Cycle 13 Abstract Catalog
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Proposal Category: GO
Scientific Category: COOL STARS
ID: 10114
Title: Lyman_alpha FUV observations of the Sun in time and effects on planetary atmospheres
PI: Edward Guinan
PI Institution: Villanova University

The chromospheric H I Ly_alpha 1215.6 feature is the dominant source of short-wave emission in the Sun and solar-type stars, contributing about 80-90% of the total FUV flux and 30-60% of the total flux between 1 and 1500 A. Also, this important chromospheric line is the major cooling channel for cool star atmospheres. Accurate Ly_alpha fluxes are the only missing element of our ongoing "Sun in Time" program. This program studies a sample of single G0-5 V stars with well-known physical properties that serve as proxies for the Sun (and solar-mass stars) over their main sequence lifetimes. One of the major goals of the program is the determination of the spectral irradiance of the early Sun. Our analyses indicate that the strong XUV emissions of the young Sun have played a crucial role in the developing planetary system. In particular, the expected strong Ly_alpha line flux may have greatly influenced the photoionization, photochemical evolution and possible erosion of planetary atmospheres, as well as played a role in the origin and development of life on Earth. The "Sun in Time" data can also be applied to investigate the atmospheric loss of exoplanets around solar-type stars resulting from XUV heating, which can eventually lead to the evaporation of "hot Jupiters". We propose to use HST/STIS-MAMA/E140M to determine accurate FUV and Ly-alpha fluxes and irradiances for 4 representative solar proxies with ages from 130 Myr to 6.7 Gyr. It is only with HST's high-resolution UV spectroscopy (to correct for ISM absorption) and the small aperture (to eliminate geocoronal emission) that the stellar Ly-alpha profile can be reliably modeled and its flux measured. The proposed study is of capital importance in reconstructing the evolutionary histories of exoplanets already known and additional planets that missions such as COROT, Kepler, SIM, and Darwin/TPF will discover in the coming years.

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Proposal Category: GO
Scientific Category: SOLAR SYSTEM
ID: 10115
Title: Rotation of Comet Tempel 1
PI: Michael A'Hearn
PI Institution: University of Maryland

We propose to accurately determine the rotational period of comet Tempel 1. This is crucial for enabling all of the science associated with the Deep Impact mission. It will also, in combination with ground-based data already on hand and images to be obtained from Deep Impact, provide the best dataset ever for investigating whether excited state rotation exists in any comet other than Halley.

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Proposal Category: GO
Scientific Category: HOT STARS
ID: 10116
Title: Towards an Accurate Calibration of the Galactic Cepheid P-L Zero Point
PI: Edward Guinan
PI Institution: Villanova University

The young open cluster NGC 7790 is unique and astrophysically important because it contains three classical Cepheid variables (CF Cas, CE Cas A, and CE Cas B). If the distance of NGC 7790 were known with certainty, these Cepheids would define the zero point for the galactic Cepheid Period-Luminosity (P-L) relationship. By a stroke of good luck, NGC 7790 also contains a 10th-mag eclipsing binary located near the turnoff of the main-sequence of the color-magnitude diagram of the cluster. This important eclipsing binary has been little studied until now and contains two B1IV-V+B3V stars with an orbital period of P=6.005 days. With HST we propose to secure the accurate distance and reddening of QX Cas (and thus of the Cepheids) by using eclipsing binaries as precise standard candles, as we have demonstrated in our work on the Large Magellanic Cloud. With absolute radii, temperatures, and luminosities of the stars known from ground-based and HST observations, the method is essentially geometric and free from many of the uncertainties that plague other less direct methods. Light and radial velocity curve data will be combined with the proposed HST/STIS spectrophotometry (1150-8000 A) to determine the physical properties of the eclipsing binary and thus to secure an accurate distance and reddening for NGC 7790. The determination of the stars' temperatures, reddenings and chemical abundances, and therefore the cluster's distance, with the necessary accuracy can only be accomplished with HST. According to our previous experience, we expect a resulting distance determination with an accuracy of about 2-3%. HST/STIS spectrophotometry will be carried out also for the three Cepheids to determine their properties and individual reddenings. Thus, the proposed HST observations could help eliminate the current nagging uncertainty of the galactic Cepheid zero point and provide the key for a firm calibration of the P-L relationship.
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Proposal Category: SNAP
Scientific Category: AGN/QUASARS
ID: 10117
Title: The Co-Evolution of Star Formation and Powerful Radio Activity in Galaxies
PI: Christopher O'Dea
PI Institution: Space Telescope Science Institute

