACS on HST, we propose to measure the H_2 emission originating in the innermost disk regions of classical T Tauri stars in different stages of evolution with the objective of revealing the timescales of gas dissipation and its relationship to dust evolution. This proposal is part of a comprehensive effort with approved programs on Spitzer, Gemini, and Magellan that aim to characterize the state of gas and dust in disks where planets may already have formed.

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Proposal Category: GO
Scientific Category: ISM IN EXTERNAL GALAXIES
ID: 11146
Title: The Role of Stellar Feedback in Galaxy Evolution
PI: Daniela Calzetti
PI Institution: University of Massachusetts

Stellar feedback - the return of mass and energy from star formation to the interstellar medium - is one of the primary engines of galaxy evolution. Yet, the observational canvass of feedback is incomplete. We propose to investigate this fundamental aspect of star formation on one local actively star-forming galaxy, He2-10, selected to occupy an unexplored niche in the key parameter space of stellar mass. The WFPC2 narrow-band observations in the light of H-beta, [OIII], H-alpha, and [SII] will: (1) discriminate the feedback-induced shock fronts from the photoionized regions; (2) map, and provide a complete census of, the shocks inside and around the starburst regions; and (3) measure the energy budget of the star-formation-produced shocks. These observations, joined by our previous data and studies on starbursts, will yield: (1) the efficiency of the feedback, i.e. the fraction of the star formation's mechanical energy transported out of the starburst volume rather than radiated away, in the dual-parameter space of host's stellar mass and star formation intensity; (2) the conditions under which feedback morphs from a localized process to a galactic scale mechanism. The high angular resolution of HST is crucial for separating the spatially narrow shock fronts (~10 pc=0.2" at 10 Mpc) from the more extended photoionization fronts. This project will provide the most comprehensive quantitative foundation of stellar feedback and a gauge for determining the role of feedback in the energetics, structure and star formation history of galaxies.
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Proposal Category: GO
Scientific Category: UNRESOLVED STELLAR POPULATIONS
ID: 11147
Title: The Origin of Diffuse UV Light from Spiral Disks
PI: Rupali Chandar
PI Institution: Carnegie Institution of Washington

The ultraviolet light from galaxies has been used as a beacon for tracing the cosmic star formation history of the Universe, yet we have an incomplete understandingof many characteristics of this light. Most of the UV emission from nearby, normal star--forming galaxies is unresolved and "diffuse", and GALEX has shown that in spiral disks it permeates the inter-arm regions. The nature of this diffuse inter-arm component is under debate. Recent results suggest that it may arise from non-ionizing UV photons which originate in star forming regions in the spiral arms, travel in the plane of the galaxy, and then scatter off of diffusely distributed cold dust grains. Alternatively, an in-situ, unresolved stellar population could produce the observed inter-arm UV emission. This project seeks to establish which of the two competing

scenarios is responsible for the bulk of this diffuse emission. We propose to use HST's UV imaging capability (ACS/SBC) to obtain deep observations of selected fields in the nearby spiral galaxy M101, for which available (low angular resolution) data favor the 'scattered light' scenario. Our observations are designed to detect any faint, UV-luminous stellar population down to main sequence B5 stars. With these data, we will establish the nature of the bulk of the diffuse UV light in this spiral galaxy by: (i) quantifying the contribution from dust-scattered light; (ii) measuring the contribution to the ubiquitous diffuse ionized medium from in-situ ionizing stars; and (iii) providing constraints on the observed stellar mass function in the field. Only HST has the UV sensitivity and angular resolution to discriminate in-situ stellar populations from scattered light. The ultimate goal of this project is to re-'calibrate' the UV emission as a star formation rate indicator, which will need to account for any scattered component.

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Proposal Category: GO
Scientific Category: ISM AND CIRCUMSTELLAR MATTER
ID: 11148
Title: High Contrast Imaging of Dusty White Dwarfs
PI: John Debes
PI Institution: Carnegie Institution of Washington

For the past 18 years, only one white dwarf with a circumstellar dust disk was known to exist. In the last two years, six new disks have been discovered. Since all material inwards of a few AU should be scoured clean during post main sequence evolution, the primary explanation is the presence of a planetary system that is perturbing relic planetesimals into the tidal disruption radius of the white dwarf. Dusty disks around white dwarfs should be markers for planets and we propose to use high contrast imaging to search for faint companions down to 6 M_J that may be feeding the disks. White dwarfs are uniquely suited for planet searches, where the planet/white dwarf contrast is less than for main sequence stars.

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Proposal Category: GO
Scientific Category: COSMOLOGY
ID: 11149
Title: Characterizing the Stellar Populations in Lyman-Alpha Emitters and Lyman Break Galaxies at 5.7<z<7 in the Subaru Deep Field
PI: Eiichi Egami
PI Institution: University of Arizona

The epoch of reionization marks a major phase transition of the Universe, during which the intergalactic space became transparent to UV photons. Determining when this occurred and the physical processes involved represents the latest frontier in observational cosmology. Over the last few years, searches have intensified to identify the population of high-redshift (z>6)

galaxies that might be responsible for this process, but the progress is hampered partly by the difficulty of obtaining physical information (stellar mass, age, star formation rate/history) for individual sources. This is because the number of z>6 galaxies that have both secure spectroscopic redshifts and high-quality infrared photometry (especially with Spitzer/IRAC) is still fairly small. Considering that only several photometric points are available per source, and that many model SEDs are highly degenerate, it is crucial to obtain as many observational constraints as possible for each source to ensure the validity of SED modeling. To better understand the physical properties of high-redshift galaxies, we propose here to conduct HST/NICMOS (72 orbits) and Spitzer/IRAC (102 hours) imaging of spectroscopically confirmed, bright (z<26 mag (AB)) Ly-alpha emitters (LAEs) and Lyman-break galaxies (LBGs) at 5.7<z<7 selected from the Subaru Deep Field. Spectroscopic redshifts remove one critical free parameter from SED modeling while bright source magnitudes ensure high-quality photometric data. By making accurate determinations of stellar masses, ages, and star-formation histories, we will specifically address the following major questions: (1) Do LAEs and LBGs represent physically different galaxy populations at z>6 as suggested recently? (2) Is Ly-alpha emission systematically suppressed at z>6 with respect to continuum emission? (i.e., are we reaching the epoch of incomplete reionization?), and (3) Do we see any sign of abnormally young stellar population in any of the z>6 galaxies?

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Proposal Category: GO
Scientific Category: ISM AND CIRCUMSTELLAR MATTER
ID: 11150
Title: Beta Pic Polarimetry with NICMOS
PI: James Graham
PI Institution: University of California - Berkeley

Debris disk stars host transient dust grains that comprise a collisional cascade with sizes ranging from planetesimals to the sub-micron. In addition to the gravity of the host star and any planets present, these grains are subject to size-dependent non-gravitational forces, e.g., corpuscular drag and radiation pressure. When a steep spectrum of grain sizes prevails, such as the Dohnanyi distribution, scattered light images preferentially trace grains with dimensionless size parameter of order unity. Thus images in scattered starlight provide unique windows on the balance of forces acting on grains at a specific size. Therefore, in an A star system such as beta Pic, the near-IR is dominated by grains close to the blow out size and therefore NICMOS traces dust on hyperbolic orbits. Scattering is fundamentally polarization sensitive, and measurements that record intensity literally see only half the picture. If linear polarization is measured then the elements of the complex scattering matrix can be reconstructed. These matrix elements provide fundamental constraints on the size, composition and structure of the scatterers. Notably, polarimetry can be used to break the degeneracy between scattering asymmetry, g, and the radial dust gradient, which are otherwise

covariant in an edge-on disk. Thus, we can use polarimetry to localize the parent bodies in the beta Pic disk. In beta Pic, dust is thought to originate mainly from the sublimation of cometary bodies near periastron. The irradiation of cometary material leads to sublimation and photodissociation of ices forming porous grains consisting of a matrix of refractory material. Such grains have a characteristic scattering signature in polarized light that can be distinguished from compact grains that arise from collisional erosion of asteroidal material.

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Proposal Category: GO
Scientific Category: STAR FORMATION
ID: 11151
Title: Evaluating the Role of Photoevaporation of Protoplanetary Disk Dispersal
PI: Gregory Herczeg
PI Institution: California Institute of Technology

Emission produced by accretion onto the central star leads to photoevaporation, which may play a fundamental role in disk dispersal. Models of disk photoevaporation by the central star are challenged by two potential problems: the emission produced by accretion will be substantially weaker for low-mass stars, and photoevaporation must continue as accretion slows. Existing FUV spectra of CTTSs are biased to solar-mass stars with high accretion rates, and are therefore insufficient to address these problems. We propose use HST/ACS SBC PR130L to obtain FUV spectra of WTTSs and of CTTSs at low masses and mass accretion rates to provide crucial data to evaluate photoevaporation models. We will estimate the FUV and EUV luminosities of low-mass CTTSs with small mass accretion rates, CTTSs with transition disks and slowed accretion, and of magnetically-active WTTSs.

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Proposal Category: GO
Scientific Category: ISM AND CIRCUMSTELLAR MATTER
ID: 11152
Title: Probing the compact dust disk of a nearby Classical T Tauri Star
PI: Bruce Macintosh
PI Institution: Lawrence Livermore National Laboratory

BP Psc is a high Galactic latitude (b = -57), bright, IRAS source that generally has been classified as a T Tauri star but little studied to date. We have carried out a multiwavelength ground-based study of this object and find that it is most likely a ~10 Myr classical T Tauri star surrounded by a gas and dust disk, and less than 100 pc from Earth, making it one of the oldest and closest such stars known. Near-IR AO images and IR photometry show it is surrounded by an compact (0.2"), almost-edge-on, optically thick disk of dust with a wide range of temperatures. We propose a multiwavelength polarimetric study of the compact disk to support quantitative modeling to recover disk and dust parameters. We also propose coronagraphic imaging to search for larger-

scale dust structures invisible in ground-based images, and narrowband imaging of an outflow jet and associated Herbig-Haro objects to study their structure and determine a kinematic distance of the system. A massive compact disk surrounding an isolated 10 Myr star is a unique environment for planet formation, and its proximity to Earth allows HST to study it in detail.
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Proposal Category: GO
Scientific Category: UNRESOLVED STELLAR POPULATIONS
ID: 11153
Title: The Physical Nature and Age of Lyman Alpha Galaxies
PI: Sangeeta Malhotra
PI Institution: Arizona State University

In the simplest scenario, strong Lyman alpha emission from high redshift galaxies would indicate that stellar populations younger than 10 Myrs dominate the UV. This does not, however, constrain the stellar populations older than 100 Myrs, which do not contribute to UV light. Also, the Lyman alpha line can be boosted if the interstellar medium is both clumpy and dusty. Different studies with small samples have reached different conclusions about the presence of dust and old stellar populations in Lyman alpha emitters. We propose HST-NICMOS and Spitzer-IRAC photometry of 35 Lyman-alpha galaxies at redshift $4.5<z<6.5$, in order to determine their spectral energy distribution (SED) extending through rest-frame optical. This will allow us to measure accurately (1) The total stellar mass in these objects, including old stars which may have formed at redshifts ($z > 8$) not easily probed by any other means. (2) The dust extinction in the rest-frame UV, and therefore a correction to their present star-formation rates. Taken together, these two quantities will yield the star-formation histories of Lyman alpha galaxies, which form fully half of the known galaxies at z=4-6. They will tell us whether these are young or old galaxies by straddling the 4000A break. Data from NICMOS is essential for these compact and faint (i=25-26th magnitude AB) high redshift galaxies, which are too faint for good near-IR photometry from the ground.
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Proposal Category: GO
Scientific Category: HOT STARS
ID: 11154
Title: Optical-UV Spectrum of the Middle-aged Pulsar B1055-52
PI: George Pavlov
PI Institution: The Pennsylvania State University

The middle-aged radio, X-ray and gamma-ray pulsar B1055-52 is one of the few pulsars that allow a multiwavelength study of pulsar radiation. An optical counterpart of the pulsar has been detected with the HST FOC, but it was observed in only one filter (F342W, m=24.9). To understand the nature of the pulsar radiation, its spectrum must be measured in a broad wavelegth range. We

propose imaging observations of the pulsar's counterpart with WFPC2 in the red part of the spectrum and ACS/SBC in the UV part to measure the broadband spectral distribution, compare it with the X-ray spectrum, and investigate the thermal and magnetospheric components of the pulsar's radiation.

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Proposal Category: GO
Scientific Category: STAR FORMATION
ID: 11155
Title: Dust Grain Evolution in Herbig Ae Stars: NICMOS Coronagraphic Imaging and Polarimetry
PI: Marshall Perrin
PI Institution: University of California - Berkeley

We propose to take advantage of the sensitive coronagraphic capabilities of NICMOS to obtain multiwavelength coronagraphic imaging and polarimetry of primordial dust disks around young intermediate-mass stars (Herbig Ae stars), in order to advance our understanding of how dust grains are assembled into larger bodies. Because the polarization of scattered light is strongly dependent on scattering particle size and composition, coronagraphic imaging polarimetry with NICMOS provides a uniquely powerful tool for measuring grain properties in spatially resolved circumstellar disks. It is widely believed that planets form via the gradual accretion of planetesimals in gas-rich, dusty circumstellar disks, but the connection between this suspected process and the circumstellar disks that we can now observe around other stars remains very uncertain. Our proposed observations, together with powerful 3-D radiative transfer codes, will enable us to quantitatively determine dust grain properties as a function of location within disks, and thus to test whether dust grains around young stars are in fact growing in size during the putative planet-formation epoch. HST imaging polarimetry of Herbig Ae stars will complement and extend existing polarimetric studies of disks around lower-mass T Tauri stars and debris disks around older main-sequence stars. When combined with these previous studies, the proposed research will help us establish the influence of stellar mass on the growth of dust grains into larger planetesimals, and ultimately to planets. Our results will also let us calibrate models of the thermal emission from these disks, a critical need for validating the properties of more distant disks inferred on the basis of spectral information alone.

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Proposal Category: SNAP
Scientific Category: SOLAR SYSTEM
ID: 11156
Title: Monitoring Active Atmospheres on Uranus and Neptune
PI: Kathy Rages
PI Institution: SETI Institute

We propose Snapshot observations of Uranus and Neptune to monitor changes in

their atmospheres on time scales of weeks and months. Uranus equinox is only months away, in December 2007. Hubble Space Telescope observations during the past several years (Hammel et al. 2005, Icarus 175, 284 and references therein) have revealed strongly wavelength-dependent latitudinal structure, the presence of numerous visible-wavelength cloud features in the northern hemisphere, at least one very long-lived discrete cloud in the southern hemisphere, and in 2006 the first dark spot ever seen on Uranus. Long-term ground-based observations (Lockwood and Jerzekiewicz, 2006, Icarus 180, 442; Hammel and Lockwood 2007, Icarus 186, 291) reveal seasonal brightness changes whose origins are not well understood. Recent near-IR images of Neptune obtained using adaptive optics on the Keck Telescope, together with HST observations (Sromovsky et al. 2003, Icarus 163, 256 and references therein) which include previous Snapshot programs (GO 8634, 10170, 10534) show a general increase in activity at south temperate latitudes until 2004, when Neptune returned to a rather Voyager-like appearance. Further Snapshot observations of these two dynamic planets will elucidate the nature of long-term changes in their zonal atmospheric bands and clarify the processes of formation, evolution, and dissipation of discrete albedo features.
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Proposal Category: GO
Scientific Category: ISM AND CIRCUMSTELLAR MATTER
ID: 11157
Title: NICMOS Imaging Survey of Dusty Debris Around Nearby Stars Across the Stellar Mass Spectrum
PI: Joseph Rhee
PI Institution: University of California - Los Angeles

Association of planetary systems with dusty debris disks is now quite secure, and advances in our understanding of planet formation and evolution can be achieved by the identification and characterization of an ensemble of debris disks orbiting a range of central stars with different masses and ages. Imaging debris disks in starlight scattered by dust grains remains technically challenging so that only about a dozen systems have thus far been imaged. A further advance in this field needs an increased number of imaged debris disks. However, the technical challege of such observations, even with the superb combination of HST and NICMOS, requires the best targets. Recent HST imaging investigations of debris disks were sample-limited not limited by the technology used. We performed a search for debris disks from a IRAS/Hipparcos cross correlation which involved an exhaustive background contamination check to weed out false excess stars. Out of ~140 identified debris disks, we selected 22 best targets in terms of dust optical depth and disk angular size. Our target sample represents the best currently available target set in terms of both disk brightness and resolvability. For example, our targets have higher dust optical depth, in general, than newly identified Spitzer disks. Also, our targets cover a wider range of central star ages and masses than previous debris disk surveys. This will help us to investigate planetary system formation and evolution across the stellar mass spectrum. The

technical feasibility of this program in two-gyro mode guiding has been proven with on-orbit calibration and science observations during HST cycles 13, 14, and 15.

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Proposal Category: GO
Scientific Category: UNRESOLVED STELLAR POPULATIONS
ID: 11158
Title: HST Imaging of UV emission in Quiescent Early-type Galaxies
PI: R. Rich
PI Institution: University of California - Los Angeles

We have constructed a sample of early type galaxies at z~0.1 that have blue UV-optical colors, yet also show no signs of optical emission, or extended blue light. We have cross-correlated the SDSS catalog and the Galaxy Evolution Explorer Medium Imaging Survey to select a sample of galaxies where this UV emission is strongest. The origin of the UV rising flux in these galaxies continues to be debated, and the possibility that some fraction of these galaxies may be experiencing low levels of star formation cannot be excluded. There is also a possibility that low level AGN activity (as evidenced by a point source) is responsbile We propose to image the UV emission using the HST/SBC and to explore the morphology of the UV emission relative to the optical light.

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Proposal Category: GO
Scientific Category: RESOLVED STELLAR POPULATIONS
ID: 11159
Title: The True Galactic Bulge Luminosity Function
PI: R. Rich
PI Institution: University of California - Los Angeles

We propose to obtain second epoch imaging of the deep Galactic bulge field observed using NICMOS by Zoccali et al. (2000). The bulge luminosity and mass function suffered from 30-50% contamination by foreground disk stars, which was impossible to correct for in the original study. Revisiting the field after 9 years, we propose to segregate the foregound disk stars because they have large transverse velocities, thus revealing the luminosity function of Galactic bulge low mass stars to near the hydrogen burning limit. The slope of the mass function has implications for galaxy formation and for understanding the nature of microlensing in the Galactic bulge.

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Proposal Category: GO
Scientific Category: COSMOLOGY
ID: 11160
Title: Escape fraction and stellar populations in a highly magnified Lyman-Break Galaxy

PI: Johan Richard
PI Institution: California Institute of Technology

Understanding how star-forming galaxies contribute to cosmic reionization is one of the frontiers of observational cosmology. A key ingredient in this issue is measuring the escape fraction of Lyman-continuum photons in high redshift galaxies (z>3). Gravitationally lensed Lyman-break galaxies (LBGs) act as important laboratories for studying the resolved physical properties at sub-kpc scales with high signal-to-noise. Correlating the local escape fraction with physical parameters derived from stellar population modeling (such as the star formation rate, age and reddening) will offer new insights into understanding the physical processes involved with the production of ionizing photons. We propose here follow-up observations of the "Cosmic Eye", a remarkable, highly magnified (x 30), Lyman-break galaxy at z~3.07 using WFPC2 and NICMOS. Deep ultraviolet WFPC2 imaging will provide a detailed study of variations in the escape fraction, while WFPC2 and NICMOS/NIC2 imaging will complement the current broad-band detections to allow a precise modeling of the spatially-dependent spectral energy distribution. This will allow the first comprehensive analysis between the escape fraction, the local SED and the dynamics of a distant galaxy.
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Proposal Category: GO
Scientific Category: COSMOLOGY
ID: 11161
Title: Revealing the Explosion Geometry of Nearby GRB-SNe
PI: Alicia Soderberg
PI Institution: California Institute of Technology

The connection between gamma-ray bursts and Type Ibc supernovae is well-established in broad terms. However, our recent identification of an intermediate class of sub-energetic GRBs, and the overall overlap in Nickel production between GRB-SNe and ordinary SNe Ibc suggest that the properties leading to the production of a relativistic engine are yet to be uncovered. A fundamental difference between the two classes of explosions may be imprinted in the overall geometry of the explosion. The relativistic component of GRBs is known to be highly collimated, but it is unclear if the SN blast is spherical or mildly collimated as well. Here we propose HST observations of the late (>30 days) decay tails of two GRB-SNe as an independent measure of the Nickel mass synthesized in the explosion. A comparison to the Nickel mass inferred from the peak brightness of the SNe will provide a direct measure of the explosion asymmetry, since at late time the explosion is essentially spherical. These observations will form the core of a multi-wavelength (optical, X-ray, radio) effort to fully characterize all aspects of the explosions, from the energy and geometry of the relativistic material (VLA, Chandra) to the early SN evolution (Keck, Magellan). The proposed observations require two slow-response (>30 days) TOOs, ideally suited to the 2-gyro operations of HST.

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Proposal Category: GO
Scientific Category: HOT STARS
ID: 11162
Title: Understanding the Long Term Impacts of Low Magnetic Accretion
PI: Paula Szkody
PI Institution: University of Washington

The low accretion rate Polar EF Eri has been in a low state for more than 9 years. Our recent GALEX photometry revealed a source of UV light that is producing more flux than the white dwarf and which is highly modulated on the 81 min orbital period of the system. We request UV spectra with the SBC on the ACS to resolve whether limb darkening or cyclotron emission can explain the observed phenomena and provide insight on the long term heating effects under low accretion scenarios.

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Proposal Category: GO
Scientific Category: HOT STARS
ID: 11163
Title: Accreting Pulsating White Dwarfs in Cataclysmic Variables
PI: Paula Szkody
PI Institution: University of Washington

Recent ground-based observations have increased the number of known pulsating white dwarfs in close binaries with active mass transfer (cataclysmic variables) from 5 to 11 systems. Our past Cycles 8 and 11 STIS observations of the first 2 known, followed by our Cycle 13 SBC observations of the next 3 discovered, revealed the clear presence of the white dwarf and increased amplitude of the pulsations in the UV compared to the optical. The temperatures derived from the UV spectra show 4 systems are much hotter than non-interacting pulsating white dwarfs. A larger sample is needed to sort out the nature of the instability strip in accreting pulsators i.e. whether effects of composition and rotation due to accretion result in a well-defined instability strip as a function of Teff.