We will carry out a STIS/NUV-MAMA snapshot imaging survey of the most compact powerful radio galaxies, the Gigahertz Peaked Spectrum (GPS) sources and Compact Steep Spectrum (CSS) sources. These objects are as powerful as the large radio doubles but are much smaller (and younger) and are crucial to our understanding not only of how radio-loud active galactic nuclei (AGN) form and evolve, but also what role they play in the evolution of galaxies. A very direct and robust way to address these issues is by high resolution imaging of the host galaxies of these sources in the UV. This has never been done before for a sample of these very compact sources, since previous HST/UV imaging programs have focussed on the larger radio galaxies. The UV emission can provide crucial information about any recent star formation that may have

occurred as a result of ongoing accretion, mergers, interactions, or triggering by the radio source. By comparing the starburst properties of GPS, CSS, and large scale radio sources, we will be able to constrain the evolution of massive star formation as a function of the relative age of the radio source.
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Proposal Category: GO
Scientific Category: ISM AND CIRCUMSTELLAR MATTER
ID: 10118
Title: Imaging the Chemical Distribution in Type Ia SN Ejecta
PI: Robert Fesen
PI Institution: Dartmouth College

We know Type Ia supernovae are thermonuclear explosions of CO white dwarfs, but we don't know the specifics of how the nuclear burning process proceeds from the core outward once it starts. The thermonuclear instability is thought to start off as a subsonic, turbulent deflagration or burning wave but then, at some point, may transition into a blast or detonation wave. In such "delayed detonation" models, differences between normal and subluminous Type Ia SNe reflect differences in the amount of burning that has occurred in the pre-detonation phase. More burning helps to pre-expand the WD before passage of the detontation wave, which then results in different final element abundances and internal Fe-rich ejecta structure. Directly imaging the 2-D chemical distribution of ejecta from a Type Ia SN is actually possible in the case of the subluminous Type Ia SN 1885, which occurred on the near-side of M31's central bulge. This 119 year old remnant is visible -- from its core to its outer edge -- via strong optical/UV Ca and Fe line absorptions. Remarkably, the SNR appears to still be in a nearly free expansion phase, meaning that the elemental stratification seen present today accurately reflects SN Ia explosive nucleosynthesis physics. We propose to obtain ACS WFC/HRC images of SN 1885 in order to take advantage of this extraordinary situation: Having a young, nearby Type Ia SN remnant visible in silhouette against a galaxy-size light table. These unique observations will reveal a SN Ia's Ca and Fe ejecta distribution, density structure, sphericity, and ionization state as a function of expansion velocity, thereby confronting various SN Ia models with detailed ejecta stratification and expansion velocity maps.
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Proposal Category: GO
Scientific Category: GALAXIES
ID: 10119
Title: Solving the Mystery of the Short-Hard Gamma-Ray Bursts
PI: Derek Fox
PI Institution: California Institute of Technology

Seven years after the afterglow detections that revolutionized studies of the long-soft gamma-ray bursts, not even one afterglow of a short-hard GRB has been seen, and the nature of these events has become one of the most important problems in GRB research. The forthcoming Swift satellite will report few-arcsecond localizations for short-hard bursts in minutes, however, enabling prompt, deep optical afterglow searches for the first time. Discovery and observation of the first short-hard optical afterglows will answer most of the critical questions about these events: What are their distances and energies? Do they occur in distant galaxies, and if so, in which regions of those galaxies? Are they the result of collimated or quasi-spherical explosions?

In combination with an extensive rapid-response ground-based campaign, we propose to make the critical high-sensitivity HST TOO observations that will allow us to answer these questions. If theorists are correct in attributing the short-hard bursts to binary neutron star coalescence events, then the short-hard bursts are signposts to the primary targeted source population for ground-based gravitational-wave detectors, and short-hard burst studies will have a vital role to play in guiding their observations.
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Proposal Category: GO
Scientific Category: HOT STARS
ID: 10120
Title: The Formation Histories and Dynamical Roles of X-ray Binaries in Globular Clusters
PI: Scott Anderson
PI Institution: University of Washington

Close binaries are fundamental to the dynamical stability and evolution of globular clusters, but large populations have been extremely difficult to identify. Chandra X-ray images provide a revolutionary resource, revealing a few to dozens of low-luminosity X-ray sources in every cluster deeply examined; our own Chandra programs uniformly study these ubiquitous X-ray sources (close binaries and their progeny) in 11 clusters. However, definitive understanding of the nature of the various X-ray subpopulations requires the identification of optical counterparts, and HST is the demonstrated key in these crowded environments. We thus propose a proven, efficient, and uniform, HST multicolor imaging program for optical identifications in 6 of our clusters with Chandra data on-hand, but which lack adequate optical images in the HST archive. The proposed ACS images will permit statistical classifications into the various subtypes: CVs, qLMXBs, BY Dra's/RS CVn's (and MSPs). A unique aspect of our program is that our clusters span a range of physical properties such as central concentration, cluster size, and mass--essential ingredients in the formation, evolution, and dynamical roles of cluster binaries. Exploiting this range of properties, we have identified a relation that provides the first compelling link between the number of X-ray sources and the predicted stellar encounter frequency in globular cluster cores. But further progress in understanding the details implicit in this relationship (e.g., whether CVs and qLMXBs formed primarily via stellar encounters, while BY Dra's/RS CVn's are mainly primordial binaries) demands uniform optical identifications for multiple clusters, spanning the full range physical properties.
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Proposal Category: GO
Scientific Category: GALAXIES
ID: 10121
Title: The Core Dynamics of the Dense Globular Cluster NGC 6752
PI: Charles Bailyn
PI Institution: Yale University

NGC 6752 is one of the best-studied dense globular clusters, and a wide variety of intriguing and anomalous results have been obtained. We propose ACS imaging of the core of this cluster. This will increase the accuracy of our previous internal proper motion measurements by almost an order of magnitude, providing an unprecedented probe of the central potential. The data will also greatly increase the radial extent of previous work on the binary frequency and luminosity function of this cluster. Together, the data

will provide a new level of constraints on the dynamics of a dense globular cluster.
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Proposal Category: GO
Scientific Category: HOT STARS
ID: 10122
Title: Accretion in the closest binary systems known
PI: Danny Steeghs
PI Institution: Smithsonian Institution Astrophysical Observatory

Recently, three variable stars have been identified as likely accreting binary systems with ultra-short orbital periods. Optical and X-ray observations have revealed periodicities of 5-10 minutes, making them the closest binaries known as well as strong sources of gravitational wave emission. Such short-period accreting binaries form the cornerstone to our understanding of binary formation and evolution, in particular of the large double white dwarf population in our galaxy, a candidate progenitor population for Type Ia supernovae. We propose to obtain the first UV observations of these objects using STIS in order to (i) determine the temperature of the primary and the composition of their donor stars, (ii) correlate the UV variability with other wavebands and determine if the periods are indeed orbital, (iii) look for dynamical signatures of direct-impact accretion that is expected to govern the survival rate of double white dwarfs. These UV observations are essential in order to unequivocally determine whether these are indeed the most compact binaries known.
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Proposal Category: GO
Scientific Category: AGN/QUASARS
ID: 10123
Title: Microarcsecond Imaging of a Gravitationally Lensed QSO: 2237+0305
PI: Rachel Webster
PI Institution: University of Melbourne

The microarcsecond scale structure of the central region of the gravitationally lensed quasar, 2237+0305, can be determined from its wavelength dependent lightcurve if viewed during a microlensing event. We are monitoring the QSO from the ground at regular intervals to ascertain the onset of a microlensing event. STIS spectra will then be taken and compared with the spectra taken after the event. As the microlensing event occurs, we will measure wavelength-dependent changes in the continuum, and also the variations in lines with different ionizations. Thus we will use microlensing to directly probe the structure of the source QSO on microarcsecond scales -- a factor of ten smaller than those measured by indirect techniques such as reverberation mapping. An already approved CHANDRA Cycle 4 GO program will provide complementary X-ray data, thus greatly increasing the wavelength range over which we hope to probe the quasar's inner structure.
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Proposal Category: GO
Scientific Category: ISM AND CIRCUMSTELLAR MATTER
ID: 10124
Title: Physical Processes in Orion's Veil: A High Resolution UV Absorption Study of the Line of Sight towards the Trapezium

PI: Gary Ferland
PI Institution: University of Kentucky

Star formation is governed by a complex interplay among magnetic, thermal, turbulent and gravitational energies. Of these, magnetic energies are the most difficult to measure. Yet magnetic energies are crucial to the evolution of molecular clouds if they are comparable to other energies. Unfortunately, magnetic field strength measurements are sparse. Moreover, detailed field strength maps exist in only one region of the ISM, the veil of neutral material in front of the Orion Nebula. From the Zeeman effect in 21cm HI absorption lines, we have accurate maps of the line-of-sight field strength in two independent velocity components of the veil. Therefore, the veil presents a unique laboratory for study of magnetic effects in star forming regions. We have recently combined archival UV absorption line data with photoionization models to estimate the veil's density, temperature and level of ionization. On this basis, we infer that magnetic energies far exceed turbulent and thermal energies in at least one HI velocity component. This component is magnetically unique. All other data about star forming regions suggest equipartition between magnetic and turbulent energies. Our analysis of physical conditions in Orion?s veil suffers from an important limitation. Existing UV absorption line data have insufficient spectral resolution to separate the two HI velocity components. Therefore, our models reflect average conditions in the two components. Yet actual conditions are likely to be quite different since one component must lie closer to the source of ionization. We propose to use STIS to obtain high resolution UV spectra of Theta 1 Ori A. These data will allow us to model the two velocity components separately. We can then estimate magnetic and other energies in the two components. We will determine if the apparent magnetic uniqueness of one component applies to both, and we will estimate the distances of each component from the ionizing stars. This study will provide the most comprehensive information obtainable about the role of magnetic effects in a star forming region.