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Proposal Category: GO
Scientific Category: ISM AND CIRCUMSTELLAR MATTER
ID: 11164
Title: Molecular Hydrogen Disks Around T Tauri Stars
PI: David Weintraub
PI Institution: Vanderbilt University

We propose to measure the properties of planetary system-sized disks around Sun-like, pre-main sequence stars by imaging the inner parts of these disks for the first time in gaseous emission from their most dominant constituent,

molecular hydrogen gas. Specifically, we will use the F212N filter and NICMOS to determine the spatial distribution of ro-vibrational H2 emission from protoplanetary disks around selected classical and weak-lined T Tauri stars. The target stars are among those detected by members of this team through high resolution, ground-based infrared spectroscopy. The spectra reveal H2 emission at the rest velocities of the stars and at positions spatially coincident with the stars at the spatial resolution of the spectroscopic data. This imaging experiment, which is impossible to do using ground-based facilities, is possible using the NICMOS camera aboard the HST because the point spread function of this system is extremely stable and can be measured to a very high accuracy. This experiment is an important test of the interpretation that the 2.122 micron H2 line emission seen toward T Tauri stars is produced at distances of 10 to 30 AU from the stars, the region in which giant planets are expected to form around these stars. These observations will contribute toward developing a better understanding of the process, likelihood, and timescale for the formation of planets around Sun-like stars.

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Proposal Category: GO
Scientific Category: STAR FORMATION
ID: 11165
Title: The Radius of the "Super-Neptune" HD 149026b
PI: Joshua Winn
PI Institution: Massachusetts Institute of Technology

Current measurements suggest that the transiting exoplanet HD 149026b is a "super-Neptune," with an enormous heavy-element core. The existence of such a planet is a major challenge to planet formation theories. We propose to place the radius measurement on much firmer footing, by obtaining a NICMOS light curve with 0.4 mmag precision and 13 sec cadence. We will improve the radius measurement by a factor of 2.3, and more importantly, the result will be more robust because we will determine the stellar radius directly from the data. Numerous attempts to do this from the ground have failed.

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Proposal Category: GO
Scientific Category: AGN/QUASARS
ID: 11166
Title: The Mass-dependent Evolution of the Black Hole-Bulge Relations
PI: Jong-Hak Woo
PI Institution: University of California - Santa Barbara

In the local universe, the masses of giant black holes are correlated with the luminosities, masses and velocity dispersions of their host galaxy bulges. This indicates a surprisingly close connection between the evolution of galactic nuclei (on parsec scales) and of stars on kpc scales. A key observational test of proposed explanations for these correlations is to measure how they have evolved over cosmic time. Our ACS imaging of 20 Seyfert

1 galaxies at z=0.37 showed them to have smaller bulges (by a factor of 3) for a given central black hole mass than is found in galaxies in the present-day universe. However, since all our sample galaxies had black hole masses in the range 10^8.0--8.5 Msun, we could only measure the OFFSET in black hole mass to bulge luminosity ratios from the present epoch. By extending this study to black hole masses another factor of 10 lower, we propose to determine the full CORRELATION of black hole mass with host galaxy properties at a lookback time of 4 Gyrs and to test mass-dependency of the evolution. We have selected 14 Seyfert galaxies from SDSS DR5 whose narrow Hbeta emission lines (and estimated nuclear luminosities) imply that they have black hole masses around 10^7 Msuns. We will soon complete our Keck spectroscopic measures of their bulge velocity dispersions. We need a 1-orbit NICMOS image of each galaxy to separate its nonstellar luminosity from its bulge and disk. This will allow us to make the first determination of the full black hole/bulge relations at z=0.37 (e.g. M-L and M-sigma), as well as a test of whether active galaxies obey the Fundamental Plane relation at that epoch.

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Proposal Category:	GO
Scientific Category:	COSMOLOGY
ID:	11167
Title:	A Unique High Resolution Window to Two Strongly Lensed Lyman Break Galaxies
PI:	Sahar Allam
PI Institution:	Fermi National Accelerator Laboratory (FNAL)

On rare occasions, the otherwise very faint Lyman Break Galaxies (LBGs) are magnified by gravitational lensing to provide exceptional targets for detailed spectroscopic and imaging studies. We propose HST WFPC2 and NICMOS imaging of two strongly lensed Lyman Break Galaxies (LBGs) that were recently discovered by members of our team. These two LBGs -- the "8 O'Clock Arc" and the "SDSS J1206+5142 Arc" -- are currently the brightest known LBGs, roughly 3 times brighter than the former record-holder, MS1512-cB58 (a.k.a. "cB58"). The z=2.73 "8 O'Clock Arc" extends ~10 arcsec in length and is magnified by a factor of 12. The z=2.00 "SDSS J1206+5142 Arc" also extends ~10 arcsec in length and is magnified by a factor of 30. Due to their brightness and magnification, these two strongly lensed LBGs offer an unprecedented opportunity for the very detailed investigation of two individual galaxies at high redshift. We are currently pursuing a vigorous ground-based campaign to obtain multi-wavelength (UV, optical, NIR, radio) observations of these two LBGs, but our campaign currently lacks a means of obtaining high-resolution optical/NIR imaging -- a lack that currently only HST can address. Our prime objective for this proposal is to obtain high resolution HST images of these two systems with two-orbit WFPC2 images in the BVI bands and two-orbit NICMOS/NIC2 images in the J and H bands. These data will allow us to construct detailed lensing models, probe the mass and light profiles of the lenses and their environments, and constrain the star formation histories and rest-frame UV/optical spectral energy distributions of

the LBGs.
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Proposal Category: GO
Scientific Category: STAR FORMATION
ID: 11168
Title: The IMF in the Hidden Galactic Starburst W49A
PI: Bernhard Brandl
PI Institution: Universiteit Leiden

W49A is one of the most luminous and prolific massive star formation regions in the disk of our Milky Way. Given the presence of several very massive OB clusters as well as an unusually high concentration of many young ultra-compact HII regions (UCHIIR) -- all embedded in about 1 million solar masses of molecular gas -- it is arguably the best Galactic template for a luminous starburst region. We propose to obtain NICMOS imaging of the central part of W49A, covering a strip from the central, massive OB cluster to the ring of UCHIIRs. Our goals are to resolve and characterize the central star cluster and determine its IMF down to about 1 solar mass. We want to characterize the distribution of intermediate-mass YSOs, and identify the NIR counterparts to the UCHIIRs. The combination of the proposed HST/NICMOS data with our recently obtained Spitzer observations would allow a great step forward in the understanding of massive star and cluster formation.
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Proposal Category: GO
Scientific Category: SOLAR SYSTEM
ID: 11169
Title: Collisions in the Kuiper belt
PI: Michael Brown
PI Institution: California Institute of Technology

For most of the 15 year history of observations of Kuiper belt objects, it has been speculated that impacts must have played a major role in shaping the physical and chemical characteristics of these objects, yet little direct evidence of the effects of such impacts has been seen. The past 18 months, however, have seen an explosion of major new discoveries giving some of the first insights into the influence of this critical process. From a diversity of observations we have been led to the hypotheses that: (1) satellite-forming impacts must have been common in the Kuiper belt; (2) such impacts led to significant chemical modification; and (3) the outcomes of these impacts are sufficiently predictable that we can now find and study these impact-derived systems by the chemical and physical attributes of both the satellites and the primaries. If our picture is correct, we now have in hand for the first time a set of incredibly powerful tools to study the frequency and outcome of collisions in the outer solar system. Here we propose three linked projects that would answer questions critical to the multiple prongs of our hypothesis. In these projects we will study the chemical effects of collisions through

spectrophotometric observations of collisionally formed satellites and through the search for additional satellites around primaries with potential impact signatures, and we will study the physical effects of impacts through the examination of tidal evolution in proposed impact systems. The intensive HST program that we propose here will allow us to fully test our new hypotheses and will provide the ability to obtain the first extensive insights into outer solar system impact processes.

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Proposal Category: GO
Scientific Category: SOLAR SYSTEM
ID: 11170
Title: UV Imaging of the Martian Corona and the Escape of Hydrogen
PI: John Clarke
PI Institution: Boston University

ACS SBC UV imaging observations of Mars are proposed to study the extended hydrogen corona, with application to the escape of hydrogen and the history of water on Mars. These observations will be scheduled when Mars is distant from the Earth, so that a field of view of +/- 4-5 Mars radii can be obtained to image the full range of the highly extended martian hydrogen corona through its H Ly alpha emission. The observations will also be obtained when the Sun-Earth-Mars angle is close to 90 degrees, so that any asymmetry along the Mars-Sun line can be observed. The observed 2-dimensional brightness distribution will be related to local density using two existing radiative transfer codes, and the upward flux and velocity distributions will be determined by comparison with runs from an exospheric distribution model. These observations, combined with simultaneous Ly alpha observations by the SPICAM instrument on Mars Express from within the atmosphere, will provide the first tight constraints on the total escape flux and importance of nonthermal processes on the rate of escape.

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Proposal Category: GO
Scientific Category: ISM IN EXTERNAL GALAXIES
ID: 11171
Title: Confirming Light Echoes from SN 2006X in M100
PI: Arlin Crotts
PI Institution: Columbia University in the City of New York

We propose a minimal investment of spacecraft time to discover and confirm a light echo from Supernova 2006X in M100, the closest Type Ia in many years. Our spectroscopic and photometric data indicate that this SN sits behind a large amount of interstellar dust likely to produce a strong echo signal. This is one of very few cases where we will be able to study the three-dimensional environment of a SN Ia in full detail, and begin to understand how environmental effects play into the evolutionary and observational factors which influence the utility of SN Ia as standard candles for probing

cosmology. We propose an efficient program to definitively detect (or not) a light echo of reasonable signal strength, to confirm that it is an echo by demonstrating apparent superluminal motion if it exists, to map the three-dimensional geometry of the reflecting interstellar structures, and to detail the reflectance properties of the dust which can be used to constrain its grain size and composition distribution.
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Proposal Category: GO
Scientific Category: RESOLVED STELLAR POPULATIONS
ID: 11172
Title: Defining Classes of Long Period Variable Stars in M31
PI: Arlin Crotts
PI Institution: Columbia University in the City of New York

We propose a thrifty but information-packed investigation (1440 exposures total) with NICMOS F205W, F160W and F110W providing crucial information about Long Period Variables in M31, at a level of detail that has recently allowed the discovery of new variable star classes in the Magellanic Clouds, a very different stellar population. These observations are buttressed by an extensive map of the same fields with ACS and WFPC2 exposures in F555W and F814W, and a massive ground-based imaging patrol producing well-sampled light curves for more than 400,000 variable stars. Our primary goal is to collect sufficient NIR data in order to analyze and classify the huge number of long-period variables in our catalog (see below) through Period-Luminosity (P/L) diagrams. We will produce accurate P/L diagrams for both the bulge and a progression of locations throughout the disk of M31. These diagrams will be similar in quality to those currently in the Magellanic Clouds, with their lower metallicity, radically different star formation history, and larger spread in distance to the variables. M31 offers an excellent chance to study more typical disk populations, in a manner which might be extended to more distant galaxies where such variables are still visible, probing a much more evenly spread progenitor age distribution than cepheids (and perhaps useful as a distance scale alternative or cross-check). Our data will also provide a massive and unique color-magnitude dataset, and allow us to confirm the microlensing nature of a large sample of candidate lensed sources in M31. We expect that this study will produce several important results, among them a better understanding of P/L and P/L-color relations for pulsating variables which are essential to the extragalactic distance ladder, will view these variables at a common distance over a range of metallicities (eliminating the distance-error vs. metallicity ambiguity between the LMC and SMC), allow further insight into possible faint-variable mass-loss for higher metallicities, and in general produce a sample more typical of giant disk galaxies predominant in many studies.
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Proposal Category: GO
Scientific Category: RESOLVED STELLAR POPULATIONS

ID: 11173
Title: Completing an Accurate Map of M31 Microlensing
PI: Arlin Crotts
PI Institution: Columbia University in the City of New York

The halo microlensing masses detected in the MACHO survey (claimed to compose about 20% of the Galaxy's mass) represent a major enigma in astrophysics, one that must be effectively cross-examined by an independent test. We have completed a large, densely-sampled survey of M31 that can reveal in another galaxy such a halo microlensing signal if it exists. In a previous HST/ACS+WFPC2 program (GO 10273, Cycle 13, 16 orbits) we were able to learn considerably more about a subsample of these M31 microlensing events. We were pleased to find that in most cases we could isolate the source star for each event, find its baseline flux and colors (essential for ruling out classes of confusing variable stars), test for misidentification of background supernovae, and measure the Einstein parameters, which constrain the range of most likely lens mass. (These Cycle 13 results are published in The Astrophysical Journal Letters.) We propose to finish the job, taking a similar series of exposures to more than double the sample of well-constrained microlensing events, which together with the larger ground-based sample for which we are completing our analyses will provide 20-30 M31 bona fide microlensing events observed by HST. This will be done via a series of targetted PC exposures, meant to maximize the number of candidates studied, one (or two) at a time. A sample of this size and quality should be sufficient to settle the issue of a significant contribution to the halos of galaxies by stellar-mass lenses. Furthermore, if there is a surplus of such microlensing events above what might be expected from stars alone, the higher quality of information will allow us to more accurately describe the spatial distribution of these lenses. We will also complete several unique studies of M31 stellar populations, both in support of the microlensing measurement and in their own right.
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Proposal Category: GO
Scientific Category: COSMOLOGY
ID: 11174
Title: A Spitzer/X-ray candidate cluster at z>2: NICMOS imaging
PI: Emanuele Daddi
PI Institution: Commissariat a l'Energie Atomique (CEA)

We propose deep H-band imaging with NICMOS of a remarkable z>2 cluster of galaxy candidate. Over a 1000 arcmin^2 field imaged with Spitzer's IRAC and MIPS we have discovered a compact (<30'' diameter) concentration of extremely red galaxies with a factor of >40 overdensity over the adjacent field. Among these galaxies for which we can derive meaningful photometric redshifts, 17 are consistent with zphot=2-2.5, making very likely that the concentrationis is a real cluster at such high redshift. This is further supported by a 3.5 sigma detection of extended X-Ray emission on Newton-XMM data, by a likely

color-magnitude sequence of red galaxies, and by the presence of a giant galaxy consistent with a BCG at the cluster redshift. While spectroscopic confirmation of the cluster might result prohibitive with current facilities, HST high resolution imaging will allow us to gain crucial information for the study and scientific exploitation of this hot gas hosting, record high-z cluster of galaxies. The HST high resolution observations will allow us to unveil the rest frame optical morphologies of the galaxies and confirm the presence of ellipticals in the structure, detect and characterize the color-magnitude relation, measure their effective radii and construct their Kormendy relation for the passively evolving subsample, improve the photometric redshift estimates to confirm the real cluster nature of the structure, estimate stellar masses and check for possible deviations from the local mass-size relation, search for mergers and AGNs, and establish a cluster benchmark for cluster-field comparisons at this highest redshift.

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Proposal Category: GO
Scientific Category: UNRESOLVED STELLAR POPULATIONS
ID: 11175
Title: UV Imaging to Determine the Location of Residual Star Formation in Galaxies Recently Arrived on the Red Sequence
PI: Sandra Faber
PI Institution: University of California - Santa Cruz

We have indentified a sample of low-redshift (z = 0.04 - 0.10) galaxies that are candidates for recent arrival on the red sequence. They have red optical colors indicative of old stellar populations, but blue UV-optical colors that could indicate the presence of a small quantity of continuing or very recent star formation. However, their spectra lack the emission lines that characterize star-forming galaxies. We propose to use ACS/SBC to obtain high-resolution imaging of the UV flux in these galaxies, in order to determine the spatial distribution of the last episode of star formation. WFPC2 imaging will provide B, V, and I photometry to measure the main stellar light distribution of the galaxy for comparison with the UV imaging, as well as to measure color gradients and the distribution of interstellar dust. This detailed morphological information will allow us to investigate the hypothesis that these galaxies have recently stopped forming stars and to compare the observed distribution of the last star formation with predictions for several different mechanisms that may quench star formation in galaxies.

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Proposal Category: GO
Scientific Category: COSMOLOGY
ID: 11176
Title: Location and the Origin of Short Gamma-Ray Bursts
PI: Andrew Fruchter
PI Institution: Space Telescope Science Institute

During the past decade extraordinary progress has been made in determining the origin of long-duration gamma-ray bursts. It has been conclusively shown that these objects derive from the deaths of massive stars. Nonetheless, the origin of their observational cousins, short-duration gamma-ray bursts (SGRBs) remains a mystery. While SGRBs are widely thought to result from the inspiral of compact binaries, this is a conjecture. A number of hosts of SGRBs have been identified, and have been used by some to argue that SGRBs derive primarily from an ancient population (~ 5 Gyr); however, it is not known whether this conclusion more accurately reflects selection biases or astrophysics. Here we propose to employ a variant of a technique that we pioneered and used to great effect in elucidating the origins of long-duration bursts. We will examine the degree to which SGRB locations trace the red or blue light of their hosts, and thus old or young stellar populations. This approach will allow us to study the demographics of the SGRB population in a manner largely free of the distance dependent selection effects which have so far bedeviled this field, and should give direct insight into the age of the SGRB progenitor population.

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Proposal Category: GO
Scientific Category: COSMOLOGY
ID: 11177
Title: The Nature of z=3 Lyman-Alpha Emitters
PI: Caryl Gronwall
PI Institution: The Pennsylvania State University

The advent of large mosaic CCD cameras on 4 -- 8 m class telescopes has recently led to a revolution in our ability to detect primordial galaxies. Today, large numbers of strong Ly-alpha emitters (LAEs) are being discovered between 2.4 < z < 6. These are important objects: not only do they sample a part of the galaxy luminosity function that is inaccessible to the Lyman-break technique, but they also tend to be younger and less chemically evolved. In fact, the LAEs now being found are currently our best candidates for galaxies in the act of formation. To investigate the properties of this class of objects, we have conducted an extremely deep narrow-band (5000 Angstrom; FWHM = 50 Angstrom) and broad-band (UBVRIzJK) survey of the Extended Chandra Deep Field South, and have identified a homogeneous sample of strong Ly-alpha emitters at z = 3.11. Twenty-seven of these objects are located within the region surveyed by Great Observatories Origins Deep Survey (GOODS) and have detailed morphological information available from the rest-frame ultraviolet. We propose 0.2" resolution narrow-band imaging of 11 of our LAEs using the F502N filter of WFPC2. By comparing the Ly-alpha and rest-frame UV continuum morphologies of these galaxies, we will be able to look for the presence of outflows, constrain their dust content, and test whether these objects are truly primordial galaxies.

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Proposal Category: GO

Scientific Category: SOLAR SYSTEM
ID: 11178
Title: Probing Solar System History with Orbits, Masses, and Colors of Transneptunian Binaries
PI: William Grundy
PI Institution: Lowell Observatory

The recent discovery of numerous transneptunian binaries (TNBs) opens a window into dynamical conditions in the protoplanetary disk where they formed as well as the history of subsequent events which sculpted the outer Solar System and emplaced them onto their present day heliocentric orbits. To date, at least 43 TNBs have been discovered, but only about a dozen have had their mutual orbits and separate colors determined, frustrating their use to investigate numerous important scientific questions. The current shortage of data especially cripples scientific investigations requiring statistical comparisons among the ensemble characteristics. We propose to obtain sufficient astrometry and photometry of 23 TNBs to compute their mutual orbits and system masses and to determine separate primary and secondary colors, roughly tripling the sample for which this information is known, as well as extending it to include systems of two near-equal size bodies. To make the most efficient possible use of HST, we will use a Monte Carlo technique to optimally schedule our observations.
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Proposal Category: GO
Scientific Category: ISM AND CIRCUMSTELLAR MATTER
ID: 11179
Title: Dynamics of Clumpy Supersonic Flows in Stellar Jets and in the Laboratory
PI: Patrick Hartigan
PI Institution: Rice University

We propose to reobserve three stellar jets in order to quantify how rapidly clumps in these flows accelerate and decelerate, and to compare the results with ongoing numerical simulations and laboratory experiments. Each jet has been imaged twice before with HST, and precise proper motions have been measured for all emitting knots in the jets. Images from the first two epochs show clear differential motions between adjacent clumps, as well as shear, and possibly fragmentation. The proposed third epoch will enable us to measure the first ever accelerations in jets, quantify errors in existing proper motion measurements, and observe in real time how fluid instabilities develop in supersonic flows. The new images will make it possible to compare the behavior of astrophysical flows directly with numerical simulations and with laboratory experiments of bow shocks and clumpy flows in progress at the Omega laser facility.
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Proposal Category: GO
Scientific Category: COOL STARS

ID: 11180
Title: The Morphology of the Post-Red Supergiant IRC+10420's Circumstellar Ejecta
PI: Roberta Humphreys
PI Institution: University of Minnesota - Twin Cities

The extremely luminous post-red supergiant and powerful OH/IR source IRC +10420 is surrounded by a complex circumstellar nebula. Numerous small condensations, arcs, jet-like rays of knots, and intriguing semi-circular structures are easily visible in our previous WFPC2 images. We have suggested that these spatially recognizable features may be evidence for episodic mass loss events possibly from localized active regions. We now propose to obtain second epoch WFPC2 images with the Planetary Camera to measure the transverse motions of these ejecta. Spatially resolved spectra from STIS showed that the embedded arcs are kinematically distinct from the spherically expanding diffuse nebulosity. The transverse motions in combination with radial velocities from the STIS spectra, will let us determine the morphology of IRC +10420's nebula and the structures embedded in it, its mass loss history, and provide clues to the mass loss mechanism responsible for the discrete ejections.

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Proposal Category: GO
Scientific Category: ISM AND CIRCUMSTELLAR MATTER
ID: 11181
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 matures into the youngest supernova remnant at age 20. HST is the essential tool for spatially-resolved observations of SN1987A's many components. A violent encounter is now underway between the fastest-moving debris and the circumstellar ring: the shock excites "hotspots." The optical, infrared and X-ray fluxes are rising rapidly on 6-month time scales: we have organized HST, SPITZER, and CHANDRA observations to understand these regions. In Cycle 16, the separate hotspots may begin to fuse as the shock fully enters the circumstellar ring. Photons from these shocks will 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, excited by radioactive isotopes from the explosion, is now resolved and seen to be aspherical, providing direct evidence on the asymmetry of the explosion. Questions about SN 1987A remain unanswered. How did the enigmatic three rings form? Precisely what happened during the core collapse and bounce? Is a black hole or a neutron star left behind? The rich and deep data set from SAINTS will help answer these central questions of supernova science.

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Proposal Category: GO
Scientific Category: RESOLVED STELLAR POPULATIONS
ID: 11182
Title: The Mass of the Milky Way: Orbits for Leo I and Leo II: Second Epoch Imaging of Leo II
PI: Konrad Kuijken
PI Institution: Universiteit Leiden

Constraining the mass of the Galaxy at large radii remains a difficult problem. Available data are still rather scarce, and orbits of even a few objects at large radii can have a large impact. We propose to obtain proper motions for the two satellites Leo I and Leo II, which orbit the Galaxy at about 200 kpc. Together with the radial velcoities of these glaaxies, which are well known, the proper motions allow space velocities ot be consructed: these can remove signifiicant uncertainty in the Galactic mass models, and in particular settle the vexed question of whether or not Leo I is gravitationally bound to the Galaxy. The proper motion of Leo I is addressed in a companion archival proposal; here we address the WFPC2 imagery of Leo II.