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Proposal Category: GO
Scientific Category: AGN/QUASARS
ID: 10125
Title: Where is the Wind in 1H0707-495?
PI: Karen Leighly
PI Institution: University of Oklahoma Norman Campus

We propose three observations using HST STIS of the narrow-line Seyfert 1 galaxy 1H 0707-495 to be coordinated with already-approved deep exposures using FUSE. A previous HST observation of 1H 0707-495 revealed strongly blueshifted high-ionization lines, suggesting an origin in an outflowing wind. Detailed photoionization modeling reveals that the wind line fluxes and ratios are consistent with two solutions: a high-density, high-column solution, originating close to the central engine, and a low-density, low-column solution, located much further out. These two locations, interestingly, correspond to those predicted by two different physical models for winds in AGNs. We can differentiate between these models by observing emission line variability on two time scales, and examining relative variability of OVI obtained by FUSE and CIV and other lines obtained by HST. We will also look for profile variability, constrain velocity ionization stratification through a detailed study of the profiles, and investigate metallicity, which has been suggested to be high in NLS1s. This program, requiring only a modest amount of time, is expected to make significant contributions to our understanding of

outflows in AGN, and the structure, origin and metallicity of the broad-line region.
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Proposal Category: GO
Scientific Category: STELLAR POPULATIONS
ID: 10126
Title: The 3-D Shape of the SMC: Is It Tidally Distorted?
PI: Edward Olszewski
PI Institution: University of Arizona

We propose to exploit the exceptional spatial resolution of HST to definitively show whether the SMC is tidally elongated along the line-of-sight, and therefore the status of the Milky Way's interaction/destruction of the Magellanic Clouds. We use BVI ACS images of several crowded SMC fields in the region predicted by models of the orbit and tidal evolution of the Magellanic Clouds (and by observations of Cepheids) to have a large depth. We exploit the red clump feature (and the rarer true horizontal branch) to derive the depth. Specifically, we will observe six fields along the predicted region of maximum distance gradient of the SMC, along with two ACS fields and several WFPC2 fields in the archives, to map out the depth of the SMC in this region. We are searching for substructure, such as a tidal tail, that may be present. Crowding in this region of the SMC is so severe that this project cannot be done from the ground.
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Proposal Category: GO
Scientific Category: COSMOLOGY
ID: 10127
Title: IMAGING A PROTOCLUSTER AT z = 3.1: EFFECTS OF ENVIRONMENT AND EVOLUTION ON GALAXY POPULATIONS IN THE EARLY UNIVERSE
PI: George Miley
PI Institution: Universiteit Leiden

We propose imaging a rich protocluster, 0316-26 at z = 3.13, with 31 confirmed Lya cluster members. The bright radio galaxy host is identified with the progenitor of the dominant cluster galaxy. Because its redshift places Lya into an ACS narrow-band filter, the protocluster provides a unique laboratory for studying galaxies at a crucial epoch in the evolution of the Universe. We shall (i) measure and compare sizes, morphologies and colors of galaxies from populations detected using 4 different selection techniques (Lyman and 4000A breaks, Lya and [OIII] excesses), (ii) study effects of an overdense environment by comparing the properties of protocluster galaxies with z~3 field galaxies from GOODS, (iii) study effects of evolution by relating our data to observations of similar protocluster/cluster targets at redshifts z = 4.1, 2.2, and 1.2, and (iv) constrain the formation of the most massive cluster galaxies by investigating the spatial distribution, Lya equivalent widths and other properties within the 5" radio galaxy host. The ultimate aim is to disentangle the history of structure development and stellar evolution for rich clusters of galaxies.
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Proposal Category: GO
Scientific Category: STELLAR POPULATIONS
ID: 10128
Title: Probing the Formation & Evolution of M31's Outer Disk and Halo, Part II

PI: Annette Ferguson
PI Institution: Max-Planck-Institut fur Astrophysik

Over the past several years, our group has conducted a large panoramic ground-based imaging survey of resolved luminous stars in M31 using the INT Wide-Field Camera. Our now complete survey covers 40 square degrees around M31, extending to a major axis distance of ~60 kpc. This survey has led to the discovery of numerous spatial density and/or colour (metallicity?) variations within the M31 halo and outer disk, and interim results motivated a successful Cycle 11 HST/ACS program to obtain deep colour-magnitude diagrams for six regions exhibiting the most prominent stellar substructure known at that time, including the giant stellar stream and the clump of stars near the anomolous cluster, G1. The present proposal requests time to augment our Cycle 11 program with observations of two new features, a very low surface brightness fragment lying 3 degrees north-east of center and a high surface brightness spur of emission in the south-western half of the galaxy, which we have discovered since 2001. Deep colour-magnitude diagrams reaching 2-3 magnitudes below the horizontal branch will be constructed, allowing detailed characterization of the luminous evolved stellar populations via the red giant metallicity distribution, the luminous asymptotic giant branch, the horizontal branch morphology and the red clump, as well as the detection of a main-sequence that may be present from any younger component. Together the Cycle 11 and 13 pointings target all prominent stellar substructure known to exist within 60 kpc of M31.
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Proposal Category: GO
Scientific Category: GALAXIES
ID: 10129
Title: Resolving Globular Clusters in NGC 1399
PI: Thomas Puzia
PI Institution: Space Telescope Science Institute