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Proposal Category: GO
Scientific Category: ISM IN EXTERNAL GALAXIES
ID: 11183
Title: Ultraviolet Imaging of Lyman-Alpha-Selected Galaxies at High Redshift
PI: Crystal Martin
PI Institution: University of California - Santa Barbara

We propose to carry out deep NICMOS/NIC2 imaging in the rest-frame, ultraviolet continuum of galaxies discovered in the Magellan Multi-Slit Lyman Alpha Survey. This spectroscopic survey identified ultra-faint, redshift 5.7 Lyman-alpha emitters (LAEs) in a 15 nm wide, OH-free band at 819 nm. Imaging with HST is the only way to measure their continuum intensity near rest-frame 160 nm. The ultraviolet photometry will directly measure the rate of star formation in common objects; and, when combined with groundbased Lyman-alpha luminosities, provide a reliable cross-calibration of Lyman-alpha attenuation and emission equivalent width. Direct measurement of the size of the star-forming regions, unresolved in the groundbased data, will extend measurements of the intensity of star formation to common objects in the high-redshift universe. Gaseous outflows from these galaxies are thought to be the source of their asymmetric line profiles, and area-averaged star formation rates are needed to calibrate feedback recipes, as well as eventually extend the Schmidt-Kennicutt law to high-redshift. The three targets proposed in Cycle~16 lie in fields covered by major galaxy surveys, are not as bright as the unusually luminous sources identified by such surveys at high-redshift, and present an opportunity to study properties of more common galaxies at high-redshift.

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Proposal Category: GO
Scientific Category: ISM AND CIRCUMSTELLAR MATTER
ID: 11184
Title: Imaging the Shock Precursor in Tycho's SNR
PI: John Raymond
PI Institution: Smithsonian Institution Astrophysical Observatory

Cosmic ray acceleration in supernova remant shocks requires shock precursors where particles are trapped by plasma turbulence. The precursors also heat and compress the upstream gas, producing H alpha emission and affecting line profiles. We propose to image the brightest non-radiative shock in Tycho's SNR to measure the brightness and width of the precursor. These measurements will constrain 2 key parameters in cosmic ray acceleration models, and they will improve the accuracy of shock speed and electron-ion equilibration derived from H alpha profiles.

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Proposal Category: GO
Scientific Category: ISM AND CIRCUMSTELLAR MATTER
ID: 11185
Title: Search for H-poor/He-rich Inclusions and a Solution to the Abundance, Temperature Problems
PI: Robert Rubin
PI Institution: NASA Ames Research Center

Our recent abundance survey of a large sample of Galactic planetary nebulae (PNe) has led to the discovery of a group of super-metal-rich nebulae whose spectra are characterized by prominent optical recombination lines (ORLs) from C, N, O, & Ne ions and a large Balmer discontinuity jump. The heavy element abundances derived from ORLs for several PNe are more than an order of magnitude higher than those derived from the traditional method based on collisionally excited lines (CELs), while the Balmer jump yields electron temperatures (Te) significantly lower than values derived from the [O III] 5007/4363 CEL line ratio. A proposition that aspires to explain both the nebular abundance and Te problems is one according to which these nebulae contain (at least) two distinct emission regions - one of "normal" Te (~ 10000 K) and chemical composition (~solar) and another of very low Te that is H-deficient, thus having high helium and metal abundances relative to hydrogen. The latter component emits strong He and heavy element ORLs but essentially no CELs. The consistent picture that emerges from fitting a 2-component photoionization model to the spectroscopic data is that the H-poor component is in high-density inclusions, which provide only a minor fraction of the total nebular mass. We propose to directly detect these inclusions in the planetary nebula M 1-42 using WFPC2 (PC) to make a high spatial resolution image in the He I 5876 A ORL and ratio it to Halpha. With NICMOS (NIC1), we plan to observe the He I 10830 A line, which is substantially collisionally excited, along with Palpha 18760 A. The ratio image of He I 10830 to Palpha is expected to be less likely to show the inclusions, thus serving as an

important control to the optical imaging. M 1-42 is one of the most extreme cases of the abundance and Te problem; it is reasonably bright and compact. This program has the potential to resolve a serious challenge to our current understanding of nebular astrophysics.
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Proposal Category: GO
Scientific Category: SOLAR SYSTEM
ID: 11186
Title: Investigation of the spatial and temporal structure of Europa's atmospheric emissisons
PI: Joachim Saur
PI Institution: Universitat zu Koeln

We propose to explore the spatial structure and temporal variability of Europa's O2 atmosphere with ACS/SBC. Previous HST images display non-uniform UV emission from Europa's atmosphere, which maximizes within the disk of Europa on its anti-Jovian northern quadrant. These images were taken at western elongation and are not conclusive, but bring up the exciting question whether the non-uniform emission is due to a locally enhanced neutral atmosphere. A locally inhomogeneous atmosphere would imply locally modified surface properties. This might provide clues on inhomogeneities of the underlying ice structure and thus properties of a potential subsurface ocean. Since the inhomogeneous emission comes from within the disk of Europa, we propose to study Europa at eastern and western elongation to decide if the locally enhanced emission is truly an atmospheric effect. We propose to take for each elongation five contiguous observations within one rotation period of Jupiter to discriminate between a competing effect that produces inhomogeneous emission patterns, i.e., the electrodynamic interaction with Jupiter's magnetosphere. We will use ACS/SBC with PR130L prism to completely separate the two prominent FUV oxygen lines OI 1304 A and OI 1356 A emitted from Europa's atmosphere.
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Proposal Category: GO
Scientific Category: SOLAR SYSTEM
ID: 11187
Title: A Deep Search for Martian Dust Rings
PI: Mark Showalter
PI Institution: SETI Institute

It has been long suspected that Mars is encircled by two faint rings of dust, one originating from each of its moons Phobos and Deimos. Similar dust rings are associated with many of the small, inner moons orbiting Jupiter, Saturn, Uranus and Neptune. On December 31, 2007, Earth will pass through Mars' equatorial plane just a week after its December 24 opposition, providing an exceedingly rare opportunity to image the rings under nearly ideal viewing geometry. The next equivalent viewing opportunity occurs in 2022. Using the

Wide Fields of WFPC2 and a highly optimized observing plan, we expect to be able to detect rings with edge-on reflectivities of ~ 10^-8, which is at or below the level where most dynamicists expect rings to be visible. This is a factor of 10-30 more sensitive than the detection limit we achieved during a slightly inferior viewing opportunity in 2001. The rings have been predicted to show some interesting dynamical properties, including large asymmetries and inclinations. A positive detection will test these predictions, serving as an effective test of dynamical models developed to account for the properties of other faint planetary rings as well. With such a stringent limit, even a negative result will be of considerable interest, challenging dynamicists to explain the remarkably low density of dust within the Martian system.
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Proposal Category: GO
Scientific Category: COSMOLOGY
ID: 11188
Title: First Resolved Imaging of Escaping Lyman Continuum
PI: Brian Siana
PI Institution: Jet Propulsion Laboratory

The emission from star-forming galaxies appears to be responsible for reionization of the universe at z>6. However, the models that attempt to describe the detailed impact of high-redshift galaxies on the surrounding inter-galactic medium (IGM) are strongly dependent upon several uncertain parameters. Perhaps the most uncertain is the fraction of HI-ionizing photons produced by young stars which escape into the IGM. Most attempts to measure this "escape fraction" (f_esc) have produced null results. Recently, a small subset of z~3 Lyman Break Galaxies (LBGs) has been found exhibiting large escape fractions. It remains unclear however, what differentiates them from other LBGs. Several models attempt to explain how such a large fraction of ionizing continuum can escape through the HI and dust in the ISM (eg. "chimneys" created by SNe winds, globular cluster formation, etc.), each producing unique signatures which can be observed with resolved imaging of the escaping Lyman continuum. We propose a deep, high resolution WFPC2 image of the ionizing continuum (F336W) and the rest-frame 1500 Angstrom continuum (F606W) of five of the six known LBGs with large escape fractions. These LBGs all fit within a single WFPC2 pointing, yielding high observing efficiency. Additionally, they all have z~3.1 or higher, the optimal redshift range for probing the Lyman Continuum region with available WFPC2 filters. These factors make our proposed sample especially suitable for follow-up. With these data we will discern the mechanisms responsible for producing large escape fractions, and therefore gain insight into the process of reionization.
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Proposal Category: GO
Scientific Category: COSMOLOGY
ID: 11189
Title: Probing the early universe with GRBs

PI: Nial Tanvir
PI Institution: University of Leicester

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 through direct observation of the host galaxies themselves. In addition, the association of GRBs with massive stars means that they are an indicator 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 targetting GRBs at z~6 and above. 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: SOLAR SYSTEM
ID: 11190
Title: Probing Uranus' Vertical Aerosol Structure at Equinox
PI: Laurence Trafton
PI Institution: University of Texas at Austin

After a decade of quiescence following the Voyager flybys, Uranus' atmosphere has been exhibiting increasing activity approaching equinox that suggests a short timescale, dynamical, response in addition to a long timescale, radiative, response to the seasonal change of hemispheric heating. We propose to investigate this dichotomy by measuring Uranus' vertical aerosol structure over the entire surface, including both poles, at equinox when the forcing insolation is hemispherically symmetric, requiring that the sub-Earth latitude be less than a degree. Only at equinox (every 42 years) can the entire surface of the planet be viewed (over a full rotation) and mapped with the same viewing geometry. We will probe the morphology of the vertical haze structure using NICMOS narrow band filters beyond 1 micron to isolate different altitude regimes between the stratosphere and cloud deck and investigate its change since Cycle 7. We will use two complementary approaches: First, imaging will be done using medium- and narrow-band filters first to locate the dynamically-produced discrete cloud features, then to probe their vertical structure and

morphology. The methane absorption bands are stronger in the proposed near-IR (1 to 2.5 microns) than at shorter wavelengths, and the strong H2 pressure-induced absorption from 2.1-2.4 microns contributes to the peak opacity. This enhances the visibility of transient, spatially isolated features and allows their structure to be probed to higher altitudes; namely, to the upper troposphere where they would be evidence of convective overshoot, a dynamical manifestation that would support strong seasonally-induced static instability. In addition to probing the structure with filter photometry, we will measure longitudinal limb profiles to probe the vertical background haze distribution vs latitude. HST/NICMOS is required because it avoids telluric water absorption and OH+O2 emission, and has a stable, well-characterized PSF, essential for limb studies and extracting the vertical structure of fine features crossing the disk. The proposed observations would complement the ground-based Uranus equinox campaign.

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Proposal Category: GO
Scientific Category: COSMOLOGY
ID: 11191
Title: NICMOS Imaging of a z>4 High-Redshift Ultraluminous Submillimeter Source
PI: Wei-Hao Wang
PI Institution: Associated Universities, Inc.

We propose 16 orbits of deep NICMOS 1.6 um imaging of GOODS850-5, a unique z>4 candidate SCUBA source that is bright in the submillimeter (submm) but extremely faint at all other wavelengths. GOODS850-5 is a 11 mJy 850 um source discovered in our GOODS-N SCUBA survey. It does not have a radio counterpart and its accurate location was recently determined with the SMA interferometer. It is not detected by the GOODS-N HST ACS imaging and is just above the detection limit of the ultradeep Spitzer imaging at 3.6-24 um. Its faint radio flux and its Spitzer color suggest a redshift of z>4, and potentially even z>6. It has an incredible star formation rate of ~1000 solar mass per year, and it can quickly grow into a >10^11 solar mass massive galaxy. Radio faint submm sources like GOODS850-5 may be a new population of high-redshift massive galaxies that are not picked up by any of the previous optical, near-IR, and radio surveys, and therefore it is crucial to obtain the redshift of GOODS850-5. However, because of its extreme optical faintness, the only way to constrain its redshift is photometric redshift with the existing Spitzer photometry and the proposed NICMOS 1.6 um photometry. NICMOS is the only instrument that can provide information about its redshift and morphology among all space-based and ground-based instruments at all wavelengths. The proposed observation will provide unique insight on galaxy evolution and mass assembly at high redshift.

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Proposal Category: GO
Scientific Category: COSMOLOGY
ID: 11192

Title: NICMOS Confirmation of Candidates of the Most Luminous Galaxies at z > 7
PI: Hao-Jing Yan
PI Institution: Observatories of the Carnegie Institution of Washington

While the deepest pencil-beam near-IR survey suggested that the Universe was too young to build up many luminous galaxies by z ~ 7--8 (Bouwens & Illingworth 2006), there is also evidenc indicating the contrary. It is now known that some galaxies with stellar masses of M>1e10 Msun were already in place by z ~ 6--7, which strongly suggests that their progenitors should be significantly more luminous, and hence detectable in deep, wide-field near-IR surveys (Yan et al. 2006). As galaxies at such a high redshift should manifest themselves as "dropouts" from the optical, we have carried out a very wide-field, deep near-IR survey in the GOODS fields to search for z-band dropouts as candidates of galaxies at z > 7. In total, six promising candidates have been found in ~ 300 sq. arcmin to J_AB ~ 24.5 mag (corresponding to restframe M(UV) < -22.5 mag at z ~ 7). By constrast, the galaxy luminosity function (LF) suggested in BI06 would predict at most 3--5 galaxies over the entire 2-pi sky at this brightness level. Here we propose to observe these candidates with NIC3 in F110W and F160W to further investigate their nature. If any of these candidates are indeed at z > 7, the result will lead to a completely new picture of star formation in the early universe. If none of our candidates are consistent with being at z > 7, then the depth and area of our near-IR survey (from which the candidates are drawn) will let us set a very stringent upper limit on the bright end of the galaxy LF at those redshift. As a result, our program will still be able to provide new clues about the processes of early galaxy formation, such as their dust contents and their merging time scale (Yan et al. 2006).
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Proposal Category: GO
Scientific Category: STAR FORMATION
ID: 11193
Title: A comprehensive study of the low-mass stellar population in the Galactic starburst region NGC 3603
PI: Wolfgang Brandner
PI Institution: University of California - Los Angeles

NGC 3603, located in the Carina spiral arm, is one of the most luminous giant HII regions in the Milky Way, and as such it is often referred to as a prime template for extragalactic starbursts. While previous studies were focussing on the high and intermediate mass stellar content of the central starburst cluster, which powers the HII region, the effects of the starburst environment with its large number of ionizing O stars on the emerging low-mass population are unknown. As the most nearby, most easily accessible starburst, NGC 3603 provides the best testbed to study the long-lived, low-mass stars originating from a starburst environment. Taking advantage of the large field of view and high sensitivity of WFPC2, we want to survey the stellar population in an area of 10pc x 10pc (6' x 6') down to a mass limit of 0.2 to 0.5 Mo. This will

enable us to derive the total cluster mass, look for spatial variations in the initial mass function, determine the age of the dispersed low-mass population in the HII region and search for evidence of sequential star formation. Ultimately, we aim at reconstructing the low-mass stellar initial mass function of the starburst epoch in NGC 3603, which in turn will advance our understanding of extragalactic starburst phenomena and the emerging low-mass stars as observed in ancient populations. The observations of NGC 3603 are part of our larger effort to study intense star-forming regions in the Milky Way, LMC and SMC.

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Proposal Category: GO
Scientific Category: COSMOLOGY
ID: 11194
Title: Beyond the Bullet: Direct Detection of Dark Matter in Merging Galaxy Clusters
PI: Douglas Clowe
PI Institution: Ohio University

Our comparison of the distribution of baryons (stars and gas) and mass (from weak lensing) in the "Bullet" Cluster has recently yielded concrete evidence for dark matter independent of basic assumptions regarding the nature of the gravitational force. The one incomplete aspect of the argument relates to potential, although highly unlikely, coincidences (special alignments along the line of sight, and/or fortuitious canceling in non-standard gravitational models) that can always be invoked against results derived from the study of one object. Therefore, we proprose to complete this line of investitgation by increasing the size of our sample with obsevations of two additional clusters. Here we propose to obtain HST WFPC2 imaging mosaics around the cores of both clusters to detect at high significance if the weak gravitational lensing mass peaks are routinely displaced from the X-ray plasma clouds and aligned with the galaxy concentrations in interacting clusters. With a relatively modest allocation of time, we seek to complete a significant step toward the eventual resolution of the dark matter question.

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Proposal Category: GO
Scientific Category: UNRESOLVED STELLAR POPULATIONS
ID: 11195
Title: Morphologies of the Most Extreme High-Redshift Mid-IR- luminous Galaxies II: The `Bump' Sources
PI: Arjun Dey
PI Institution: National Optical Astronomy Observatories, AURA

The formative phase of some 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, and thus far we have been restricted to studying the 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 optically extremely faint (R>26) but nevertheless bright at mid-infrared wavelengths (F[24um] > 0.5 mJy). Mid-infrared spectroscopy with Spitzer/IRS reveals that they have redshifts z~2, implying luminosities ~1E13 Lsun. Their mid-IR SEDs fall into two broad, perhaps overlapping, categories. Sources with brighter F[24um] exhibit power-law SEDs and SiO absorption features in their mid-IR spectra characteristic of AGN, whereas those with fainter F[24um] show a "bump" characteristic of the redshifted 1.6um peak from a stellar population, and PAH emission characteristic of starformation. We have begun obtaining HST images of the brighter sources in Cycle 15 to obtain identifications and determine kpc-scale morphologies for these galaxies. Here, we aim to target the second class (the "bump" sources) with the goal of determining if these constitute morphologically different objects, or simply a "low-AGN" state of the brighter class. The proposed observations will help us determine whether these objects are merging systems, massive obscured starbursts (with obscuration on kpc scales

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Proposal Category:	GO
Scientific Category:	UNRESOLVED STELLAR POPULATIONS
ID:	11196
Title:	An Ultraviolet Survey of Luminous Infrared Galaxies in the Local Universe
PI:	Aaron Evans
PI Institution:	State University of New York at Stony Brook

At luminosities above 10^11.4 L_sun, the space density of far-infrared selected galaxies exceeds that of optically selected galaxies. These Luminous Infrared Galaxies (LIRGs) are primarily interacting or merging disk galaxies undergoing starbursts and creating/fueling central AGN. We propose far (ACS/SBC/F140LP) and near (WFPC2/PC/F218W) UV imaging of a sample of 27 galaxies drawn from the complete IRAS Revised Bright Galaxy Sample (RBGS) LIRGs sample and known, from our Cycle 14 B and I-band ACS imaging observations, to have significant numbers of bright (23 < B < 21 mag) star clusters in the central 30 arcsec. The HST UV data will be combined with previously obtained HST, Spitzer, and GALEX images to (i) calculate the ages of the clusters as function of merger stage, (ii) measure the amount of UV light in massive star clusters relative to diffuse regions of star formation, (iii) assess the feasibility of using the UV slope to predict the far-IR luminosity (and thus the star formation rate) both among and within IR-luminous galaxies, and (iv) provide a much needed catalog of rest-frame UV morphologies for comparison with rest-frame UV images of high-z LIRGs and Lyman Break Galaxies. These observations will achieve the resolution required to perform both detailed photometry of compact structures and spatial correlations between UV and redder wavelengths for a physical interpretation our IRX-Beta results. The HST UV data, combined with the HST ACS, Spitzer, Chandra, and GALEX observations of this sample, will result in the most comprehensive study of luminous starburst galaxies to date.