We intend to use the ACS/WFC to measure structural parameters (half light radius, King core radius and concentration parameter) of individual globular clusters (GCs) in NGC 1399. Very little is known about structural parameters of globular clusters as a function of radius outside the Local Group. The proposed observations, arranged in a 3x3 ACS mosaic, will allow us to perform the first detailed wide-field study of structural parameters of globular clusters in a giant elliptical galaxy. In particular we will: 1) study the size-galactocentric distance relation of globular clusters out to ~55 kpc (~1.6 eff. radius of the GCS) and determine whether the observed differences in sizes between metal-rich and metal-poor globular cluster in early-type galaxies are primordial and thereby reflect fundamental differences in formation, or are due to projection effects; 2) match the GC position observed with HST/ACS with X-ray binaries identified over the full Chandra field, and use the above sizes to constrain physical models for X-ray binary formation in GCs. 3) The wealth of ground-based data available for this system (photometry+spectroscopy), will allow us to correlate the structural properties with other GC properties, such as their chemical composition, luminosity, etc.
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Proposal Category: SNAP
Scientific Category: STELLAR POPULATIONS
ID: 10130
Title: Systemic Proper Motions of the Magellanic Clouds from

Astrometry with ACS: II. Second Epoch Images
PI: Charles Alcock
PI Institution: University of Pennsylvania

We request second epoch observations with ACS of Magellanic Cloud fields centered on the 40 quasars in the LMC and SMC for which we have first epoch Cycle 11 data. The new data will determine the systemic proper motion of the Clouds. An extensive astrometric analysis of the first epoch data shows that follow-up observations with a two year baseline will allow us to measure the proper motion of the clouds to within 0.022 mas/year in each of the two orthogonal directions (assuming that we can image 25 quasars, i.e., with a realistic Snapshot Program completion rate). The best weighted combination of all previous measurements has a seven times larger error than what we expect. We will determine the proper motion of the clouds with 2% accuracy. When combined with HI data for the Magellanic Stream this will constrain both the mass distribution in the Galactic Halo and theoretical models for the origin of the Magellanic Stream. Previous measurements are too crude for such constraints. Our data will provide by far the most accurate proper motion measurement for any Milky Way satellite. With the cancellation of SM4, HST is expected to transition to two-gyroscope guiding in Cycle 14. This guiding mode has additional jitter that will decrease the accuracy of all HST astrometry. Moreover, there will be a 10 degree radius hole about the ecliptic poles that will be unobservable, which regrettably includes the LMC. So this cycle may be the last realistic opportunity for this fundamental measurement. If no second epoch data are obtained, the previous investment of 40 snapshot orbits will be wasted. There will be no other observatory for at least a decade that can make this measurement.
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Proposal Category: GO
Scientific Category: STELLAR POPULATIONS
ID: 10131
Title: Determining the Origin of Virgo's Intracluster Stars
PI: Robin Ciardullo
PI Institution: The Pennsylvania State University

Intracluster stars constitute about 20% of the total stellar population of a typical galaxy cluster, and their existence provides a vital clue for our understanding of cluster formation and evolution. However, to exploit their probative value, we need to know their origins: are they the remnants of dwarf galaxies, long since destroyed by the cluster potential, or have the stars been harassed from their parent galaxies at recent epochs? To answer this question, we propose to use the Wide-Field Channel of ACS to make an I, (V-I) color-magnitude diagram of Virgo's intracluster stars. From the position and morphology of the population's red giant branch, we will be able to determine the metallicity distribution function of the stars, and thereby determine their likely origin and ejection mechanisms. Only HST with the ACS has the sensitivity and resolution to perform this fundamental measurement. This program has two options. Option one uses conventional methods of cluster photometry and requires 37 orbits of exposure time. Option two involves a novel analysis technique, which promises to achieve most of the same science in two-thirds the time (23 orbits). We describe this alternative method of analysis and demonstrate its use via simulations.
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Proposal Category: SNAP
Scientific Category: QUASAR ABSORPTION LINES AND IGM

ID: 10132
Title: UV Confirmation of New Quasar Sightlines Suitable for the Study of Intergalactic Helium
PI: Scott Anderson
PI Institution: University of Washington

The reionization of intergalactic helium is thought to have occurred between redshifts of about 3 and 4. The study of HeII Lyman-alpha absorption towards a half-dozen quasars at 2.7<z2.9 SDSS quasars, but with special emphasis on extending helium studies to the highest redshift sightlines. Our proposed approach has already proven successful, and additional sightlines will enable follow-up observations at higher S/N with STIS to measure the spectrum and evolution of the ionizing background radiation, the density of intergalactic baryons, and the epoch of reionization of the IGM.
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Proposal Category: GO
Scientific Category: AGN/QUASARS
ID: 10133
Title: HST / Chandra Monitoring of a Dramatic Flare in the M87 Jet
PI: John Biretta
PI Institution: Space Telescope Science Institute