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Proposal Category: GO
Scientific Category: COSMOLOGY
ID: 11197
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 that 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 Phillip's relation over cosmic time. High signal-to-noise measurements of 16 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. In Cycle 15 we obtained NICMOS photometry of 8 ESSENCE supernovae and are awaiting template observations to place them on the IR Hubble diagram. Here we request another 8 supernovae be studied in the final season of the ESSENCE search. 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: 11198
Title: Pure Parallel Imaging in the NDWFS Bootes Field
PI: Anthony Gonzalez
PI Institution: University of Florida

The NOAO Deep-Wide Field Survey (NDWFS) Bootes field is the target of one of the most extensive multiwavelength campaigns in astronomy. In addition to ground-based optical and near-infrared imaging, deep radio mapping, and extensive spectroscopy, this entire region has been imaged by the Chandra, Spitzer (IRAC and MIPS), and GALEX missions. Robust photometric redshifts (calibrated using over 20,000 spectroscopic redshifts) exist for all sources brighter than R=24.5 or than 13 uJy at 4.5 microns. To enhance the value of this data set, we propose pure parallel observations for all approved Cycle 16 programs in this region that lack coordinated parallel observations. The primary aim of this program will be to provide a database useful for the broad range of science programs underway in this region.
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Proposal Category: GO
Scientific Category: STAR FORMATION
ID: 11199
Title: A Hard Look at Stellar Disks at the Epoch of Planet Formation
PI: Lee Hartmann
PI Institution: University of Michigan

We propose to use HST/ACS/SBC and Chandra/ACIS-S3 to observe the high energy fluxes of 4 stars surrounded by disks in the newly discovered aggregate 25 Ori, the most populous 10 Myr group known within 500 pc. Our observations will cover the 1-25A and 1250-2000A bandpasses, and will complement our optical and Spitzer data for these objects, to provide essential input to physically-consistent models of disk structure and chemistry in the age range around 10 Myr, thought to be a critical period in the planet-forming process. We will be able to determine the Ne/O ratio and determine if the anomalous metal abundances observed in X-ray spectra of young stars are an evolutionary or an environmental effect. Our proposed observations will double the number of 10 Myr old accreting stars with known high energy radiation fields, and will be the first FUV observations of low mass accreting stars in an OB association.
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Proposal Category: GO
Scientific Category: UNRESOLVED STELLAR POPULATIONS
ID: 11200
Title: An Ultraluminous EUV Source?
PI: Philip Kaaret
PI Institution: University of Iowa

Ultraluminous X-ray sources (ULXs) are bright, irregularly variable, non-nuclear, X-ray sources with apparent luminosities exceeding the Eddington limit for stellar-mass black holes. There is great interest in ULXs because they may represent a new class of black holes with masses intermediate between stellar-mass and supermassive black holes. Recently, it has been found that X-ray emission from the nebula MF 16 in the galaxy NGC 6946, previously thought to be an usually luminous supernova remnant, actually arises from an accreting compact object. Optical spectroscopy of nebula shows that it is powered via photoionization by an extreme ultraviolet (EUV) source with a luminosity exceeding that measured from the X-ray source. If correct this would be the first ultraluminous UV source and may be a 10,000 solar mass black hole. We propose an FUV observation with the ACS/SBC to determine if a highly luminous EUV source is indeed, present within MF 16.
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Proposal Category: SNAP
Scientific Category: RESOLVED STELLAR POPULATIONS
ID: 11201
Title: Systemic and Internal motions of the Magellanic Clouds: Third Epoch Images

PI: Nitya Kallivayalil
PI Institution: Harvard University

In Cycles 11 and 13 we obtained two epochs of ACS/HRC data for fields in the Magellanic Clouds centered on background quasars. We used these data to determine the proper motions of the LMC and SMC to better than 5% and 15% respectively. These are by far the best determinations of the proper motions of these two galaxies. The results have a number of unexpected implications for the Milky Way-LMC-SMC system. The implied three-dimensional velocities are larger than previously believed, and are not much less than the escape velocity in a standard 10^12 solar mass Milky Way dark halo. Orbit calculations suggest the Clouds may not be bound to the Milky Way or may just be on their first passage, both of which would be unexpected in view of traditional interpretations of the Magellanic Stream. Alternatively, the Milky Way dark halo may be a factor of two more massive than previously believed, which would be suprising in view of other observational constraints. Also, the relative velocity between the LMC and SMC is larger than expected, leaving open the possibility that the Clouds may not be bound to each other. To further verify and refine our results we now request an epoch of WFPC2/PC data for the fields centered on 40 quasars that have at least one epoch of ACS imaging. We request execution in snapshot mode, as in our previous programs, to ensure the most efficient use of HST resources. A third epoch of data of these fields will provide crucial information to verify that there are no residual systematic effects in our previous measurements. More importantly, it will increase the time baseline from 2 to 5 yrs and will increase the number of fields with at least two epochs of data. This will reduce our uncertainties correspondingly, so that we can better address whether the Clouds are indeed bound to each other and to the Milky Way. It will also allow us to constrain the internal motions of various populations within the Clouds, and will allow us to determine a distance to the LMC using rotational parallax.
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Proposal Category: GO
Scientific Category: COSMOLOGY
ID: 11202
Title: The Structure of Early-type Galaxies: 0.1-100 Effective Radii
PI: Leon Koopmans
PI Institution: Kapteyn Astronomical Institute

The structure, formation and evolution of early-type galaxies is still largely an open problem in cosmology: how does the Universe evolve from large linear scales dominated by dark matter to the highly non-linear scales of galaxies, where baryons and dark matter both play important, interacting, roles? To understand the complex physical processes involved in their formation scenario, and why they have the tight scaling relations that we observe today (e.g. the Fundamental Plane), it is critically important not only to undertstand their stellar structure, but also their dark-matter distribution from the smallest to the largest scales. Over the last three years the SLACS

collaboration has developed a toolbox to tackle these issues in a unique and encompassing way by combining new non-parametric strong lensing techniques, stellar dynamics, and most recently weak gravitational lensing, with high-quality Hubble Space Telescope imaging and VLT/Keck spectroscopic data of early-type lens systems. This allows us to break degeneracies that are inherent to each of these techniques seperately and probe the mass structure of early-type galaxies from 0.1 to 100 effective radii. The large dynamic range to which lensing is sentive allows us both to probe the clumpy substructure of these galaxies, as well as their low-density outer haloes. These methods have convincingly been demonstrated, by our team, using smaller pilot-samples of SLACS lens systems with HST data. In this proposal, we request observing time with WFPC2 and NICMOS to observe 53 strong lens systems from SLACS, to obtain complete multi-color imaging for each system. This would bring the total number of SLACS lens systems to 87 with completed HST imaging and effectively doubles the known number of galaxy-scale strong lenses. The deep HST images enable us to fully exploit our new techniques, beat down low-number statistics, and probe the structure and evolution of early-type galaxies, not only with a uniform data-set an order of magnitude larger than what is available now, but also with a fully coherent and self-consistent methodological approach

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Proposal Category: GO
Scientific Category: STAR FORMATION
ID: 11203
Title: A Search for Circumstellar Disks and Planetary-Mass Companions around Brown Dwarfs in Taurus
PI: Kevin Luhman
PI Institution: The Pennsylvania State University

During a 1-orbit program in Cycle 14, we used WFPC2 to obtain the first direct image of a circumstellar disk around a brown dwarf. These data have provided fundamental new constraints on the formation process of brown dwarfs and the properties of their disks. To search for additional direct detections of disks around brown dwarfs and to search for planetary-mass companions to these objects, we propose a WFPC2 survey of 32 brown dwarfs in the Taurus star-forming region.

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Proposal Category: GO
Scientific Category: STAR FORMATION
ID: 11204
Title: Imaging Circumstellar Disks and Envelopes around Proto- Brown Dwarfs
PI: Kevin Luhman
PI Institution: The Pennsylvania State University

Using the Spitzer Space Telescope, we have discovered two young brown dwarfs with Class I spectral energy distributions (i.e., proto-brown dwarfs). We

propose to perform broad-band NICMOS imaging of these Class I brown dwarfs to spatially resolve their circumstellar disks and envelopes. If successful, these data would comprise the first measurements of this kind for brown dwarfs and would provide fundamental constraints on models for the formation of brown dwarfs.
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Proposal Category: GO
Scientific Category: STAR FORMATION
ID: 11205
Title: The Effects of Multiplicity on the Evolution of Young Stellar Objects: A NICMOS Imaging Study
PI: James Muzerolle
PI Institution: University of Arizona

We propose to use NICMOS to investigate the multiplicity of young stellar objects (YSOs) in the Orion B molecular cloud. Previous observations with the Spitzer Space Telescope have revealed a remarkable star forming filament near the NGC 2068 reflection nebula. The population of YSOs associated with the filament exhibit a surprisingly wide range of circumstellar evolutionary states, from deeply embedded protostars to T Tauri accretion disks. Many of the circumstellar disks themselves show evidence for significant dust evolution, including grain growth and settling and cleared inner holes, apparently in spite of the very young age of these stars. We will estimate the binary fraction of a representative sample of objects in these various stages of evolution in order to test whether companions may play a significant role in that evolution.
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Proposal Category: GO
Scientific Category: UNRESOLVED STELLAR POPULATIONS
ID: 11206
Title: At the cradle of the Milky Way: Formation of the most massive field disk galaxies at z>1
PI: Kai Noeske
PI Institution: University of California - Santa Cruz

We propose to obtain 2 orbit WFPC2 F814W images of a sample of the 15 most massive galaxies found at $1 < z < 1.3$. These were culled from over 20,000 Keck spectra collected as part of DEEP and are unique among high redshift massive galaxy samples in being kinematically selected. Through a recent HST NICMOS-2 imaging program (GO-10532), we have confirmed that these galaxies have regular stellar disks, and their emission line kinematics are not due to gradients from merging components. These potentially very young galaxies are likely precursors to massive local disks, assuming no further merging. The proposed WFPC2 and existing NIC-2 data provide colors, stellar masses, and ages of bulge and disk subcomponents, to assess whether old stellar bulges and disks are in place at that time or still being built, and constrain their

formation epochs. Finally, this sample will yield the first statistically significant results on the $z > 1$ evolution of the size-velocity-luminosity scaling relations, for massive galaxies at different wavelengths, and constrain whether this evolution reflects stellar mass growth, or passive evolution, of either bulge or disk components.

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Proposal Category: GO
Scientific Category: UNRESOLVED STELLAR POPULATIONS
ID: 11207
Title: Star Formation in the Perseus Cluster Cooling Flow
PI: Robert O'Connell
PI Institution: The University of Virginia

We propose to obtain high resolution, UV/optical imaging of the "accretion populations" in the massive cooling flow of the Perseus cluster of galaxies. New GALEX observations show that the dominant galaxy in this nearby cluster, NGC 1275, has an extended network of UV-bright populations apparently formed recently from the intracluster gas. Cluster cooling flows are the most prominent of the environments where we can readily observe the cycle of gas accretion, star formation, and feedback from active nuclei that is thought to play a central role in the formation and evolution of galaxies. Because they can be readily age-dated, the accretion populations help to trace the sequence of exchange of material between galaxies and the intracluster medium. The ACS/SBC and WFPC2/PC cameras offer the highest spatial resolution and best panchromatic performance available to map the spatial and age distribution of the accretion populations and their relationship to radio-emitting plasma and the hot intracluster gas.

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Proposal Category: GO
Scientific Category: COSMOLOGY
ID: 11208
Title: The co-evolution of spheroids and black holes in the last six billion years
PI: Tommaso Treu
PI Institution: University of California - Santa Barbara

The masses of giant black holes are correlated with the luminosities, masses, and velocity dispersions of the bulges of their host galaxies. This empirical correlation of phenomena on widely different scales (from pcs to kpcs) suggests that the formation and evolution of galaxies and central black holes are closely linked. In Cycle 13, we have started a campaign to map directly the co-evolution of spheroids and black-holes by measuring in observationally favorable redshift windows the empirical correlations connecting their properties. By focusing on Seyfert 1s, where the nucleus and the stars contribute comparable fractions of total light, black hole mass and bulge dispersion are obtained from Keck spectroscopy. HST is required for accurate measurement of the non stellar AGN continuum, the morphology of the galaxy,

and the structural parameters of the bulge. The results at z=0.36 indicate a surprisingly fast evolution of bulges in the past 4 Gyrs (significant at the 95%CL), in the sense that bulges were significantly smaller for a given black hole mass. Also, the large fraction of mergers and disturbed galaxies (4+2 out of 20) identifies gas-rich mergers as the mechanisms responsible for bulge-growth. Going to higher redshift -- where evolutionary trends should be stronger -- is needed to confirm these tantalizing results. We propose therefore to push our investigation to the next suitable redshift window z=0.57 (lookback-time 6 Gyrs). Fifteen objects are the minimum number required to map the evolution of the empirical correlations between bulge properties and black-hole mass, and to achieve a conclusive detection of evolution (>99%CL).

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Proposal Category: GO
Scientific Category: UNRESOLVED STELLAR POPULATIONS
ID: 11209
Title: Determining the Structural Parameters of the First Globular Cluster Found to Host an Black-Hole X-ray Binary
PI: Stephen Zepf
PI Institution: Michigan State University

We recently published the discovery of the first black hole X-ray binary in a globular cluster. This object is located in a bright globular cluster around the Virgo elliptical NGC 4472. Here we propose to obtain HST PC images of this black-hole hosting globular cluster and a sample of other NGC 4472 globulars. We will use these data to determine the structural parameters of both the globular cluster known to have a black hole and a control sample of other NGC 4472 clusters. This will test recent theoretical predictions how black holes affect the structural parameters of globular clusters, and more generally will allow for the first time constraints on any relationship between the presence of a black hole and the surface brightness profiles of globular clusters. The deep WFPC2 images outside of the galaxy's central regions will also be invaluable for studying how the sizes and luminosity function of globular clusters depend on distance from the center of the galaxy, and thus address questions about the origin of the size differences between metal-rich and metal-poor clusters and the shape of the globular cluster luminosity function. In addition, parallel NIC3 images will allow the optical to near-infrared colors of NGC 4472 globular cluster to be determined over a wide range of galactocentric radii.

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Proposal Category: GO
Scientific Category: COOL STARS
ID: 11210
Title: The Architecture of Exoplanetary Systems
PI: George Benedict
PI Institution: University of Texas at Austin

Are all planetary systems coplanar? Concordance cosmogony makes that prediction. It is, however, a prediction of extrasolar planetary system architecture as yet untested by direct observation for main sequence stars other than the Sun. To provide such a test, we propose to carry out FGS astrometric studies on four stars hosting seven companions. Our understanding of the planet formation process will grow as we match not only system architecture, but formed planet mass and true distance from the primary with host star characteristics for a wide variety of host stars and exoplanet masses. We propose that a series of FGS astrometric observations with demonstrated 1 millisecond of arc per-observation precision can establish the degree of coplanarity and component true masses for four extrasolar systems: HD 202206 (brown dwarf+planet); HD 128311 (planet+planet), HD 160691 = mu Arae (planet+planet), and HD 222404AB = gamma Cephei (planet+star). In each case the companion is identified as such by assuming that the minimum mass is the actual mass. For the last target, a known stellar binary system, the companion orbit is stable only if coplanar with the AB binary orbit.

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Proposal Category: GO
Scientific Category: RESOLVED STELLAR POPULATIONS
ID: 11211
Title: An Astrometric Calibration of Population II Distance Indicators
PI: George Benedict
PI Institution: University of Texas at Austin

In 2002 HST produced a highly precise parallax for RR Lyrae. That measurement resulted in an absolute magnitude, M(V)= 0.61+/-0.11, a useful result, judged by the over ten refereed citations each year since. It is, however, unsatisfactory to have the direct, parallax-based, distance scale of Population II variables based on a single star. We propose, therefore, to obtain the parallaxes of four additional RR Lyrae stars and two Population II Cepheids, or W Vir stars. The Population II Cepheids lie with the RR Lyrae stars on a common K-band Period-Luminosity relation. Using these parallaxes to inform that relationship, we anticipate a zero-point error of 0.04 magnitude. This result should greatly strengthen confidence in the Population II distance scale and increase our understanding of RR Lyrae star and Pop II Cepheid astrophysics.

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Proposal Category: SNAP
Scientific Category: HOT STARS
ID: 11212
Title: Filling the Period Gap for Massive Binaries
PI: Douglas Gies
PI Institution: Georgia State University Research Foundation

The current census of binaries among the massive O-type stars is seriously

incomplete for systems in the period range from years to millennia because the radial velocity variations are too small and the angular separations too close for easy detection. Here we propose to discover binaries in this observational gap through a Faint Guidance Sensor SNAP survey of relatively bright targets listed in the Galactic O Star Catalog. Our primary goal is to determine the binary frequency among those in the cluster/association, field, and runaway groups. The results will help us assess the role of binaries in massive star formation and in the processes that lead to the ejection of massive stars from their natal clusters. The program will also lead to the identification of new, close binaries that will be targets of long term spectroscopic and high angular resolution observations to determine their masses and distances. The results will also be important for the interpretation of the spectra of suspected and newly identified binary and multiple systems.

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Proposal Category: GO
Scientific Category: COOL STARS
ID: 11213
Title: Distances to Eclipsing M Dwarf Binaries
PI: Gerard van Belle
PI Institution: California Institute of Technology

We propose HST FGS observations to measure accurate distances of 5 nearby M dwarf eclipsing binary systems, from which model-independent luminosities can be calculated. These objects have either poor or no existing parallax measurements. FGS parallax determinations for these systems, with their existing dynamic masses determed to better than 0.5%, would serve as model-independent anchor points for the low-mass end of the mass-luminosity diagram.

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Proposal Category: GO
Scientific Category: STAR FORMATION
ID: 11214
Title: HST/FGS Astrometric Search for Young Planets Around Beta Pic and AU Mic
PI: John Wisniewski
PI Institution: NASA Goddard Space Flight Center

Beta Pic and AU Mic are two nearby Vega-type debris disk stars. Both of these disk systems have been spatially resolved in exquisite detail, predominantly via the ACS coronagraph and WFPC-2 cameras onboard HST. These images exhibit a wealth of morphological features which provide compelling indirect evidence that these systems likely harbor short-period planetary body(ies). We propose to use the superlative astrometric capabilities of HST/FGS to directly detect these planets, hence provide the first direct planet detection in a Vega-type system whose disk has been imaged at high spatial resolution.

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Proposal Category: GO
Scientific Category: QUASAR ABSORPTION LINES AND IGM
ID: 11215
Title: New Sightlines for the Study of Intergalactic Helium: Dozens of High-Confidence, UV-Bright Quasars from SDSS/GALEX
PI: Scott Anderson
PI Institution: University of Washington

The reionization of IGM helium is thought to have occurred at redshifts of z=3 to 4. Detailed study of HeII Lyman-alpha absorption toward a handful of QSOs at 2.7<z<3.3 demonstrated the high potential of such IGM probes, but the critically small sample size limits confidence in cosmological inferences. The requisite unobscured sightlines to high-z are extremely rare, but SDSS provides 5800, z>3.1 QSOs potentially suitable for HeII studies. We've cross-correlated SDSS quasars with GALEX UV sources to obtain dozens of new, high confidence, candidate sightlines (z=3.1-4.9) potentially useful for detailed HeII studies with HST. We propose brief, 2-orbit reconnaissance ACS SBC prism exposures toward each of the best dozen new quasars, to definitively verify UV flux down to HeII. Our combined SDSS/GALEX selection insures a high confirmation rate, as the quasars are already known to be UV bright in GALEX. Our program will provide a statistical sample of HeII sightlines extending to high redshift, enabling future long exposure follow-up spectra with the SBC prism, or superb quality COS or STIS spectra after SM4. Stacks of our prism spectra will also directly yield ensemble information. Ultimately, the new sightlines will enable confident measures of the spectrum and evolution of the ionizing background, the evolution of HeII opacity, the epoch of helium reionization, and the density of IGM baryons.
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Proposal Category: GO
Scientific Category: AGN/QUASARS
ID: 11216
Title: Monitoring the Giant Flare of HST-1 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 six epochs of HST/WFPC2 flux monitoring during Cycle 16, as well as seven epochs of Chandra/ACIS observation (5ksec each, six Chandra

epochs contemporary with HST). At two of the HST/WFPC2 epochs we also gather spectral information, and at one epoch we will 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 new observations will allow us to track the decay phase of the giant flare, and study smaller secondary flares such as seen late in 2006. Ultimately we will 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: ISM AND CIRCUMSTELLAR MATTER
ID: 11217
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 three 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. We have also used our HST data to 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 16, in order to continue the mapping of the circumstellar dust and to accomplish the other goals listed above.

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Proposal Category: SNAP
Scientific Category: RESOLVED STELLAR POPULATIONS
ID: 11218
Title: Snapshot Survey for Planetary Nebulae in Globular Clusters of the Local Group
PI: Howard Bond
PI Institution: Space Telescope Science Institute

Planetary nebulae (PNe) in globular clusters (GCs) raise a number of interesting issues related to stellar and galactic evolution. The number of

PNe known in Milky Way GCs, 4, is surprisingly low if one assumes that all stars pass through a PN stage. However, it is likely that the remnants of stars now evolving in Galactic GCs leave the AGB so slowly that any ejected nebula dissipates long before the star becomes hot enough to ionize it. Thus there should not be ANY PNe in Milky Way GCs--but there are four

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Proposal Category: SNAP
Scientific Category: AGN/QUASARS
ID: 11219
Title: Active Galactic Nuclei in nearby galaxies: a new view of the origin of the radio-loud radio-quiet dichotomy?
PI: Alessandro Capetti
PI Institution: Osservatorio Astronomico di Torino

Using archival HST and Chandra observations of 34 nearby early-type galaxies (drawn from a complete radio selected sample) we have found evidence that the radio-loud/radio-quiet dichotomy is directly connected to the structure of the inner regions of their host galaxies in the following sense: [1] Radio-loud AGN are associated with galaxies with shallow cores in their light profiles [2] Radio-quiet AGN are only hosted by galaxies with steep cusps. Since the brightness profile is determined by the galaxy's evolution, through its merger history, our results suggest that the same process sets the AGN flavour. This provides us with a novel tool to explore the co-evolution of galaxies and supermassive black holes, and it opens a new path to understand the origin of the radio-loud/radio-quiet AGN dichotomy. Currently our analysis is statistically incomplete as the brightness profile is not available for 82 of the 116 targets. Most galaxies were not observed with HST, while in some cases the study is obstructed by the presence of dust features. We here propose to perform an infrared NICMOS snapshot survey of these 82 galaxies. This will enable us to i) test the reality of the dichotomic behaviour in a substantially larger sample; ii) extend the comparison between radio-loud and radio-quiet AGN to a larger range of luminosities.

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Proposal Category: GO
Scientific Category: COSMOLOGY
ID: 11220
Title: Mapping the FUV Evolution of Type IIn Supernovae
PI: Jeff Cooke
PI Institution: University of California - Irvine

We will use the PR110L prism on the SBC of ACS to map the FUV evolution of Type IIn supernovae (SNe). The main goal of this proposal is to measure the FUV continuum, Ly-a emission line flux, and their evolution to (1) quantify and interpret Type IIn SN transient event detections at high redshift and (2) dramatically improve current high redshift Type IIn selection criteria. We show that the inherent properties of Type IIn SNe facilitate high redshift

detection. We will observe the rest-frame FUV of a sample of eight 0.02 < z < 0.33 Type IIn SNe to directly measure the survival of Ly-alpha photons in low redshift Type IIn SNe environments and extrapolate the results to high redshift. We will calibrate relationships such as FUV luminosity vs. emission line flux and measure emission line evolution vs. FUV light evolution. The intent is to categorize and improve the utility of Type IIn SNe.

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Proposal Category: GO
Scientific Category: COSMOLOGY
ID: 11221
Title: A Dark Core in Abell 520
PI: Julianne Dalcanton
PI Institution: University of Washington

We have recently disocovered that the rich cluster Abell 520 exhibits truly extreme multi-wavelength characteristics. The data indicate that the cluster is the site of a major merger. Our weak lensing analysis, based on a deep CFHT image, suggests the presence of a massive dark core that coincides with the central X-ray emission peak, while being largely devoid of galaxies. Although a displacement between the X-ray gas and the galaxy/dark matter distribution may be expected in a merger (e.g. as in the bullet cluster), the dark matter peak without galaxies cannot be easily explained within the current collisionless dark matter paradigm. A higher resolution mass map is required to make further progress, as it will enable us to examine the detailed structure of the dark matter distribution, as well as improve the significance of the dark peak. We propose a 3 x 3 WFPC2 mosaic of interlaced images, where each pointing consists of two sets of F814W exposures offset by 5.5 pixels. This will precisely pinpoint the locations of the highest lensing peaks, enhance the comparison with the Chandra X-ray data, and test physical and geometrical models for the spatial and thermal structure of this remarkable cluster derived from our suite of gas+dark matter simulations of head-on/off-axis cluster mergers.

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Proposal Category: GO
Scientific Category: AGN/QUASARS
ID: 11222
Title: Direct Detection and Mapping of Star Forming Regions in Nearby, Luminous Quasars
PI: Michael Eracleous
PI Institution: The Pennsylvania State University

We propose to carry out narrow-band emission line imaging observations of seven quasars at z=0.05-0.09 with the WFPC2 ramp filters and with the NICMOS narrow-band filters. We will obtain images in the [O II], [O III], H-beta, and Pa-alpha emission line bands to carry out a series of diagnostic tests aimed at detecting and mapping out star-forming regions in the quasar host galaxies.

This direct detection of star-forming regions will confirm indirect indications for star formation in quasar host galaxies. It will provide a crucial test for models of quasar and galaxy evolution, that predict the co-existence of starbursts and "monsters" and will solve the puzzle of why different indicators of star formation give contradictory results. A secondary science goal is to assess suggested correlations between quasar luminosity and the size of the narrow-line region.
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Proposal Category: GO
Scientific Category: COOL STARS
ID: 11223
Title: The Key to Understanding RR Lyr Stars: WFPC2 Observations of a Unique LMC EB with a RR Lyr Component
PI: Edward Guinan
PI Institution: Villanova University

We are proposing HST/WFPC2 2550-10420A multi-band photometry of an important "unique" LMC eclipsing binary with an RR Lyr component. This binary is the only bona fide eclipsing binary (EB) with an RR Lyr component. Because of their constant mean luminosities (L ~ 45 Lsun; <Mv> ~ +0.5 mag) and easily recognizable light curves, RR Lyr variables have long served as the "cornerstone" of the Pop II distance scale in our galaxy and for Local Group galaxies. However, in spite of their critical importance to astronomy, there is a paucity of fundamental data available for RR Lyr stars. In fact, there are no direct measures of their most fundamental properties - such as Mass, Radius and Luminosity. The astrophysical and cosmological consequences of finding an RR Lyr star in an EB are considerable, because the masses and absolute radii of the stars of eclipsing binaries can be determined to within a few percent from time-tested analyses of their light and radial velocity curves. With accurate temperatures and ISM absorption values, determined from the proposed WFPC2 observations, it is possible to determine reliable stellar luminosities and distances. It is for these reasons that we propose WFPC2 observations of the recently discovered detached LMC eclipsing binary OGLE J052218.07-692827.4 (<V> ~18.6-mag; <B-V>0 ~+0.27; Porb = 8.9231-d); the RR Lyr primary component has a pulsation period of P(RR) = 0.564876-d. This important binary star is an integral part of our on-going multi-wavelength study of selected eclipsing binaries in nearby galaxies. Three HST/WFPC2 orbits are requested to determine complementary accurate Teff, log g and ISM absorption (A-lambda) for the component stars. These quantities will be combined with the fundamental stellar data being determined from our ground-based radial velocity and photometric observations. The combined observations will yield accurate stellar masses, radii, temperatures and luminosities, as well as a direct distance to the binary and LMC-Bar. This RR Lyr/EB thus offers the unprecedented opportunity to: (1) determine directly (and for the first time) the fundamental physical properties (M, R, L) of an RR Lyr star, (2) directly calibrate "in situ" the zero-point of the LMC RR Lyr - P - Mv - Z relation and (3) to derive an additional accurate distance to the Bar region

of the LMC.
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Proposal Category: GO
Scientific Category: HOT STARS
ID: 11224
Title: Unraveling Mira AB Accretion Mysteries
PI: Margarita Karovska
PI Institution: Smithsonian Institution Astrophysical Observatory

Wind accretion is one of the most common yet poorly understood phenomena in astrophysics. A key step toward advancing our understanding of physical processes and accretion geometries in wind accreting systems is direct imaging of the individual components and mass flows. The nearby symbiotic binary Mira AB, composed of an AGB donor star and an accreting compact companion, is a unique target since it can be easily spatially resolved with the HST, and thus serves as a perfect test laboratory for accretion studies in wind interacting systems. We propose to carry out WFPC2 observations of Mira AB following the HST and Chandra detections of an unprecedented outburst from the cool giant, and the discovery of an accretion stream showing for the first time evidence for a direct mass transfer between the components in a wind accreting system. High-angular-resolution multiwavelength imaging at UV /optical wavelengths will allow us to determine the properties of the ejected material as it flows throughout the binary and interacts with the Mira A circumstellar material and wind; the physical characteristics of mass transfer in this system and especially the role of the accretion stream between Mira A and Mira B; and the response of the system to the increased accretion rate onto Mira B following the outburst. These results will provide crucial inputs and quantitative constraints to models of wind interacting systems and will also anchor our understanding of accretion processes in a wide range of interacting binaries that cannot be currently resolved, including in other symbiotics and more exotic systems such as accreting black holes and neutron stars in high-mass X-ray binaries.
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Proposal Category: GO
Scientific Category: AGN/QUASARS
ID: 11225
Title: The Wavelength Dependence of Accretion Disk Structure
PI: C. Kochanek
PI Institution: The Ohio State University Research Foundation

We can now routinely measure the size of quasar accretion disks using gravitational microlensing of lensed quasars. The next step to testing accretion disk models is to measure the size of accretion disks as a function of wavelength, particularly at the UV and X-ray wavelengths that should probe the inner, strong gravity regime. Here we focus on two four-image quasar lenses that already have optical (R band) and X-ray size measurements using

microlensing. We will combine the HST observations with ground-based monitoring to measure the disk size as a function of wavelength from the near-IR to the UV. We require HST to measure the image flux ratios in the ultraviolet continuum near the Lyman limit of the quasars. The selected targets have estimated black hole masses that differ by an order of magnitude, and we should find wavelength scalings for the two systems that are very different because the Blue/UV wavelengths should correspond to parts of the disk near the inner edge for the high mass system but not in the low mass system. The results will be modeled using a combination of simple thin disk models and complete relativistic disk models. While requiring only 18 orbits, success for one system requires observations in both Cycles 16 and 17.

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Proposal Category: GO
Scientific Category: SOLAR SYSTEM
ID: 11226
Title: Hubble Investigation of Comet 8P/Tuttle
PI: Philippe Lamy
PI Institution: Laboratoire d'Astrophysique de Marseille

Comet 8P/Tuttle is a returning nearly isotropic comet (NIC) with an outstanding apparition in cycle 16, passing within 0.25 AU of the Earth. We propose a 12-orbit Hubble investigation that will allow us to determine the size, shape, rotational period, and color (UBVRI) of 8P, thereby providing the most detailed view of a NIC nucleus since the spacecraft flyby of 1P/Halley in 1986. The return of 8P is a rare opportunity, and we expect many other observatories, including Spitzer, to be investigating this comet. Combining the Hubble results with those from other observatories should yield a comprehensive picture of this NIC that can be compared to the detailed data collected on ecliptic comets (ECs) during the past 3 decades. The differences and similarities between NICs and ECs should yield valuable insights into the origin and evolution of comets.

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Proposal Category: GO
Scientific Category: UNRESOLVED STELLAR POPULATIONS
ID: 11227
Title: The orbital period for an ultraluminous X-ray source in NGC1313
PI: Jifeng Liu
PI Institution: Smithsonian Institution Astrophysical Observatory

The ultraluminous X-ray sources (ULXs) are extragalactic point sources with luminosities that exceed the Eddington luminosity for conventional stellar-mass black holes by factors of 10 - 100. It has been hotly debated whether the ULXs are just common stellar-mass black hole sources with beamed emission or whether they are sub-Eddington sources that are powered by the long-sought intermediate mass black holes (IMBH). To firmly decide this question, one

must obtain dynamical mass measurements through photometric and spectroscopic monitoring of the secondaries of these system. The crucial first step is to establish the orbital period of a ULX, and arguably the best way to achieve this goal is by monitoring its ellipsoidal light curve. The extreme ULX NGC1313 X-2 provides an outstanding target for an orbital period determination because its relatively bright optical counterpart (V = 23.5) showed a 15% variation between two HST observations separated by three months. This level of variability is consistent with that expected for a tidally distorted secondary star. Here we propose a set of 20 imaging observations with HST/WFPC2 to define the orbital period. This would be the first photometric measurement of the orbital period of a ULX binary. Subsequently, we will propose to obtain spectroscopic observations to obtain its radial velocity amplitude and thereby a dynamical estimate of its mass.

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Proposal Category: GO
Scientific Category: STAR FORMATION
ID: 11228
Title: Extrasolar Planet XO-2b
PI: Peter McCullough
PI Institution: Space Telescope Science Institute

We propose observations of the newly discovered extrasolar planet XO-2b and its twin star XO-2. When combined with the transit light curve, the FGS-derived parallax will constrain the stellar mass of the host star XO-2. From the high signal-to-noise near-IR time series resulting from NICMOS grism spectroscopy, we will refine the system parameters, in particular radii of the star and planet. From the same data, we will search for evidence of water vapor in the atmosphere via transmission spectroscopy. Differential observations with NICMOS in the spectroscopic mode will be used to search for the small spectral changes that occur during planetary transits resulting from absorption of stellar light as it passes through the planetary atmosphere. Water is an important constituent, the detection of which would provide information on Oxygen, and it has a convenient strong band well-positioned for NICMOS.

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Proposal Category: GO
Scientific Category: ISM AND CIRCUMSTELLAR MATTER
ID: 11229
Title: SEEDS: The Search for Evolution of Emission from Dust in Supernovae with HST and Spitzer
PI: Margaret Meixner
PI Institution: Space Telescope Science Institute

The role that massive stars play in the dust content of the Universe is extremely uncertain. It has long been hypothesized that dust can condense within the ejecta of supernovae (SNe), however there is a frustrating

discrepancy between the amounts of dust found in the early Universe, or predicted by nucleation theory, and inferred from SN observations. Our SEEDS collaboration has been carefully revisiting the observational case for dust formation by core-collapse SNe, in order to quantify their role as dust contributors in the early Universe. As dust condenses in expanding SN ejecta, it will increase in optical depth, producing three simultaneously observable phenomena: (1) increasing optical extinction; (2) infrared (IR) excesses; and (3) asymmetric blue-shifted emission lines. Our SEEDS collaboration recently reported all three phenomena occuring in SN2003gd, demonstrating the success of our observing strategy, and permitting us to derive a dust mass of up to 0.02 solar masses created in the SN. To advance our understanding of the origin and evolution of the interstellar dust in galaxies, we propose to use HST's WFPC2 and NICMOS instruments plus Spitzer's photometric instruments to monitor ten recent core-collapse SNe for dust formation and, as a bonus, detect light echoes that can affect the dust mass estimates. These space-borne observations will be supplemented by ground-based spectroscopic monitoring of their optical emission line profiles. These observations would continue our 2-year HST and Spitzer monitoring of this phenomena in order to address two key questions: Do all SNe produce dust? and How much dust do they produce? As all the SN are witin 15 Mpc, each SN stands an excellent chance of detection with HST and Spitzer and of resolving potential light echoes.

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Proposal Category:	GO
Scientific Category:	ISM IN EXTERNAL GALAXIES
ID:	11230
Title:	HST FUV Observations of Brightest Cluster Galaxies: The Role of Star Formation in Cooling Flows and BCG Evolution
PI:	Christopher O'Dea
PI Institution:	Rochester Institute of Technology

The intracluster medium (ICM) now appears to be a very dynamic place where heating and cooling processes vie for dominance and an uneasy equilibrium is maintained. Since these same processes may operate during the process of galaxy formation, the centers of clusters of galaxies provide low redshift laboratories for studying the critical processes involved in galaxy formation and black hole growth. At the present time, the main questions are (1) How much gas is cooling out of the ICM? (2) How much star formation is ongoing? (3) What is the impact of the gas and star formation on the central BCG? In order to measure the current star formation in BCGs we have undertaken a program of Spitzer IRAC and MIPS observations. We are in process of obtaining observations of a sample of Brightest Cluster Galaxies in 70 clusters selected from the ROSAT all sky survey. In about 25% of the sources observed so far, we detect a mid-IR excess which we attribute to dust heated by star formation. We propose to obtain ACS/SBC observations of the Lyman Alpha emission line and the adjacent FUV continuum in 7 BCGs which are in cooling core clusters of galaxies and have a large mid-IR excess. We also propose WFPC2 F606W observations of the two clusters without high resolution imaging to allow us

to image the dust on the same scale as the Far UV continuum. The FUV will allow us to confirm the presense of ongoing starformation in these BCGs and will allow us to rule out an AGN as the dominant contributer to the mid-IR. The morphology and spatial extent of the young stars and the heated dust and CO will constrain the spatial scale over which star formation occurs and thus where the cooling gas is deposited. The combination of our FUV and IR observations will allow us to estimate the star formation rates which must balance the rate at which cold gas is deposited in the BCG. Our proposed FUV observations will produce unique information about the cooling gas, the true mass accretion rates, and the star formation rates in BCGs and its effect on the galaxy.

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Proposal Category: GO
Scientific Category: ISM AND CIRCUMSTELLAR MATTER
ID: 11231
Title: Calibration of the WFPC2 HeII and [SII] Filters.
PI: C. O'Dell
PI Institution: Vanderbilt University

Observations of NGC 6720 (the Ring Nebula) will be used to determine the calibration constants for the important emission-line filters that isolate nebular HeII (F469N) and [SII] (F673N) emission. The pre-launch calibrations are inadequate because of possible temporal changes and the fact that these interference filters are used in a different configuration from that of the ground calibration. The Ring Nebula is a nearly ideal reference source as multiple 2.4"x4.0" samples have been accurately measured spectro-photometrically and five of the six samples can be imaged with one pointing of the HST. The method of derivation of the calibration constants will be the same as previously employed to calibrate the primary emission-line filters for the WFPC2 (F487N, F502N, F656N, F658N) and ACS (F502N, F658N, F660N) using the Orion Nebula as a reference source. However, Orion cannot be used for this calibration because the targeted lines are weak ([SII]) or absent (HeII) and the scattered-light continuum is strong. The Ring Nebula has strong HeII emission in its middle, strong [SII] emission in its main ring, and a weak (atomic only) continuum.

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Proposal Category: GO
Scientific Category: ISM AND CIRCUMSTELLAR MATTER
ID: 11232
Title: Determination of Angular Expansion Velocities in the Ring Nebula
PI: C. O'Dell
PI Institution: Vanderbilt University

The Ring Nebula (NGC 6720) represents an important stage in the evolution of planetary nebulae, being large enough that it has entered the post fast-wind stage yet has not reached the late ballistic phase of objects like the Helix

Nebula. Understanding this nebula well presents the opportunity to determine how nebulae transition from their creation phase into the form they have as their material enters the interstellar medium. A recent study based on ground-based spectroscopy has derived a new and accurate model for the Ring Nebula. A well defined characteristic of this model is that it predicts a tangential velocity of 20 km/s whereas the application of its quite uncertain trigonometric parallax distance of 700 (+450/-200) pc with the angular expansion velocity determined from HST observations with a 2 year time base indicates a tangential velocity of 69 (+45/-20) km/s. This disagreement indicates that either the distance is even more uncertain than thought or that the earlier angular velocity is incorrect. We propose to make a new set of observations of the Ring Nebula in the diagnostic emission line filters F469N (HeII), F502N ([OIII]), and F658N ([NII]) that will produce much more accurate angular velocities than the previous study by having a time base of 8.8 years and imaging the nebula entirely within a single CCD of the WFPC2. The primary result from this study will be an accurate distance to this important nebula and from this to be able to use this object to refine our picture of how planetary nebulae evolve during middle-age.

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Proposal Category: GO
Scientific Category: RESOLVED STELLAR POPULATIONS
ID: 11233
Title: Multiple Generations of Stars in Massive Galactic Globular Clusters
PI: Giampaolo Piotto
PI Institution: Universita di Padova

This is a follow-up to recent HST imaging of NGC 2808, which discovered that its main sequence is triple, with three well-separated parallel branches (Fig.~1). Along with the double MS of Omega Centauri, this challenges the long-held paradigm that globular clusters are simple, single stellar populations. The cause of this main sequence multiplicity in both clusters is likely to be differences in helium abundance, which could play a fundamental role in the understanding of stellar populations. We propose to image seven more of the most massive globular clusters, to examine their main sequences for indications of splitting.

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Proposal Category: GO
Scientific Category: HOT STARS
ID: 11234
Title: A Brief Revisit of the Crab
PI: Roger Romani
PI Institution: Stanford University

We propose using WFPC2 to obtain continuum-dominated images of the Crab pulsar and environs closely duplicating archival exposures from 1994 and 1995. By matching the archival data we can realize ~3mas precision astrometry with a

minimum of systematic effects over a maximum (~13.5y) baseline. This determines the Crab proper motion to better than 0.3mas/yr (3km/s) accuracy and measures its position angle to better than 1.5degrees, i.e. reducing the errrors of the best present (HST archive) measurement by a factor of three. Most importantly, this provide a nearly systematic-free result. This proper motion measurement would match the precision of the CXO-measured angular momentum vector. Comparison of these vectors is the foundation of an effort to understand the physical origin of the large momentum kick at pulsar birth.
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Proposal Category: GO
Scientific Category: UNRESOLVED STELLAR POPULATIONS
ID: 11235
Title: HST NICMOS Survey of the Nuclear Regions of Luminous Infrared Galaxies in the Local Universe
PI: Jason Surace
PI Institution: California Institute of Technology

At luminosities above 10^11.4 L_sun, the space density of far-infrared selected galaxies exceeds that of optically selected galaxies. These `luminous infrared galaxies' (LIRGs) are primarily interacting or merging disk galaxies undergoing enhanced star formation and Active Galactic Nuclei (AGN) activity, possibly triggered as the objects transform into massive S0 and elliptical merger remnants. We propose NICMOS NIC2 imaging of the nuclear regions of a complete sample of 88 L_IR > 10^11.4 L_sun luminous infrared galaxies in the IRAS Revised Bright Galaxy Sample (RBGS: i.e., 60 micron flux density > 5.24 Jy). This sample is ideal not only in its completeness and sample size, but also in the proximity and brightness of the galaxies. The superb sensitivity and resolution of NICMOS NIC2 on HST enables a unique opportunity to study the detailed structure of the nuclear regions, where dust obscuration may mask star clusters, AGN and additional nuclei from optical view, with a resolution significantly higher than possible with Spitzer IRAC. This survey thus provides a crucial component to our study of the dynamics and evolution of IR galaxies presently underway with Wide-Field, HST ACS/WFC and Spitzer IRAC observations of these 88 galaxies. Imaging will be done with the F160W filter (H-band) to examine as a function of both luminosity and merger stage (i) the luminosity and distribution of embedded star clusters, (ii) the presence of optically obscured AGN and nuclei, (iii) the correlation between the distribution of 1.6 micron emission and the mid-IR emission as detected by Spitzer IRAC, and (iv) the evidence of bars or bridges that may funnel fuel into the nuclear region. The NICMOS data, combined with the HST ACS, Spitzer, and GALEX observations of this sample, will result in the most comprehensive study of merging and interacting galaxies to date.
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Proposal Category: GO
Scientific Category: COSMOLOGY
ID: 11236

Title: Did Rare, Large Escape-Fraction Galaxies Reionize the Universe?
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 that the escape fraction is close to zero in most galaxies, even among young starbursts, but is large in 15-25% of them. Non-uniform escape fractions are expected as a result of violent events creating clear paths in small parts of galaxies. The number of galaxies observed with high escape fraction will result from the combination of the intrinsic number with clear lines of sight and their orientation with respect to the observer. We propose to measure the fraction of escaping Lyman continuum radiation in a large sample (47) of z~0.7 starbursts in the COSMOS field. These compact UV-lumnious galaxies are good analogs to high redshift LBGs. Using the SBC/PR130L we can quickly (1-4 orbits) detect relative escape fractions (f_LC/f_1500) of 25% or more. This will be the first measurement of the escape fraction in sources between z=1 and the local universe. We expect ~10 detections. Stacking will set limits of <4% on the relative escape fraction in the rest. We will correlate the LC detections with the properties of the galaxies. By targetting z~0.7 in COSMOS, we will have tremendous ancillary information on those sources. A non-detection in all sources would be significant (99% confidence). This would imply that QSOs provide the overwhelming majority of ionizing radtion at z<1, requiring substantial evolution in the processes within Lyman break galaxies which allow large escape fractions at high redshift.
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Proposal Category: GO
Scientific Category: AGN/QUASARS
ID: 11237
Title: The origin of the break in the AGN luminosity function
PI: Lutz Wisotzki
PI Institution: Astrophysikalisches Institut Potsdam

We propose to use NICMOS imaging to measure rest-frame optical luminosities and morphological properties of a complete sample of faint AGN host galaxies at redshifts z ~ 1.4. The targets are drawn from the VLT-VIMOS Deep Survey, and they constitute a sample of the lowest luminosity type 1 AGN known at z > 1. The spectroscopically estimated black hole masses are up to an order of magnitude higher than expected given their nuclear luminosities, implying highly sub-Eddington accretion rates. This exactly matches the prediction made by recent theoretical models of AGN evolution, according to which the faint end of the AGN luminosity function is populated mainly by big black holes that have already exhausted a good part of their fuel. In this proposal we want to

test further predictions of that hypothesis, by focussing on the host galaxy properties of our low-luminosity, low-accretion AGN. If the local ratio between black hole and bulge masses holds at least approximately at these redshifts, one expects most of these low-luminosity AGN to reside in fairly big ellipticals with stellar masses around and above 10^11 solar masses (in contrast to the Seyfert phenomenon in the local universe). With NICMOS imaging we will find out whether that is true, implying also a sensitive test for the validity of the M_BH/M_bulge relation at z ~ 1.4.

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Proposal Category: AR
Scientific Category: COOL STARS
ID: 11238
Title: Searching For Unresolved Binary Brown Dwarfs Using Point Spread Functions
PI: Jacob Albretsen
PI Institution: Brigham Young University

There currently are objects of L and T spectral type with errors in their classification of +/- 1 to 2. Metallicity and gravitational differences have accounted for some of these discrepancies, and recent studies have shown unresolved binary brown dwarfs may offer some explanation as well. However limitations in technology and resources make it difficult to clearly resolve an object that may be binary in nature. It has been shown that using model point-spread functions for single and binary sources have been able to identify statistically strong binary candidates from images that are apparently unresolved. The HST archive contains numerous observations of brown dwarfs from NICMOS that have never been rigorously analyzed for binary properties. Results from for this archive proposal will help determine if there really is an increase in binary brown dwarfs in the L/T transition and identify potential candidates for future observations to determine orbital information.

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Proposal Category: AR
Scientific Category: COOL STARS
ID: 11239
Title: Identifying Atomic and Molecular Absorption in an Extrasolar Planet Atmosphere
PI: Travis Barman
PI Institution: Lowell Observatory

A significant amount of Hubble Space Telescope time has been spent observing a normal bright main-sequence star, HD209458, which happens to also be home to one of the few transiting extrasolar planets. Time-series spectroscopic data taken with STIS and ASC are available in the archive covering numerous planetary transits over the past 7 years. These data have allowed the discovery of sodium absorption in HD209458b's atmosphere along with a hydrogen-rich extended exosphere. There is great potential for significant

new discoveries with these data that could further constrain the chemical composition and chemical evolution of HD209458b. This proposal outlines steps toward improving our understanding of the chemical composition of extrasolar giant planet atmospheres by developing new models for the wavelength-dependent eclipse depth that may be directly compared to archival Hubble Space Telescope observations.