As the nearest galaxy with an optical jet, M87 affords an unparalleled opportunity to study extragalactic jet phenomena at the highest resolution. During 2002, HST and Chandra monitoring of the M87 jet detected a dramatic flare in knot HST-1 located ~1" from the nucleus. As of late 2003 its brightness has increased twenty-fold in the optical band, and continues to increase sharply; the X-rays show a similarly dramatic outburst. In both bands HST-1 now greatly exceeds the nucleus in brightness. 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 seven epochs of HST/STIS monitoring during Cycle 13, as well as seven epochs of Chandra/ACIS observation (5ksec each). We also include a brief HRC/ACS observations that will be used to gather spectral information and map the magnetic field structure. This monitoring is continued into Cycles 14 and 15. The results of this investigation are of key importance not only for understanding the nature of the X-ray emission of the M87 jet, but also for understanding flares in blazar jets, which are highly variable, but where we have never before been able to resolve the flaring region in the optical or X-rays. These observations will allow us to test synchrotron emission models for the X-ray outburst, constrain particle acceleration and loss timescales, and study the jet dynamics associated with this flaring component.
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Proposal Category: GO
Scientific Category: GALAXIES
ID: 10134
Title: The Evolution and Assembly of Galactic Disks: Integrated studies of mass, stars and gas in the Extended Groth Strip
PI: Marc Davis
PI Institution: University of California - Berkeley

We propose a 126 orbit total F606W/F814W ACS imaging program to measure the evolution of galaxy disks from redshift z=1.4 to the present. By combining HST imaging with existing observations in the Extended Groth Strip, we can for the first time simultaneously determine the mass in dark matter that underlies disks, the mass in stars within those disks, and the rate of formation of new stars from gas in the disks, for samples of >1,000 objects. ACS observations are critical for this work, both for reliable identifications of disks and for determining their sizes and inclinations. Combining these with the kinematics measured from high-resolution Keck DEIMOS spectra will give dynamical masses, which include dark matter. Stellar masses can be measured separately from dark matter using ground-based BRIK and Spitzer IRAC GTO data, while cross-calibrated star formation rates will come from DEEP2 spectra, GALEX, and Spitzer/MIPS. The field chosen is the only one where all multiwavelength needed will be available in the near term. This data will show how the fundamental properties of disks (luminosity, rotation speed, scale length) and their scaling relations have evolved since z~1, and also will measure the buildup of stellar disks directly; these avenues will provide fundamental tests of models of disk formation and evolution.
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Proposal Category: GO
Scientific Category: GALAXIES
ID: 10135
Title: Unveiling the Progenitors and Physics of Cosmic Explosions
PI: Shrinivas Kulkarni
PI Institution: California Institute of Technology

GRBs and XRFs are clearly highly asymmetric explosions and require a long-lived power source (central engine). In contrast, nearby core-collapse events are essentially spherical explosions. However, the failure of spherical neutrino driven collapses has led to the idea that asymmetric energy release is essential for the explosion. The recent finding of a Type Ic SN in GRB 030329, the association of the low energy event GRB 980425 with SN 1998bw, the theoretical development discussed above and the rise of collapsar models make it timely to consider whether all these explosions contain engines. Given the uncertainties in theoretical modeling it is clear that observations are needed to guide models. A priori there is little reason to expect connection between the ultra-relativistic jet that powers the GRB and the explosive nucleosynthesis of the ~0.5 solar masses of Nickel-56 that powers the accompanying supernova. We propose a comprehensive program of ACS photometric searches (and measurements) for SNe associated with GRBs and XRFs. In concert, we will undertake ground-based spectroscopy to determine velocity widths, and measure engine parameters from pan-chromatic afterglow observations. Our goal is to produce a comprehensive database of engine and SN physical parameters against which theoretical modeling will be guided.
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Proposal Category: GO
Scientific Category: STELLAR POPULATIONS
ID: 10136
Title: Post-AGB Stars in the Halo of M81
PI: Howard Bond
PI Institution: Space Telescope Science Institute

Post-asymptotic-giant-branch (PAGB) stars of spectral types A-F are the brightest members of Population II. We have shown, using ground-based

observations, that PAGB stars have tremendous potential as highly efficient standard candles and as tracers of halo populations and late stellar evolution. Our analysis of PAGB stars in archival HST images of M32, based on the equivalent of one orbit of HST time, precisely reproduces the accepted distance. We propose to obtain ACS/WFC and WFPC2 images of fields in the halo of M81, as another test of the PAGB method. We show that 4 orbits of HST data will produce a distance of comparable accuracy to the much more laborious Cepheid technique. If successful on M81, we will propose in the next cycle to measure the distance to Virgo using our method, a distance ladder that has only two rungs (trigonometric parallaxes of subdwarfs to calibrate PAGB stars in globular clusters, and then PAGB stars in Virgo).
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Proposal Category: SNAP
Scientific Category: GALAXIES
ID: 10137
Title: Cluster Archeology: The Origin of Ultra-compact Dwarf Galaxies
PI: Michael Drinkwater
PI Institution: University of Queensland

Ultra-compact dwarf (UCD) galaxies are a new type of galaxy we have discovered in the central regions of the Fornax and Virgo galaxy clusters. Our most recent observations in the Fornax Cluster show that UCDs outnumber normal galaxies in the centre of that cluster. Here we propose snapshot imaging of UCDs in the Fornax and Virgo clusters to test theories of how these fascinating objects formed. In particular we wish to image Virgo cluster UCDs for which we have ground-based Keck spectroscopy to test predictions that they formed more recently than the Fornax UCDs.
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Proposal Category: GO
Scientific Category: STELLAR POPULATIONS
ID: 10138
Title: Searching for the Bottom of the Initial Mass Function
PI: Kevin Luhman
PI Institution: Smithsonian Institution Astrophysical Observatory

The minimum mass of the Initial Mass Function (IMF) should be a direct reflection of the physical processes that dominate in the formation of stars and brown dwarfs. To date, the IMF has been measured down to 10 M_Jup in a few young clusters; there is no sign of a low-mass cutoff in the data for these clusters. We propose to obtain deep images in the SDSS i and z filters (i=26, z=25) with the ACS/WFC on HST for a 800"x1000" field in the Chamaeleon I star-forming region (2 Myr, 160 pc). By combining these HST data (0.8, 0.9 um) with comparably deep broad-band photometry from ground-based telescopes (1.2, 1.6, 2.2 um) and SIRTF (3.6, 4.5, 5.8, 8.0 um), we will measure the mass function of brown dwarfs down to the mass of Jupiter and thus determine the lowest mass at which objects can form in isolation in a typical star forming cluster.
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Proposal Category: GO
Scientific Category: AGN/QUASARS
ID: 10139
Title: Structure of the Accretion Disk in the NLS1 NGC 4051
PI: Bradley Peterson
PI Institution: Ohio State University

We propose to obtain a UV spectrum of the narrow-line Seyfert 1 (NLS1) galaxy NGC 4051 on a target-of-opportunity basis when it goes into a faint state for the purpose of exploring the variable nature of the shape of the ionizing continuum in this source. Previous simultaneous X-ray and optical monitoring of this source reveals that at some times the X-rays and the He II 4686 emission line nearly disappear, while the UV/optical continuum and Balmer lines are weaker, but present and continue to vary. This suggests that there is a variable cutoff in the shape of the ionizing continuum, and in the faint state this occurs at low enough energies to affect all the strong UV lines. By comparing emission-line flux ratios in the low state to those in high states and with photoionization equibrium calculations, we can identify the cutoff energy. The cutoff energy may correspond to a transition radius in the accretion disk, inside of which the source has entered into a low-radiative efficiency mode.

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Proposal Category: GO
Scientific Category: SOLAR SYSTEM
ID: 10140
Title: Identification of a magnetic anomaly at Jupiter from satellite footprints
PI: Denis Grodent
PI Institution: Universite de Liege

Repeated imaging of Jupiter's aurora has shown that the northern main oval has a distorted 'kidney bean' shape in the general range of 90-140¼ System III longitude, which appears unchanged since 1994. While it is more difficult to observe the conjugate regions in the southern aurora, no corresponding distortion appears in the south. Recent improved accuracy in locating the satellite footprint auroral emissions has provided new information about the geometry of Jupiter's magnetic field in this and other areas. The study of the magnetic field provides us with insight into the state of matter and the dynamics deep down Jupiter. There is currently no other way to do this from orbit. The persistent pattern of the main oval implies a disturbance of the local magnetic field, and the increased latitudinal separation of the locus of satellite footprints from each other and from the main oval implies a locally weaker field strength. It is possible that these phenomena result from a magnetic anomaly in Jupiter's intrinsic magnetic field, as was proposed by A. Dessler in the 1970's. There is presently only limited evidence from the scarcity of auroral footprints observed in this longitude range. We propose to obtain HST UV images with specific observing geometries of Jupiter to determine the locations of the auroral footprints of Io, Europa, and Ganymede in cycle 13 to accurately determine the magnetic field geometry in the suggested anomaly region, and to either confirm or refute the suggestion of a local magnetic anomaly.