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Proposal Category: AR
Scientific Category: STAR FORMATION
ID: 11240
Title: Mass Loss From Hot Jupiters
PI: Eugene Chiang
PI Institution: University of California - Berkeley

Photoionization heating from UV radiation incident on the atmospheres of hot Jupiters drives planetary mass loss in the form of hydrodynamic winds. HST STIS observations of HD 209458b, the first hot Jupiter discovered to transit its host star, have confirmed that the planet is losing atomic hydrogen (Vidal-Madjar et al. 2003) and have suggested that it may be losing OI and CII (Vidal-Madjar et al. 2004). These observations, which can be repeated with the advent of the HST Cosmic Origins Spectrograph (COS), do not necessarily imply loss of gas at a rate large enough to significantly reduce the mass of the planet. HST STIS observations indicating a population of hydrogen in the n=2 state constrain the structure of the planet's escaping atmosphere (Ballester et al.~2007). We propose to construct a model of mass loss from hot Jupiter atmospheres, including realistic heating and cooling, ionization balance, tidal gravity, and pressure-confinement by the stellar wind. We have already constructed a model that resolves the atmosphere's transition from atomic to ionized hydrogen. In our proposed work, we plan to also resolve the transition from molecular to atomic hydrogen. We will employ ray-tracing through our model to explain the HST STIS detections of Lyman alpha and Balmer continuum absorption by neutral hydrogen in an extended atmosphere around HD 209458b, and we will experiment with metal chemistry and vertical mixing in an attempt to reproduce the HST STIS measurement of OI and CII. Our work will provide predictions for future COS measurements. We will infer the correct mass loss rate implied by the Vidal-Madjar et al. (2003) observation and search for new observational diagnostics of hot Jupiter atmospheres.

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Proposal Category: AR
Scientific Category: COSMOLOGY
ID: 11241
Title: IR Background Fluctuations in NICMOS Ultra and Hubble Fields and the Surface Density of First-Light Galaxies
PI: Asantha Cooray
PI Institution: University of California - Irvine

We propose an archival analysis of F160W and F110W NICMOS Ultra Deep Field (NUDF) and Hubble Deep Field North (HDFN) data, combined with deep HST ACS images of the same field, to measure clustering of unresolved IR background (IRB) present in "empty" pixels. These clustering measurements will be used to study any indications for the presence of an unresolved, diffuse IR background from redshifts related to reionization and associated with redshifted UV emission from first-light galaxies and Lyman-alpha emission from recombinations in surrounding HII halos. The IR background from these sources are expected to peak at wavelengths between 1 and 2 microns and it's fluctuations have a clustering spectrum distinctively different from that of low-redshift faint galaxies. We will account for the confusion from latter with ACS detections of faint blue optical galaxies with no IR counterparts in NICMOS images. We will cross-correlate unresolved IR fluctuations between F110W and F160W images of the same field to determine any wavelength dependence of the IR background and to separate various noise and systematic effects which are not common to both passbands. We will simulate to estimate the noise floor generated by residual flat-field errors and the pedestal effect involving varying bias in different quadrants of the NICMOS array. For IR anisotropy power spectrum measurements, we will borrow and implement well established techniques used with cosmic microwave background (CMB) anisotropy maps by the CMB community. At a wavelength of 1.25 microns, DIRBE indicates a total IRB intensity of 54 +/- 17 nW/m^2/sr or 28 +/- 15 nW/m^2/sr, while about 8 nW/m^2/sr comes from known galaxy counts. Our clustering measurements, combined with analytical and numerical models, will lead to a detection of the total IRB intensity from first-light galaxies containing Pop III stars during reionization as low as 3 nW/m^2/sr. A direct estimate on the integrated intensity, and thus the surface density of first-light galaxies, from unresolved IR fluctuations has strong consequences for imaging searches for high-redshift Lyman-alpha emitters and for models of galaxy formation and evolution.

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Proposal Category:	AR
Scientific Category:	COSMOLOGY
ID:	11242
Title:	IR Background Intensity, Anisotropy, and Lyman-alpha Sources in Large Volume Simulations of Reionization
PI:	Asantha Cooray
PI Institution:	University of California - Irvine

We propose to analyze properties of the UV photon background emitted by reionizing sources redshifted to IR wavelngths today in a set of large volume, (100 Mpc)^3, high resolution simulations (24 billion particles) of the cosmic reionization process. Using these cosmological simulations, we will establish, for the first time, the expected IR background intensity at wavelengths between ~1 micron and ~4 microns as well as the anisotropy power spectrum of fluctuations observable with NICMOS F110W/F160W bands and WFC3 IR bands. The new hybrid code for reionization simulations developed at Princeton by CoIs

Cen & Trac includes an adaptive ray tracing algorithm for radiative transfer of ionizing photons from first-light galaxies containing both population II and population III stars. Fluctuation studies of the unresolved intensity in deep IR images, including those with NICMOS, have shown an excess anisotropy contribution above noise when resolved sources down to very faint flux levels are masked out. This excess has been described as a signature of first galaxies containing Pop III stars. While fluctuation measurements have not conclusively established the presence of Pop III stars, we do expect unresolved IR background to fluctuate due to clustering of first-light sources. Given differences in model assumptions, analytical predictions on the fluctuation strength vary widely in the literature, while numerical simulations of reionization have not been used to study IR background statistics. These will be compared to existing measurements and to establish requirements (depth, area) for a WFC3 survey to measure statistics of first galaxies. We will investigate how color information, in terms of fluctuation amplitude ratios of IR bandpasses of NICMOS and WFC3, can be used to study the redshift duration of reionization. Simulations will be used to update number counts, luminosity functions, and clustering of Lyman-alpha sources, and to compare with recent measurements of Lyman-alpha source statistics at z > 6 by taking into account of sample variance within the ~1 degree^2 field provided by simulations. Simulations will also be used to study the transition between dominant Pop III to dominant Pop II starformation, and any observable signatures. In addition to results in peer-reviewed publications, simulation outputs in the form of Lyman-alpha source maps at various passbands of both NICMOS and WFC3 will be made available publicly on the web within a year of beginning this research.

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Proposal Category:	AR
Scientific Category:	AGN/QUASARS
ID:	11243
Title:	Determining the Inclinations of AGN using Narrow-Line Region Kinematics
PI:	D. Crenshaw
PI Institution:	Georgia State University Research Foundation

We will determine the inclinations of the AGN in 36 Seyfert galaxies with STIS G430M and/or G430L long-slit spectra, by measuring radial velocities as a function of position in their narrow-line regions (NLRs) and generating kinematic models to match the observed radial velocities. Our previous studies of three Seyfert galaxies with STIS show that the kinematics of their NLRs are dominated by radial outflow, and that simple biconical outflow models can be used to derive the inclination of the bicone axis, and hence the obscuring torus, with respect to our line of sight. The inclinations will be compared with those from other techniques (water masers, broad Fe K-alpha profiles) to test for discrepancies and identify possible misalignments between the accretion disk, torus, and/or host galaxy. More importantly, our results will provide the foundation for future studies that investigate the dependence of observed properties (e.g., SEDs, absorbing columns, broad-line widths) on

inclination, which is vital for understanding the physics of AGN.
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Proposal Category: AR
Scientific Category: RESOLVED STELLAR POPULATIONS
ID: 11244
Title: WFPC2 CTE and Photometric Zero Points
PI: Andrew Dolphin
PI Institution: Raytheon Company

With charge-transfer efficiency (CTE) losses of several tenths of a magnitude in many current exposures, the accuracy of CTE corrections is a limiting factor in the accuracy of photometry that can be obtained with WFPC2. However, the CTE corrections in common use are five years old, and thus corrections for CTE loss on current observations are made with the dangerous assumption that CTE loss has continued growing over the past five years at the rate it grew for the instruments first eight years of service. The uncertainty caused by this assumption implies that the use of these old CTE corrections is the dominant error source in many WFPC2 images, and will become even worse in Cycle 16 as the extrapolation increases. This proposal seeks to remedy this situation by undertaking an examination of CTE using data of the Omega Cen calibration field obtained over the entire lifetime of WFPC2. The methodology has been proven to produce accurate CTE corrections (indeed, they are the recommended corrections in the WFPC2 handbook and online CTE calculator).
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Proposal Category: AR
Scientific Category: RESOLVED STELLAR POPULATIONS
ID: 11245
Title: Mining the Rich Archive for 47 Tucanae
PI: Peter Edmonds
PI Institution: Eureka Scientific Inc.

We propose to capitalise on the extensive set of scientific and calibration observations of the remarkable globular cluster 47 Tuc. The chief goals are: (1) to address key questions about the binaries found in this massive cluster, including studies of cataclysmic variables (CVs), low-mass X-ray binaries (LMXBs), millisecond pulsars (MSPs) and chromospherically active binaries, and (2) to study a dynamically important but thus far neglected class of binaries, containing subgiant and giant stars. We plan to make the most extensive analysis to date of long-term variability in globular cluster binaries, including searches for dwarf nova outbursts, high and low states and periodic variations for CVs; study accretion rate changes for LMXBs; study active binaries that appear to undergo coronal mass ejections; identify the nature of two binaries that experience incredibly bright X-ray flares; confirm new candidates of rare MSPs with main sequence companions; search for optical IDs of unidentified Chandra sources. This is the richest population of binaries

known in any globular cluster and the complete archival dataset is unlikely to be rivaled for many years. These studies will add to our understanding of this important crash-test laboratory and have broader implications for stellar dynamics, stellar and binary evolution and globular cluster evolution.
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Proposal Category: AR
Scientific Category: COSMOLOGY
ID: 11246
Title: Evolution in the Dark Matter Properties of Strong Lenses through Weak Lensing
PI: Christopher Fassnacht
PI Institution: University of California - Davis

To fully exploit the information on the dark matter mass profiles of galaxies gained from weak lensing and to tie this to their inner regions where baryons play an important role, we propose to investigate a special sample of galaxies, namely strong gravitational lenses. These systems are excellent targets for weak lensing studies because the Einstein ring radii provide a direct measurement of the projected mass at very small scales -- information that is not available for most galaxy samples. This project is especially well suited for an archival program because nearly every strong lens system has been imaged with HST, and the data are public. What makes this project stand out is that we can compare strong lens samples at moderate redshift (median z ~ 0.6) and lower redshift (median z ~ 0.2) and can, thus, use the full power of combining strong and weak lensing in our investigation of evolutionary effects over this timescale. We will use our samples to (1) measure the average mass profile of the sample to R ~ 300 kpc/h, (2) quantify the evolution of stellar mass and virial mass-to-light ratios, and (3) investigate whether the ``bulge-halo conspiracy'', whereby the CDM profiles of galaxies are NFW but the total (baryonic plus CDM) mass profile are isothermal out to ~ 300 kpc/h, is in place at higher redshifts.
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Proposal Category: AR
Scientific Category: ISM AND CIRCUMSTELLAR MATTER
ID: 11247
Title: Light Element Nucleosynthesis through Measurements of Interstellar Boron
PI: Steven Federman
PI Institution: University of Toledo

With the aim of identifying the sources of light element (Li, Be, B, and F) synthesis, we propose a survey of interstellar boron. The B II line at 1362 A will be used to extract the B column density along more than fifty sight lines, many of which are associated with regions of massive star formation shaped by core-collapse supernovae (SNe II). HST spectra are the only means for determining the elemental B abundance for sources outside the solar system. The survey will contain directions that are both molecule poor and molecule rich, thereby enabling us to examine the overall level of boron

depletion onto grains as a function of gas density. Both the average density of neutral material along the line of sight and the density inferred from the fraction of neutral gas in molecular form will be incorporated into the analysis. We will seek sight lines with B abundances enhanced over the value seen in regions with the least depletion; such enhancements mainly arise from recent production of B-11. The boron column density, with the fluorine column density obtained from archival FUSE spectra of the F I line at 954 A, will give the B/F abundance ratio. This ratio is a diagnostic of the importance of neutrino-induced spallation in SNe II in effecting synthesis of B and F, a process for which direct observational evidence is still lacking.

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Proposal Category: AR
Scientific Category: RESOLVED STELLAR POPULATIONS
ID: 11248
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 16, we plan to extend our successful work from previous cycles. This proposal is complementary to our Cycle 16 survey proposal, whose primary purpose is to obtain late-time photometry of SNe. It is also complementary to our Cycle 16 ToO proposal, which is designed to pinpoint the locations of recent SNe to help determine their progenitor stars.

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Proposal Category: AR
Scientific Category: ISM IN EXTERNAL GALAXIES
ID: 11249
Title: Dust Enhancement of the Lyman Alpha Equivalent Width at z ~ 4.5 in the CDF-S
PI: Steven Finkelstein
PI Institution: Arizona State University

We propose to study high-redshift Lyman alpha emitting galaxies in order to discover the true nature of their large equivalent widths. Lyman alpha galaxies are interesting to study because they are very faint in the continuum but exhibit a very strong emission line, beyond what is expected from normal stellar populations. It has been believed that the large equivalent widths seen in high-redshift galaxies are intrinsic, and are caused by hot stellar photospheres from ongoing star formation. This would indicate that these objects are young, with a primitive composition. It would also indicate that they could be a significant source of reionization photons. However, there is an alternative scenario for the cause of this large Lyman alpha EW. If the interstellar medium inside one of these galaxies consisted of clumpy dust clouds in a tenuous ionized medium, then continuum photons would penetrate deep into these clouds, while the Lyman alpha photons would be resonantly scattered at the surface. This would result in a much higher escape fraction for Lyman alpha photons than for continuum photons, effectively enhancing the equivalent width. Thus, a galaxy with this ISM and older stars could be made to look like a young, star-forming galaxy on the basis of its Lyman alpha EW. We will use the GOODS CDF-S treasury data set to measure the continuum colors of Lyman alpha galaxies, and thereby distinguish between these scenarios: If large equivalent widths are due to hot photospheres, the continuum should be blue, while if they are due to dust enhancement, the continuum should be red. The GOODS CDF-S dataset has a limiting magnitude that is 2 magnitudes deeper than our ground-based broad-band dataset. This will reduce the errors on the broad-band colors by up to 75%. To find Lyman alpha galaxies in the CDF-S, we have narrow-band images which will be used for selection of z ~ 4.5 galaxies. By combining our narrow band images with the high quality GOODS data, we will be able to study the cause of the Lyman alpha equivalent width in individual galaxies at high-redshift.

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Proposal Category:	AR
Scientific Category:	STAR FORMATION
ID:	11250
Title:	Shedding Light on Feedback: The Interaction of YSO Outflows in L1551
PI:	Adam Frank
PI Institution:	University of Rochester

Energetic outflows are an ubiquitous phenomena associated with young stellar objects and are believed to exert a strong effect on their parent molecular clouds. In most young clusters the density of newly forming stars implies that parsec scale outflows may sweep over a significant fraction of the cluster volume and interact with each other. The nature and dynamics of these interactions in an environmental context has yet to be investigated in detail. Thus the time is ripe to push forward the construction of detailed ecological studies of star formation where the cloud, stars and outflows are seen as a coherent interacting system. Such a perspective is however hampered by the complexity of the problem. Proceeding forward will require isolation of key

components of an overarching theory. Finding relatively clean examples of outflow feedback is critical to exploring more general issues star formation ecology. We seek to carry forward a well focused study of outflow feedback in the L1551 region. Using Adaptive Mesh Refinement MHD code we propose a computational study of multiple jets interacting with their environment and their role in altering the properties of their parent cloud. The questions to be addressed are: What is the combined effect of jets oriented at different angles on the overall turbulent motions in the cloud; How effective is the coupling between outflows atndcloud material; How effective are the combined outflows at disrupting and dispersing the cloud material; How effective are the combined outflows at seeding turbulence into the cloud.

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Proposal Category: AR
Scientific Category: ISM AND CIRCUMSTELLAR MATTER
ID: 11251
Title: Beyond the Textbook: Temporal Systematics of Planetary Nebula Evolution
PI: Adam Frank
PI Institution: University of Rochester

The study of PN shapes has been propelled forward by the high angular resolution of HST into a state of flux. Currently the field is undergoing a profound reassessment as mechanisms such as binary companions, accretion disks, MHD outflow launching and jets become central to a fundamental understanding of these objects. Making progress now requires more systematic studies of PN databases (such as HST) which show strong evidence that nebular shapes change dramatically in time. In order to connect PN shapes to evolutionary mechanisms we propose using high resolution Adaptive Mesh Refinement MHD codes, built by the PI, to follow the evolution of three broad classes of models and compare their predictions with the existing data, particularly a new catalogue of HST PN images.

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Proposal Category: AR
Scientific Category: UNRESOLVED STELLAR POPULATIONS
ID: 11252
Title: Ultraluminous X-ray sources in elliptical galaxies and the X-ray binary/globular cluster connection
PI: Elena Gallo
PI Institution: University of California - Santa Barbara

We propose to exploit archival HST/ACS observations of 100 spheroidal galaxies in the Virgo cluster in order to identify the optical counterparts of about 4500 bright X-ray binaries from our ongoing Chandra survey. Based on the shape of the cumulative luminosity function scaled to the mass of the whole sample, we expect to detect around 100 Ultraluminous X-ray Sources (ULXs): the combination of the high resolution and sensitivity of the ACS images will effectively allow us, for the first time, to discriminate between background

sources and genuine ULXs for each and every candidate. This, in turn, will allow us to determine whether early-type galaxies harbor ULXs in abundance, and, if so, whether they are preferably in globular clusters, also readily identifiable from the HST images. In addition, this unprecedented catalog of optical counterparts of X-ray sources will yield new information on the properties of low mass X-ray binaries and their association with globular clusters. Finally, by producing a large and clean sample, our study will settle the debate on the presence of a break in the X-ray luminosity function of this population.
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Proposal Category: AR
Scientific Category: COSMOLOGY
ID: 11253
Title: Sizes and Morphology of z=3.1 Lyman Alpha Emitting Galaxies in the Extended CDF-S
PI: Eric Gawiser
PI Institution: Rutgers the State University of New Jersey

Lyman Alpha Emitting galaxies (LAEs) seen at high redshift appear to be galaxies in the act of formation. They are currently the most promising candidates for the progenitors of typical spiral galaxies like the Milky Way. The LAEs tend to be younger, lower in mass, and less chemically evolved than the better-studied Lyman Break Galaxies (LBGs). Wide-field ACS imaging allows us to study the physical properties of these objects at kpc scales to gain a better understanding of the interconnected processes of mergers and star formation that play fundamental roles in galaxy formation. We will use archival ACS images of the Extended Chandra Deep Field-South from GEMS, GOODS, and UDF to study the size and morphology of our sample of 162 Lyman Alpha Emitters at z=3.1, 47 of which have confirmed spectroscopic redshifts. We will perform the identical analysis on a sample of 34 spectroscopically confirmed Lyman Break Galaxies at $2.7<z<3.9$ to compare the physical properties of these two families of high-redshift galaxies. At this redshift, the ACS F606W and F850LP bands trace the rest-frame ultraviolet radiation from ongoing star formation. We will determine parametric measures of morphology (Sersic radii, CAS parameters, Gini coefficient, M20) along with non-parametric measures (half-light radii, number of star-forming clumps, size and separation of clumps) to provide critical constraints upon models of galaxy formation. We will use the objects that lie in the deeper GOODS and UDF regions to model uncertainties in the GEMS results. We will correct the astrometric zeropoints of the GEMS images and reproject them to match the standard GOODS/MUSYC pixelization scheme for this field and will offer these images to the community via the HST archive.
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Proposal Category: AR
Scientific Category: COOL STARS
ID: 11254

Title: Analysis of Red Giant Oscillations from a 27 Day ACS/WFC Time-Series on NGC 6397
PI: Ronald Gilliland
PI Institution: Space Telescope Science Institute

Observations of solar-like oscillations have started to provide excellent results with firm detections in recent years for dwarfs, subgiants and red giant stars -- all with radial velocities. We are now poised to further exploit these recent successes with more systematic exploration of oscillations in stars across the color-magnitude diagram (CMD). Giants are of particular interest as allowing tests of stellar structure and evolution in this complicated time in a stars life, while presenting observational signals of much larger amplitude than for dwarfs. Study of stellar oscillations requires unusual combinations of long time coverage to obtain the requisite frequency resolution, and precision to detect the fraction of a mmag amplitude modes to be studied here. Time coverage of one week is a lower limit for study of modes which in the giants will have periods of 0.25-3 days, while intensive observations over multiple weeks would be ideal. We will show excellent success at detecting oscillations in giants (all of which are strongly saturated in these data) from a 7 day observation program (GO 9750) conducted for extrasolar planet detection in the galactic bulge. This proposal is for analysis of giants serendipitously observed as part of GO-10424 a 126 orbit program with ACS/WFC on NGC 6397 to probe the bottom of the white dwarf cooling sequence. These ~400 exposures over 27 days for NGC 6397 will allow asteroseismic results on ~40 giants, including mode lifetime estimates not possible at only 7 days.
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Proposal Category: AR
Scientific Category: UNRESOLVED STELLAR POPULATIONS
ID: 11255
Title: Simulating the Evolution of the Galaxy Luminosity Function from z=6 to the Present.
PI: Fabio Governato
PI Institution: University of Washington

Using hydrodynamical simulations of galaxy formation we will provide (1) updated predictions for the luminosity function of galaxies in HST and Spitzer bands from z ~ 6 to the present and (2) study the physical mechanism that drives its evolution. Particular emphasis will be on providing results easily comparable with the real observations: Using the code Sunrise (developed by P.Jonsson, UCSC) we will produce artificial images at kpc resolution for thousand of galaxies to obtain individual magnitudes and light profiles in HST and Spitzer bands that keep into account the detailed geometry of each galaxy and a self consistent treatment of dust reprocessing of light sources. The simulations will consists of a large, 800 million particles SPH simulation of a 50 Mpc cosmological volume and of several very high resolution simulations of individual galaxies in a cosmological context. While the large volume will

provide us with a large statistical sample, the high resolution simulations will allow us to identify the physical mechanisms (cold flows, energy feedback, mergers) that drive the evolution of the galaxy Luminosity Function at different masses and cosmic times. This double approach will allow us to properly evaluate any numerical effects present in the simulations.
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Proposal Category: AR
Scientific Category: HOT STARS
ID: 11256
Title: Neon Abundance in Hot Central Stars of Planetary Nebulae: A New Clue to Late Stellar Evolution
PI: James Herald
PI Institution: The Johns Hopkins University

We propose to analyze archival HST spectra of a selected sample of central stars of planetary nebulae (CSPN) for which FUSE spectra are also available. The primary goal is to derive the neon abundance in their stellar atmospheres. While the abundances of most "hydrogen-rich" CSPN are well explained by evolutionary models, those of "hydrogen-deficient" CSPN are not. One explanation for the abundances of the latter is the "born-again" scenario, which predicts enhancements in carbon, oxygen, and neon resulting from a late helium shell flash. From recent modeling of far-UV and UV spectra with a revised version of the stellar atmosphere code CMFGEN which included high-ionization stages of neon, we discovered that in very hot (Teff > 80,000 K) CSPN, several transitions from high ionized neon may be visible at UV and far-UV wavelengths (Herald, Bianchi & Hillier, 2005). Our modeling shows that these features are highly sensitive to the neon abundance. We will model archival HST spectra concurrently with FUSE spectra to determine the stellar parameters such as effective temperature, and also the neon abundance. Our sample of hot CSPN spans a range of evolutionary phases. The neon abundance is an important clue to the chemical processing and subsequent dredge-up and mixing in the stellar atmosphere as predicted by the born-again scenario. Also, neon is a key component to understanding how CSPN contribute to the chemical enrichment of the surrounding ISM. This study will probe the late stages of stellar evolution with unprecedented diagnostics.
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Proposal Category: AR
Scientific Category: COSMOLOGY
ID: 11257
Title: Dust lanes since z~1
PI: Benne Holwerda
PI Institution: Space Telescope Science Institute

Dust lanes are an iconic part of edge-on spirals which predominantly occur in the larger faster-rotating disks (V > 120 km/s). This observational fact has now been well established and linked to the vertical gravitational stability

of spiral disks: the ISM in the massive disks collapses into the thin lanes. A survey of distant (z<1) edge-on spirals in the Extended Groth Strip will give the corresponding critical velocity at which dust lanes appear and the fraction of spirals that display them. This will allow us to study the evolution in dust disks with redshift. This survey will have implications for the number of massive HI-rich disks, the balance between ISM and SFR in earlier disks and the Tully-Fisher relation.
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Proposal Category: AR
Scientific Category: RESOLVED STELLAR POPULATIONS
ID: 11258
Title: Removing the herring-bone pattern-noise from *all* STIS Side-2 CCD data: a factor ~3 enhancement in sensitivity
PI: Rolf Jansen
PI Institution: Arizona State University

When STIS resumed operations in July 2001 using the redundant "Side-2" electronics, the read-noise of the CCD detector appeared to have increased by ~1 e- due to a superimposed and highly variable "herring-bone" pattern-noise. For the majority of programs aiming to detect signals near the STIS design limits, the impact of this noise is far more serious than implied by a mere 1 e- increase in the amplitude of the read-noise, as it is of a systematic nature. We have perfected a method to cleanly remove this pattern-noise from raw STIS CCD frames. It is robust, but too costly in terms of CPU time and overhead to incorporate into the regular HST/STIS OTFR-pipeline. Systematic application therefore demands a one-time dedicated off-line effort beyond the scope of the work outlined in the STIS close-out calibration plan. As a service to the STIS user community, we propose to fully remove this excess noise from *all* raw, un-binned, "Side-2" STIS/CCD frames, and so significantly augment the potential of the STIS data base for future NUV--NIR archival research. The noise characteristics and effective sensitivity of the resulting cleaned data, to be delivered back to the HST Archive, will closely match those of CCD data taken during operations with the primary electronics --- representing a gain of a factor ~3 in sensitivity at faint flux levels, at low surface-brightness levels, as well as at small spatial scales. All software will be documented and made available to the community. This archival calibration legacy program requests a modest, but necessary, investment of resources to assure a long-lasting STIS legacy. Science programs that will benefit include: (1) *all* STIS/CCD spectroscopy of faint point- or extended sources; (2) *all* STIS/CCD imaging of faint point sources or low surface-brightness extended sources; and (3) *all* STIS/CCD programs that combine data obtained with both primary and redundant electronics.
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Proposal Category: AR
Scientific Category: SOLAR SYSTEM
ID: 11259

Title: Comprehensive Analysis of Neptune's Features
PI: Erich Karkoschka
PI Institution: University of Arizona

Hubble took an amazing data set of Neptune in nine GO programs between 1994 and 2006, consisting of 408 WFPC2 exposures with several filters present in each program. The PIs of these programs, Hammel, Sromovsky, and Rages, published a variety of results about Neptune's atmosphere based on each program. However, the typical size of the grants for each program did not allow all scientific questions of these rich data sets to be addressed. I propose to analyze these 400 images to create a consistent data set spanning 12 years, and I will make even the intermediate results available, such as 400 consistently calibrated images. The combined data set will then be able to address more far reaching questions than could be done by single data sets. Whereas previous studies focused on only a few center-to-limb measurements for a limited selection of latitudes and wavelengths, I will investigate the whole data set and analyze 16,000 center-to-limb curves. I will use the principal component analysis and various statistical tests to find the hidden variations on Neptune. I created software for a similar project on Hubble's Saturn images. I am ready to adapt and apply it to Hubble's Neptune images. The huge number of variable features on Neptune contain an ideal probe about atmospheric dynamics. Previous investigations have only scratched pieces of the surface of this treasure. It is time for a comprehensive study of the whole data to discover fundamenatal insights about atmospheric dynamics.
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Proposal Category: AR
Scientific Category: COSMOLOGY
ID: 11260
Title: Galaxy Shapes and Gravitational Lensing
PI: Charles Keeton
PI Institution: Rutgers the State University of New Jersey

The mass distributions in gravitational lens galaxies--even just the stellar components--are almost certainly more complicated that we usually assume. This probably contributes to the problems with lensing constraints on the Hubble constant. It might also confound studies of dark matter substructure: we recently found that edge-on disk components in elliptical lens galaxies can create "anomalous" flux ratios similar to those often attributed to dark matter substructure. We propose to critically examine how galaxy shapes affect these applications of gravitational lensing. We will use real galaxies from the GEMS (Galaxy Evolution from Morphology and SEDs) survey to construct a large catalog of mock lenses. Working with mock lenses allows us to perform controlled experiments; but the power comes from using real galaxies so that we automatically include structures that are more general than conventional parametric lens models yet are guaranteed to be realistic. We will use the catalog of mock lenses to determine whether the observed incidence of anomalous flux ratios can be explained by "disky" lens galaxies or requires

dark matter substructure. In doing so, we will derive new constraints on the amount of dark matter substructure required or allowed by gravitational lensing, which realistically account for the complexity in galaxy (stellar) mass distributions. We will also use the mock lenses to provide the first objective calibration of non-parametric lens models.
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Proposal Category: AR
Scientific Category: ISM IN EXTERNAL GALAXIES
ID: 11261
Title: Dynamically-Driven Star Formation in M51
PI: Jin Koda
PI Institution: California Institute of Technology

We propose to investigate gas dynamical environments around star forming regions in the ground-design spiral galaxy M51. The archival HST/ACS Halpha image will reveal the location and properties (e.g. size, luminosity) of HII regions. The CARMA key project observes molecular gas over the entire M51 disk, overlaying the gas density and velocity structures on the HII image. CARMA has sufficient spatial and velocity resolutions for revealing dynamical environments (e.g. shocks, shears) around individual star forming regions. We will correlate the HII region properties with their dynamical environments. The comparison of CARMA and HST image will reveal the previously unseen connection between galactic gas dynamics and the trigger of star formation.
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Proposal Category: AR
Scientific Category: COSMOLOGY
ID: 11262
Title: Deepening the Hubble UDF - Constraining the High-z Galaxy Luminosity Function Faint End Slope and Reionization
PI: Anton Koekemoer
PI Institution: Space Telescope Science Institute

We propose to significantly improve the depth of the Hubble Ultra Deep Field (UDF) by ~0.4-0.5 magnitudes (equivalent to doubling the exposure time of the original UDF), through recalibrating and reprocessing the original UDF ACS data with improved reference files and new techniques to remove a variety of electronic instrumental signatures from the images. Since ACS has now been in operation for almost 5 years, this provides an opportunity to improve significantly upon the original calibration which had been performed using the best available information 18 months after the installation of ACS. Our team has the demonstrated expertise to carry out this recalibration and reprocessing, and we also have the demonstrated ability to release such products to the commmunity on a timely basis. We propose this as an Archival Legacy program because the resulting dataset, as well as the techniques that we are using, will be of great value to the community and should enable significant new science to be obtained from this unique dataset. In addition,

the resulting improvements on the number counts of redshift ~6 dropout sources will significantly improve the current uncertainties in this field regarding the faint end slope and normalization of the luminosity function of the redshift ~6 population, and ultimately the role played by these sources in reionizing the universe.

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Proposal Category: AR
Scientific Category: ISM AND CIRCUMSTELLAR MATTER
ID: 11263
Title: Modeling Coronagraphic Images of Beta Pictoris and other Debris Disks with Gas
PI: Marc Kuchner
PI Institution: NASA Goddard Space Flight Center

We propose to study the dynamics of dust grains in the Beta Pictoris disk and to model the X pattern, otherwise known as the "warp," revealed in ACS Coronagraph images. We will use our models to test the idea that the X pattern does not stem from the gravitational perturbations of a planet and we will tie together what we know about the dust and what we know about the gas in this nascent planetary system. We will provide numerical tools to the astronomical community that they can use to model other new and upcoming HST images of debris disks with gas.

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Proposal Category: AR
Scientific Category: UNRESOLVED STELLAR POPULATIONS
ID: 11264
Title: Blue Tilts and Other Properties of Halo Globular Clusters in Nearby Galaxies - Cosmological or Observational Bias?
PI: Arunav Kundu
PI Institution: Michigan State University

Old metal-poor globular clusters are seen in large numbers in the halos of all nearby galaxies. Cosmological simulations suggest that these clusters, which appear as the blue peak in the typical bimodal color distribution of globular cluster systems, are among the first objects to form at high redshift. Until recently these primordial clusters were assumed to be `universal' because the properties of blue globular clusters found in all types and sizes of galaxies appeared to be identical. A series of new ACS-based studies, using the ACS Virgo Cluster Survey (GO-9401) data and other samples (GO-9427, GO/DD-9714), suggest that there is a mass-metallicity relation in the blue halo globular clusters. The brighter blue clusters trend to redder colors in this `blue-tilt' phenomenon. This seems to suggest that larger globular clusters have self enriched either because they were formed in large gas clouds, or because in the past they had significant dark matter halos that have subsequently been stripped. These ACS studies also find that the mean metallicity of the halo clusters increases with the mean mass of the host galaxy. It has been argued that this is evidence of self enrichment in large halos and points towards an

in situ model of galaxy formation. We suggest that both these correlations are caused by subtle systematic observational effects that have been overlooked in previous studies. We propose to undertake a systematic analysis of the globular cluster systems of the 145 galaxies observed by the ACS Virgo and Fornax cluster surveys (GO-9401, GO-10217), and the mosaic of M104 (GO/DD-9714) in order to answer the crucial question, `Just how universal are the properties of the metal-poor halo globular clusters?'. These ACS observations are likely to remain the largest globular cluster datasets for the foreseeable future. Our independent analysis of these extended datasets will provide an important check on the results found for globular cluster systems and their implications on galaxy formation and evolution.

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Proposal Category: AR
Scientific Category: ISM AND CIRCUMSTELLAR MATTER
ID: 11265
Title: Highly Ionized Plasma in the Milky Way: A Benchmark for Feedback Studies in the Universe
PI: Nicolas Lehner
PI Institution: University of Notre Dame

We propose to produce an homogeneous study of the high-resolution STIS E140H (1.5-2.7 km/s resolution) spectra of the interstellar Si IV, C IV, and N V absorption along 26 extended Galactic sight lines to study the properties of highly ionized gas in the Milky Way. Absorption from these ñhigh ionsî is used to probe hot gas from the Milky Way to high-redshift primordial galaxies. However, only in our own Galaxy have they been observed with high enough spectral resolution to fully resolve the line profiles. Such observations have revealed surprisingly narrow absorbing clouds that would not have been identified at lower resolution and that likely trace non-equilibrium cooling or photoionization of feedback-driven gas. The sight lines chosen for study in this work sample a variety of physical environments or structures (e.g., the lower Galactic halo, H I shells and supershells, spiral arm and interarm gas, and evolved supernova remnants). The very high resolution of the observations to be analyzed will allow us to derive properties for the individual physical clouds connected to such structures and to study effects unobservable at lower resolutions where the clouds are smeared together. Our survey has three main goals: 1) to produce an homogeneous reduction and analysis of the archival E140H spectra of these stars; 2) to determine the primary ionization mechanisms responsible for the highly ionized gas in various physical environments in the Milky Way; 3) to understand the physical origins of the different types of highly-ionized gas so that the signatures seen in the Milky Way might be used for understanding highly ionized gas in the halos of neighboring galaxies, in starburst outflows, and in primordial galaxies.

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Proposal Category: AR

Scientific Category: STAR FORMATION
ID: 11266
Title: Radiation-induced Grain Dynamics in Dust Disks: Radiation Pressure, Poynting-Robertson Drag, and Photophoresis
PI: Aigen Li
PI Institution: University of Missouri - Columbia

We propose a theoretical program to rigorously calculate the radiation pressure and Poynting-Robertson drag parameters for both porous and compact grains in dust disks illuminated by stars of a wide range of spectral types, using the scattering parameters obtained from our HST Cycle 15 theory project. We also propose to study the rotational excitation of grains in gas-rich, optically thin disks (through collisions with neutrals, ions, "plasma drag" which may drive them to rotate suprathermally) to test the "photophoresis" hypothesis which was recently invoked to explain the central clearing and the formation of narrow rings in dust disks. This program will create a web-based library of radiation pressure and Poynting-Robertson drag parameters for both porous dust and compact dust (including nano-sized grains) as a function of size, composition, porosity (for porous dust), and stellar spectral type. This library will be made publicly available via the WWW at http://www.missouri.edu/~lia/. These parameters are essential (1) for modeling disk dynamics to interpret the un-smooth structures (e.g. asymmetry, warps, inner holes, clumps, rings) seen in scattered light images of disks obtained with HST, and (2) for reliably determining the dust removal and replenishment rates of debris disks as well as disk evolution.
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Proposal Category: AR
Scientific Category: STAR FORMATION
ID: 11267
Title: Dynamical Heat Re-Distribution Modeling in Hot-Juipter's
PI: Douglas Lin
PI Institution: University of California - Santa Cruz

Observations of transiting hot-Jupiter's have opened a new avenue for exploring the structure and atmospheres of giant extra-solar planets. Significantly different then our own giant planets, tidally locked hot-Jupiter's are subject to intense irradiation from their host star, which drives supersonic winds across the face. In this proposal we describe a study coupling full 3-dimensional radiative hydrodynamic models to radiative transfer models and detailed opacity studies. Noticeably absent in current studies, these models will allow us to self-consistently explore existing observations and predict properties of new objects, including spectral signatures and light curves. These predications should be directly testable by the Hubble Space Telescope and should lead to a greatly improved understanding of atmospheric physics on the surface of extra-solar planets.
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Proposal Category: AR
Scientific Category: QUASAR ABSORPTION LINES AND IGM
ID: 11268
Title: New Synthesis Models of the Extragalactic Ionizing Background
PI: Piero Madau
PI Institution: University of California - Santa Cruz

The intergalactic medium (IGM) contains evidence of the epochs of galaxy formation, metal enrichment, reionization, and reheating of the baryons left over from the Big Bang. Hydrogen, helium, and many heavy elements (C, Si, N, 0) observed by Hubble through quasar absorption line studies are kept highly ionized by the extragalactic UV/soft X-ray background (UVB) from active nuclei and star-forming galaxies. The spectrum and intensity of the UVB is one of the most uncertain yet critically important astrophysical input parameters into cosmological simulations of the IGM. It provides the ionization corrections needed for interpreting QSO absorption-line data and derive crucial information on the distribution of primordial baryons and of the nucleosynthetic products of star formation. We propose here to build improved synthesis models of the UVB intensity, spectrum, and evolution with redshift using the radiative transfer code CUBA, updating and extending our previous results (Haardt & Madau 1996). We will adopt up-to-date determinations of the quasar optical/X-ray luminosity functions and intrinsic spectra, intergalactic photoelectric absorption, and cosmic star formation history from GOODS/ACS data. This research will make use, enhance the value of and have a lasting benefit for past and observational programs with the HST. We will make the latest version of CUBA freely available for public use, allowing for several user-supplied quantities such as source emissivity as a function of frequency and redshift, and amount of intervening absorption.
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Proposal Category: AR
Scientific Category: HOT STARS
ID: 11269
Title: Determining O star mass loss rates from Sulfur wind lines.
PI: Derck Massa
PI Institution: SGT, Inc.

The winds of massive stars power and enrich the ISM, control the evolution of the stars, determine their ultimate fate and the nature of their remnants, determine the appearance of HRDs in young, massive clusters and star-bursts, and play a major role in the initial stages of massive star cluster formation and evolution. Thus, recent suggestions that O star mass loss rates are up to ten times less than previous observational determinations or theoretical expectations warrant further investigation. Perhaps the most compelling evidence for reduced mass loss rates comes from analyses of the far UV P V 1118, 1128A resonance doublet, which has become widely accessible since the launch of FUSE. Because Phosphorus has a low cosmic abundance, this doublet never saturates, providing accurate estimates of the mass loss rate times the

ionization fraction. By examining the strength of this doublet as a function of temperature for a large sample of stars, it is argued that the ion fraction of P V must be near unity somewhere in the O star range. If this conjecture is correct, then the mass loss rates inferred from P V never exceed 10-15% of previous expectations. In this proposal, we intend to verify this important result by analyzing HST and FUSE data for the wind lines of three adjoining stages of Sulfur (S IV, V and VI) in a sample of LMC O stars. We show how the analysis of these lines can furnish a direct measurement of the mass loss rate from UV wind lines alone, without the need to assume an ion fraction. As a result, they provide a powerful verification of the P V results. Furthermore, we argue that our results should not be strongly affected by clumping in the winds, a mechanism often invoked to explain the differences between different observational measures of mass loss rates.

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Proposal Category: AR
Scientific Category: HOT STARS
ID: 11270
Title: The Effective Temperatures and Physical Properties of O- type Stars at Low Metallicity
PI: Philip Massey
PI Institution: Lowell Observatory

An accurate knowledge of the effective temperatures of O-type stars is the key to knowing their other physical properties. Improvements in stellar atmosphere models in the past few years have significantly reduced the deduced temperatures of Galactic O-type stars due to the effects of wind- and line-blanketing. At the lower metallicities of the SMC and LMC, blanketing should have a lesser effect, but there is considerable disagreement in the literature at present as to the effective temperatures scale for SMC and LMC O stars. We plan a comprehensive study using HST archive UV data supplemented by optical ground-based data recently obtained with the Magellan 6.5-m telescope. In addition to using improved data, our study will apply different models (FASTWIND and CMFGEN) to the same data-sets, and we will also separately and jointly determine physical parameters based upon the UV and optical spectra. This will lead to a much better understanding of where the any systematic differences originate. In the end, we expect to have not only a definitive effective temperature scale of low-metallicity O-type stars, but also a very realistic estimate of what the uncertainties are in that scale. This study will also serve as the impetus for long-term improvement in the stellar atmosphere models of hot luminous stars.

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Proposal Category: AR
Scientific Category: HOT STARS
ID: 11271
Title: Establishing a Zero Motion Reference Frame for the FGS
PI: Bernard McNamara

PI Institution: New Mexico State University

We propose to measure the internal proper motions of the stars in M35 that are used to calibrate the HST/FGS. The goal of this effort is to remove the influence these stars have the FGS distortion map. Employing the approximately 108 orbits of available archival FGS data, these motions can be determined to an accuracy of 0.05 mas/year. By iteratively measuring these motions using successively longer time bases and then accounting for them in the distortion map, their influence on this map can be essentially eliminated.

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Proposal Category: AR
Scientific Category: ISM AND CIRCUMSTELLAR MATTER
ID: 11272
Title: An Archival Study of Solar-System-Scale Interstellar Structure
PI: David Meyer
PI Institution: Northwestern University

The evidence for significant solar-system-scale (< 100 AU) structure in the diffuse ISM has increased dramatically over the past decade through multi-epoch H I 21 cm and optical Na I absorption-line observations of various extragalactic, pulsar, and stellar sightlines. Possible explanations for this structure range from small-scale filamentary geometries to fractal geometries driven by turbulence to a separate population of small, dense self-gravitating clouds. The latest Na I data now indicate that the solar-system-scale Na I structure is most common in the vicinity of dynamic interstellar regions. However, the physical interpretation of this structure is unclear because Na I is not the dominant Na ion in H I clouds. Such a detailed understanding requires the diagnostic power of the rich diversity of interstellar species observable in the UV. We have identified 13 objects in the HST data archive with multi-epoch STIS echelle observations of UV interstellar absorption lines. We propose to analyze the interstellar lines in the 212 datasets comprising these observations and probe the physical character of any temporal profile variations. Our specific goals in this archival study are to assess the extent of solar-system-scale structure in the H I gas as well as the thermal gas pressure, electron density, and dust content of any observed structure.

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Proposal Category: AR
Scientific Category: HOT STARS
ID: 11273
Title: Tracing the wind interface of the massive binary Eta Carinae
PI: Krister Nielsen
PI Institution: Catholic University of America

The binarity of Eta Carinae has been debated for a long time, but most recent evidence favors a binary star interpretation. However, very little is known

about the nature of the companion star. Over Eta Carinae's spectroscopic period many observable wind lines in the NUV/Optical region, have been shown to exhibit peculiar line profiles with unusual velocity shifts relative to the system velocity. Some of the lines are exclusively blue-shifted over the entire 5.54 yr cycle and their ionization/excitation imply formation in the interface between the two massive stars. Especially, the He I emission lines are mainly formed in the wind interface region. Since the wind momentum is much larger for the primary star than its companion, the wind interface is located fairly close to the companion. Consequently, by tracing the He I emission we can construct a radial velocity curve that will describe the motion of the companion star and will derive the relation between the masses of the binary system stars. Furthermore, we will measure velocity and intensity variations in H I and Fe II to further investigate the ionization/excitation structure throughout Eta Carinae's wind. The analysis of the central source of Eta Carinae, due to the closeness of the two stars in the binary system (30 AU) and the intervening matter in line-of-sight towards Eta Carinae, is extremely dependent on data obtained with high angular resolving power. The HST archival data is crucial for the continuance of this project.

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Proposal Category: AR
Scientific Category: ISM AND CIRCUMSTELLAR MATTER
ID: 11274
Title: A Final Calibration of the Primary WFPC2 Emission-Line Filters Using the Orion Nebula
PI: C. O'Dell
PI Institution: Vanderbilt University

Emission-line imaging with the WFPC2 has been dominated by use of the F656N, F 658N, and F502N filters.These filters require on-orbit calibration in order to convert their signals to absolute energy surface brightness units. This has previously been done, but there is a question of time variation of their properties and this will be addressed by special observations of the Orion Nebula as part of calibration program 11038. This archive program will use the previously adopted method that uses a well-calibrated long-slit reference sample to calibrate the data. There is also a mid-lifetime set that will allow tracking variations with time. I will also determine if a new set of multi-aperture groundbased data is satisfactory for use as a reference source and if it is, to determine variations in the calibration constants across the individual CCD detectors and with better time resolution by using five additional studies.

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Proposal Category: AR
Scientific Category: HOT STARS
ID: 11275
Title: The Effect of Metallicity on the Rotation Rates of Massive Stars

PI: Laura Penny
PI Institution: College of Charleston

Stellar interior models are critical tools used in all branches of astronomy from chemical evolution and population synthesis studies to the determination of evolutionary masses. Until recently the effects of rotation were not included in these codes. The new models show that rotation induces interior mixing that produces some drastic external changes for massive stars while they are still core-hydrogen burning. While the inclusion of rotation was expected to explain the enhanced surface abundances seen in some stars, the prediction that massive stars have luminosities that are rotation dependent was not expected. This last prediction creates a serious scatter in the mass-luminosity relationship and makes the determination of an evolutionary mass essentially impossible. These new models must be tested to determine if their treatment of angular momentum is correct. A straightforward method is to determine if massive starsÍ rotation rates match those predicted by the new models. At solar or Galactic metallicity (Z = 0.020), massive stars are expected to quickly slow their rotation speeds while on the main sequence (MS). Stars at lower metallicity (Z) experience reduced mass loss rates and subsequently retain more of their angular momentum during the MS. The HST archive at the Multimission Archive at Space Telescope (MAST) contains spectra of 180 LMC (Z = 0.007) and SMC (Z = 0.004) O-type stars. This is an extremely large sample of O-type spectra, all observed with the same instrument. It contains both cluster and field stars. These stars represent a completely uniform, unbiased sample for evaluating the predictions from the new stellar interior models. Projected rotation velocities for all stars will be obtained through a cross-correlation methodology that we have used successfully in the past with both IUE and HST/STIS spectra. Comparisons of the rotation rates of unevolved (close to ZAMS) stars at low Z to those of the same classes at higher Z will determine if the initial rotation rates of massive stars are metallicity dependent. Comparisons of the rotation rates of evolved (close to TAMS) massive stars to the unevolved stars in the same metallicity environment will determine the extent of angular momentum (and hence mass) loss during the core hydrogen burning. The proposed survey represents a critical and needed test of the treatment of angular momentum in the new stellar models and the accuracy of the models predictions.

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Proposal Category: AR
Scientific Category: AGN/QUASARS
ID: 11276
Title: Hydrodynamical models of Narrow Line Regions in Seyfert Galaxies
PI: Daniel Proga
PI Institution: University of Nevada - Las Vegas

We propose to study large-scale outflows from Seyfert galaxies (SG). We will explore our hydrodynamical model of flows influenced by the gravitational and radiation fields of the central part of SG. The model predicts an outflow in

the polar region which is driven by thermal and radiation pressures and is confined by a very hot ambient gas accreting on to a central black hole. Our preliminary calculation shows that this model promises to explain the kinematics of winds in the Narrow Line Regions of SG. We will apply the model to NGC 1068, NGC 4151, and Mrk 3 where winds were spatially resolved by HST. In particular, we will compute, based on our wind model, synthetic images and position-dependent line profiles (i.e., for many positions along a given slit) for direct comparison with the data from the Space Telescope Imaging Spectrograph. A similar model can be apply to outflows from other Active Galactic Nuclei and accreting systems.

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Proposal Category: AR
Scientific Category: RESOLVED STELLAR POPULATIONS
ID: 11277
Title: RR Lyrae Variables in Local Group Galaxies
PI: Ata Sarajedini
PI Institution: University of Florida

We propose to reduce and analyze WFPC2 images of 5 Local Group galaxies in order to identify and characterize their RR Lyrae variables. These galaxies, which include NGC 147, IC 10, LGS 3, Tucana, and Andromeda V, have no published variability studies using HST imaging.The presence of RR Lyrae variables would suggest that an old (Age >~ 10 Gyr) stellar population is present in these galaxies. In additon, because the minimum-light color of ab-type RR Lyraes is a constant irrespective of metallicity or period, these stars can be used to study the extinction properties of each galaxy. Furthermore, the period of ab-type RR Lyraes is directly related to their metal abundance so that we can also study the metallicity distribution function of each galaxy. Lastly, it is well known that RR Lyraes are excellent distance indicators allowing us to measure the distance of each galaxy.

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Proposal Category: AR
Scientific Category: AGN/QUASARS
ID: 11278
Title: AGN Variability in the GOODS Fields
PI: Vicki Sarajedini
PI Institution: University of Florida

Variability is a proven method to identify intrinsically faint active nuclei in galaxies found in deep HST surveys. We propose to extend our short-term variability study of the GOODS fields to include the more recent epochs obtained via supernovae searchers, increasing the overall time baseline from 6 months to ~2.5 years. Based on typical AGN lightcurves, we expect to detect ~70% more AGN by including these more recent epochs. Variable-detected AGN samples complement current X-ray and mid-IR surveys for AGN by providing unambigous evidence of nuclear activity. Additionallty, a significant number

of variable nuclei are not associated with X-ray or mid-IR sources and would thus go undetected. With the increased time baseline, we will be able to construct the structure function (variability amplitude vs. time) for low-luminosity AGN to z~1. The inclusion of the longer time interval will allow for better descrimination among the various models describing the nature of AGN variability. The variability survey will be compared against spectroscopically selected AGN from the Team Keck Redshift Survey of the GOODS-N and the upcoming Flamingos-II NIR survey of the GOODS-S. The high-resolution ACS images will be used to separate the AGN from the host galaxy light and study the morphology, size and environment of the host galaxy. These studies will address questions concerning the nature of low-luminosity AGN evolution and variability at z~1.

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Proposal Category:	AR
Scientific Category:	ISM AND CIRCUMSTELLAR MATTER
ID:	11279
Title:	A Legacy Archive PSF Library And Circumstellar Environments (LAPLACE) Investigation
PI:	Glenn Schneider
PI Institution:	University of Arizona

NICMOS coronagraphy, with well-matched template Point Spread Function (PSF) subtraction, probes the closest environments of occulted targets with the highest imaging sensitivity in intrinsically high contrast fields at the smallest radial distances afforded, uniquely, by HST. NICMOS PSF-subtracted coronagraphy has been invoked in a wide variety of HST programs with science themes as divergent as detecting and characterizing disks of circumstellar material in neo-natal stellar environments, to studying faint nebulosity associated with luminous active galaxies, to searching for planetary-mass companions in extrasolar planetary systems recently born and in the "stellar graveyard." The investment in HST time in the execution of these and other programs, which has resulted in more than 8450 NICMOS coronagraphic images to date, has met with mixed returns. Stunning (but infrequent) successes, importantly advancing their fields highlight much more frequent, unfortunately common, failures arising from highly compromised technically-achievable performance due to the lack of suitable template PSFs required to produce high-fidelity, photometrically robust, high contrast coronagraphic images. We propose to remedy this situation by undertaking a rigorous, homogeneous, and complete recalibration and analysis of the full archival set of raw NICMOS coronagraphic images previously obtained and residing in the MAST to create a Legacy library of template PSFs enabling the recovery of the large body of science otherwise lost. This PSF library, along with generically applicable analysis software that we will deliver to STScI, will: (1) critically augment the needs of future observational programs reliant on high-fidelity PSF subtractions, (2) increase their yields and photometric efficacy, (3) reduce the observing time (HST orbit allocations) otherwise required for near-contemporaneous reference PSF observations, and (4) greatly enrich the yet-

unrealized potential of the many NICMOS coronagraphic observations already acquired from the broad spectrum of science programs previously executed. We will then use the enabling power of the PSF library to re-reduce and re-analyze all archival NICMOS coronagraphic observations of circumstellar disk and VLM stellar, brown dwarf, and EJP companion candidate stars (~ 400 targets) to probe for previously undetected circumstellar disks. Through image analysis and modeling we will ascertain the physical properties of newly-discovered disks and their constituent grains. With a very large and homogeneously contrast-limited sample of optimally PSF-subtracted images, we will also set spatially resolved dust-scattered light flux density limits from non-detections to constrain the properties of the many IR-excess (and other) sources in this sample.

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Proposal Category: AR
Scientific Category: HOT STARS
ID: 11280
Title: The Variable Magnetic White Dwarf in the Hyades Eclipsing Binary V471 Tauri
PI: Edward Sion
PI Institution: Villanova University

V471 Tau is a detached eclipsing binary in the Hyades cluster consisting of a hot magnetic white dwarf and a rapidly rotating K dwarf companion. With an orbital period of only 12.5 hour, the stellar components emerged from common envelope interactions which drastically reduced their initially wide separations. It is the prototypical pre-cataclysmic binary. The white dwarf exhibits soft X-ray, EUV and optical variations on its 9.25 minutes rotation period. These variations are due to heavy elements accreted onto the WD's magnetic poles from the companion's wind. The implied accretion rate from the companion's wind, however, is so low that a magnetic propeller mechanism must be rejecting most of the material that attempts to accrete. We propose a comprehensive analysis of all existing HST STIS echelle spectroscopic observations that will focus on: (1) the variation of line strengths of accreted ions in the WD photosphere over the 9.25 minute rotation period of the WD, covering the four years over which STIS echelle spectra were taken; (2) probe the Zeeman splitting we first detected in a greater mix of metallic absorptions species, thus accurately determining the magnetic field strength and its variation at the rotational period; (3) determine the chemical abundances of accreted metals and study the process of magnetic accretion onto, and diffusion of heavy elements out of, the photosphere of the magnetic white dwarf using newly available models and diffusion parameters by Co-I J. Dupuis; (4) refine the mass of the WD and other system parameters with a more complete radial velocity curve.

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Proposal Category: AR
Scientific Category: RESOLVED STELLAR POPULATIONS
ID: 11281

Title: The Durations of Starbursts in Blue Compact Galaxies
PI: Evan Skillman
PI Institution: University of Minnesota - Twin Cities

The starburst phenomenon is a very important phase of galaxy evolution, and especially so for dwarf galaxies. The duration of the burst is important because it impacts both the evolution of the galaxy itself and the evolution of the local environment external to the galaxy. In addition to the physical conditions and evolution of the galaxy, the length of the burst and degree of "burstiness" affects the detectability of low luminosity galaxies. There is no consensus in the literature on the typical duration of a burst in a dwarf galaxy; some studies favor durations of roughly 5 Myr, and others roughly 100 Myr. We propose to resolve this discrepancy. The HST archive contains high quality imaging observations of a number of nearby starbursts in dwarf galaxies (often called Blue Compact Dwarf galaxies or BCDs). However, these have been obtained through a number of diverse investigations focusing on a wide variety of science questions. Here we propose a systematic, uniform analysis of these nearby BCDs that will produce star formation histories (SFHs) with a primary goal of determining the duration of the burst. Specifically, we will: (1) reduce the photometry in a uniform manner using programs optimized for HST observations, (2) use two of the most sophisticated programs available to derive optimal star formation histories from the resulting color-magnitude diagrams, including modeling of the effects of differential extinction, and (3) compare these results and conduct Monte Carlo simulations in order to securely quantify the uncertainties in the derived star formation rates. This approach will allow us, for the first time, to compare the results for a significant sample in a uniform and unbiased way, and thus, draw unambiguous conclusions regarding the duration of starbursts in BCDs.

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Proposal Category: AR
Scientific Category: SOLAR SYSTEM
ID: 11282
Title: Diurnal Martian Ice Cloud and Ozone Maps from HST WFPC2 Multi-Band Images
PI: Tracy Smith
PI Institution: Space Science Institute

Mars atmospheric aerosols such as dust, ice and ozone play important roles in the meteorology of the planet. Much controversy still exists among observers and modelers over what represents the average Mars atmosphere, and how it changes diurnally, seasonally and interannually. Ozone is an important tracer of the photochemical processes responsible for the stability of Mars' carbon dioxide atmosphere. Water vapor is also an important trace element in atmospheric models, and contributes to the formation of water ice clouds. Seasonal global temperature fluctuations affect the water vapor saturation altitude (hygropause), which in turn determines water ice cloud formation altitude at low- to mid-latitudes. Models predict large diurnal ozone

fluctuations as a result of the seasonal changes in the hygropause. The mapping of global, diurnal water ice clouds and ozone column densities can only be performed by using Hubble Space Telescope (HST) WFPC2 multi-band images of Mars. No other spacecraft, including Mars Global Surveyor and Mars Express, can achieve this. Diurnal water ice cloud and ozone column density maps derived from a long baseline of HST measurements (1993-2004), would serve as useful reference data for workers using current mission data, such as Mars Orbital Camera (MOC), providing context and connection to their temporally limited data. A water ice map and an ozone column density map have already been produced by the PI from the January 2001 HST cycle9 Mars multi-band WFPC2 images.

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Proposal Category: AR
Scientific Category: AGN/QUASARS
ID: 11283
Title: The Near and Far Sides of M87
PI: William Sparks
PI Institution: Space Telescope Science Institute

We propose to assemble the deepest ever image of the M87 jet and its environs using archival data acquired for unrelated purposes. By studying the AGN, the jet and ISM physics we address the role and nature of AGN feedback to the ISM and the quantitative physical nature of the jet and AGN. With over 50 orbits of ACS/WFC F606W and F814W imaging we can detect or place significant upper limits on the brightness of a counter-jet, yielding insight into the jet beaming factor and orientation to the line of sight. With this deepest ever jet image, we will also probe the extent to which optical emission can be traced both from the primary jet into the radio lobe and the SE synchrotron hotspot at the termination of the counter-jet, to quantify optical synchrotron loss processes and map spectral ageing. We will seek scattered light from ambient hot electrons known to be present in the nuclear regions of M87 and hence identify the allowed parameter space involving nuclear luminosity, nuclear beam pattern and ISM density. Electron scattering in particular is symmetric with respect to direction and hence we have the best chance to detect a scattering beam in the counter-jet direction. Faint dust features and emission-line filaments will also be mapped and compared to the radio source morphology to better understand their interaction and provide information on the energetic interplay between radio sources, jets and the ISM.

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Proposal Category: AR
Scientific Category: RESOLVED STELLAR POPULATIONS
ID: 11284
Title: Intermediate Mass Black Holes in Globular Clusters: Key Photometric Fingerprints
PI: Michele Trenti
PI Institution: Space Telescope Science Institute

Intermediate Mass Black Holes (IMBHs) are important and interesting objects. Their existence has been predicted in different astrophysical contexts, such as in runaway collapse of massive stars in Globular Clusters (GCs) and as remnants of the explosion of Pop III stars in the early universe. Ultra Luminous X-ray sources observed in various environments may be IMBHs, but their nature remains poorly understood. GCs may ultimately present the best chance of finding IMBHs. HST line-of-sight velocity studies have suggested IMBHs in M15 and G1, but these detections are not unambiguous. HST proper motion studies are now also underway, but these are challenging and have not yet yielded any detections. This proposal therefore addresses an alternative approach for finding IMBHs in GCs with HST, namely through their photometric signature. Numerical simulations have shown only recently that IMBHs leave a clear photometric signature in GCs that differs considerably from the simplified analytical predictions that have been accepted for decades. Instead of a steep cusp, an IMBH induces a shallow cusp within a large core radius. Recent WFPC2-HST archival analysis by Noyola & Gebhardt has shown that many GCs have surface brightness profiles that are generically consistent with this prediction. However the data-model comparisons carried out to date have not been sophisticated: only projected mass profiles were derived from N-body models and there has been no attempt to simulate real data, taking into account star colors, luminosities, PSFs, and crowding. Therefore we propose to facilitate credible IMBH detections in GCs based on photometry by: (a) running sophisticated N-body simulations of star clusters with IMBHs, primordial binaries and stellar evolution; and (b) simulating photometric datasets from these observations and deriving surface brightness profiles from them using techniques similar to those customarily applied to real data. This work is ideally suited for the HST Theory program as HST is the only telescope with sufficient resolution to measure photometric profiles down to the required resolution. Much effort has been invested in such GC observations (e.g., a 134-orbit Cycle 14 ACS survey - PI Sarajedini), yet theoretical simulations are generally not performed as part of such programs. Our work will be important for the interpretation of these and other data, and it will complement efforts to detect IMBHs in globulars using dynamics or X-ray observations.

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Proposal Category: AR
Scientific Category: COSMOLOGY
ID: 11285
Title: TRGB Distances from Archived Data
PI: R. Tully
PI Institution: University of Hawaii

Accurate distances can be determined to galaxies if the Tip of the Red Giant Branch (TRGB) can be resolved. The methodology was taken to a new level of refinement with HST/ACS, with distances accurate to 5% obtained for galaxies at 8 Mpc with single orbit observations. Given multiple orbit observations,

distances can be obtained for galaxies as remote as the Virgo Cluster. There are now a tremendous number of images in the HST archive that can be used for TRGB measurements. Many were obtained expressly for this purpose but many more were taken for other reasons. While the TRGB method has been demonstrated to give accurate distances, systematic effects can dominate if the data is not analyzed in a coherent manner. The authors of this proposal have recently developed an end-to-end analysis procedure that they have been applying to data acquired in the course of their own program. Now that ACS is not available, there will be less new material entering the archive. It is an appropriate time to process all the available images and recover consistent TRGB measurements and distances for all nearby galaxies observed with HST.

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Proposal Category: AR
Scientific Category: QUASAR ABSORPTION LINES AND IGM
ID: 11286
Title: Lyman continuum Absorption and the IGM Opacity at low Redshifts
PI: David Tytler
PI Institution: University of California - San Diego

We will measure the amount of Lyman continuum absorption in the universe at $0.5 < z < 2.5$ three times more accurately than currently published results, which have errors of 30%. We will work with FOS high dispersion spectra of 134 QSOs, FOS low dispersion spectra of 42 QSOs, STIS low dispersion spectra of 79 QSOs and ACS spectra of 36 QSOs. We expect to detect approximately 155 Lyman limit absorption systems (LLS) towards these QSOs. Published work uses approximately 17 LLS at these redshifts from HST spectra. The list of LLS have many uses, since these systems are amongst the best places to measure ionization and abundances, they include likely COS targets. We will derive the LLS density, per unit redshift, which is a key input to calculations of the intensity of the cosmic UV background. We use the optical depths in the Lyman continuum, and fits to Lyman series in the best spectra, to obtain the distribution of the H I column densities of the LLS, and especially the partial LLS with optical depth < 1. The UV background is required to understand the ionization of the intergalactic medium and the gas in the outer regions of galaxies that causes QSO absorption lines. It is also needed to run realistic simulations which are the key to understanding the IGM and QSO absorption systems.

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Proposal Category: AR
Scientific Category: COSMOLOGY
ID: 11287
Title: Fundamental Limitations in deep HST Fields: Surface Brightness, Natural Confusion, & Algorithmic Biases
PI: Rogier Windhorst
PI Institution: Arizona State University

In the last decade, 1000's of orbits were invested in deep HST surveys. The HUDF, HDF, GOODS, GEMS and COSMOS resulted in many new discoveries, ranging from dwarf galaxies at the end of reionization to the hierarchical formation of galaxies. At the same time, the fundamental limitations in these surveys may not have been explored or quantified well enough to fully understand their impact. For instance, while deep surveys for faint galaxies with HST are obviously limited by surface brightness (SB) constraints, at the faintest HST limits other effects also begin to play a dominant role. First, the rapid decline in galaxy sizes at fainter fluxes -- reflecting their hierarchical assembly -- may result in a significant fraction being point sources at the HST diffraction limit (<0.08" FWHM), hence affecting their selection and preventing reliable size measurements. More seriously, natural confusion may overtake SB-selection as the dominant selection factor at faint fluxes. Natural confusion occurs when there are fewer than a minimum number of "object beams" (with area = pi . r_e^2) for each detected (extended) object, analogous to the role of the telescope FWHM in the classical instrumental confusion limit. Last, various systematics in the parameter determination algorithms can bias the results from deep HST surveys in rather uncharted ways. This Archival project will quantify these fundamental issues as follows: (1) run very high-resolution hierarchical simulations of the expected object sizes for AB<31 mag; (2) simulate effects from the HST-PSF, charge-diffusion, multi-drizzle, and CCD-noise on the measured object sizes; (3) simulate how object finding and deblending algorithms affect measured fluxes and sizes; (4) identify corrections for size overestimation (noise) and underestimation (SB-dimming); and (5) delineate the exact locus of the natural confusion limit, and determine if and how it overtakes SB as the major cause of incompleteness in HST surveys for AB>24-28 mag.

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Proposal Category:	AR
Scientific Category:	COSMOLOGY
ID:	11288
Title:	PASS: Paying Attention to the Small Structure
PI:	Roger Blandford
PI Institution:	Stanford University

One of the main predictions of the Cold Dark Matter (CDM) cosmology is the existence of structure formations on all mass scales. Gravitational lensing offers a powerful tool for exploring dark matter distributions.Weak-lensing methods proved to be a great success in detecting dark-matter large-scale structure, but there is still little known about small-scale structures on sub-galactic scales. Weak lensing traditionally measures galaxy ellipticities but it is clear that there is much more information contained in the galaxy shapes. We propose to extend gravitational lensing approach to detect small scale structures on cosmological distances using a new method of nonlinear gravitational lensing. This method is sensitive to higher derivatives of the gravitational potentials (also known as flexions), and can measure mass scales on the order of 10^9 Msun to 10^10 Msun. The Ultra Deep Field (UDF) and a

new Ultra Deep Field Follow-Up (UDF05) are extremely well suited for detection of nonlinear lensing. Their high resolution is great for measuring the details of galaxy shapes. They also provide a detection of large number of background galaxies necessary for statistical measurements. We will construct our own super image of the fields, so that we can also model PSFs in the same frame, using the empirical library PSFs. These PSFs will allow us to better model the true morphology of the background galaxies. The images and PSF models created within the framework of this proposal will be made publicly available.

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Proposal Category:	SNAP
Scientific Category:	COSMOLOGY
ID:	12289
Title:	SL2S: The Strong Lensing Legacy Survey
PI:	Jean-Paul Kneib
PI Institution:	Observatoire de Marseille

Recent systematic surveys of strong galaxy-galaxy lenses (CLASS, SLACS, GOODS, etc.) are producing spectacular results for galaxy masses roughly below a transition mass M~10^13 Mo. The observed lens properties and their evolution up to z~0.2, consistent with numerical simulations, can be described by isothermal elliptical potentials. In contrast, modeling of giant arcs in X-ray luminous clusters (halo masses M >~10^13 Mo) favors NFW mass profiles, suggesting that dark matter halos are not significantly affected by baryon cooling. Until recently, lensing surveys were neither deep nor extended enough to probe the intermediate mass density regime, which is fundamental for understanding the assembly of structures. The CFHT Legacy Survey now covers 125 square degrees, and thus offers a large reservoir of strong lenses probing a large range of mass densities up to z~1. We have extracted a list of 150 strong lenses using the most recent CFHTLS data release via automated procedures. Following our first SNAPSHOT proposal in cycle 15, we propose to continue the Hubble follow-up targeting a larger list of 130 lensing candidates. These are intermediate mass range candidates (between galaxies and clusters) that are selected in the redshift range of 0.2-1 with no a priori X-ray selection. The HST resolution is necessary for confirming the lensing candidates, accurate modeling of the lenses, and probing the total mass concentration in galaxy groups up to z~1 with the largest unbiased sample available to date.

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