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Proposal Category: GO
Scientific Category: HOT STARS
ID: 10141
Title: UV spectroscopy of the hot bare stellar core H1504+65
PI: Klaus Werner
PI Institution: Universitat Tubingen, Institut fur Astronomie & Astrophysik

H1504+65 ist the hottest known white dwarf (Teff=200 000 K). It has an

extraordinary surface composition. The photosphere is devoid of hydrogen and helium. It is mainly composed of carbon and oxygen (by equal parts) and neon (2%). We obviously see the exposed core of a former red giant. The evolutionary history of this unique object is unknown. We have identified magnesium absorption lines in the soft X-ray photospheric (Chandra) spectrum, which suggests that H1504+65 may be a O-Ne-Mg white dwarf. We will test this hypothesis by abundance determinations of Mg and Na. If confirmed, then H1504+65 would be the most compelling case for the existence of single O-Ne-Mg white dwarfs.

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Proposal Category: GO
Scientific Category: QUASAR ABSORPTION LINES AND IGM
ID: 10142
Title: The connection between star-forming galaxies and low-redshift quasar absorption line systems
PI: Regina Schulte-Ladbeck
PI Institution: University of Pittsburgh

We have positionally matched our database of over 19,000 star-forming galaxies (SFGs) from the Sloan Digital Sky Survey (SDSS) against the SDSS QSO catalog. This has allowed us to discover nineteen bright QSOs with redshifts of less than or about one behind local SFGs. Two of the QSOs were fortuitously already observed with HST, and show strong Lyman alpha lines at the emission-line redshifts of the SFGs with which we matched them

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Proposal Category: SNAP
Scientific Category: COOL STARS
ID: 10143
Title: Ultracool companions to the nearest L dwarfs
PI: I. Reid
PI Institution: Space Telescope Science Institute

We propose to conduct the most sensitive survey to date for low mass companions to nearby L dwarfs. We will use NICMOS to image targets drawn from a volume-complete sample of 70 L dwarfs within 20 parsecs. The combination of infrared imaging and proximity will allow us to search for T dwarf companions at separations as small as 1.6 AU. This is crucial, since no ultracool binaries are currently known with separations exceeding 15 AU. Only 10 dwarfs in this sample have previous HST observations, primarily at optical wavelengths. With the increased sensitivity of our survey, we will provide the most stringent test to date of brown dwarf models which envisage their formation as ejected stellar embryos. In addition, our observations will be capable of detecting binaries with mass ratios as low as 0.3, and will therefore also test the apparent preference for equal-mass ultracool binaries. Finally, our observations offer the best prospect to date of detecting companions significantly cooler than the coolest T dwarf currently known.

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Proposal Category: GO
Scientific Category: SOLAR SYSTEM
ID: 10144
Title: The Gas Environment of Comet 9P/Tempel 1 During the Deep Impact Encounter
PI: Paul Feldman
PI Institution: The Johns Hopkins University

We propose a series of observations of the periodic comet 9P/Tempel 1 in conjunction with NASA's Deep Impact mission. This mission is a spacecraft that will release a 360 kg impactor into the nucleus of the comet on July 4, 2005. Our primary objective is to study the generation and evolution of the gaseous coma resulting from this impact. To this end we plan to obtain ultraviolet spectra with STIS before, during, and following the impact. As a secondary objective we will obtain wide-band images of the visual outburst resulting from the impact. We also plan to use the high resolution capability of the ACS/HRC, in conjunction with the camera on board the spacecraft, two weeks prior to impact, to determine the spatial orientation of active jets emanating from the comet's nucleus and to assess the potential hazards of these jets to the spacecraft.

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Proposal Category: GO
Scientific Category: STAR FORMATION
ID: 10145
Title: Physical parameters of the upper atmosphere of the extrasolar planet HD209458b
PI: Alfred Vidal-Madjar
PI Institution: CNRS, Institute d'Astrophysique de Paris

Every 3.5 days, the transits of the gaseous planet orbiting HD209458 offers the unique opportunity to investigate the spectral features of an extra-solar planetary atmosphere. Using HST, we first discovered the extended upper atmosphere of HD209458b through the detection of a 15% HI absorption. We concluded that the hydrogen must be escaping the planet with a lower limit of 10^10 g/s (Vidal-Madjar et al. 2003, Nature 422, 143). With additional observations, we subsequently detected OI and CII in the upper atmosphere showing that this atmosphere is hydrodynamically escaping (in "blow off", Vidal-Madjar et al. 2004). Here we propose to further study this upper atmosphere to better constrain the "blow off" state by directly estimating the physical conditions and the flow characteristics. In particular we will determine the temperature and density distribution in the upper atmosphere, the density at the Roche lobe, the limit between the lower and upper atmosphere and their ionization states. Comparison between the optical and near ultraviolet occultation light curves will provide useful information on the molecular/haze content of the lower atmosphere. The observation of six HD209458b transits with a single E230M setting will allow the detection of many lines adressing these issues. The proposed observations will give us for the first time a detailed probe of the atmosphere of an "evaporating" extra-solar planet.

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Proposal Category: GO
Scientific Category: STELLAR POPULATIONS
ID: 10146
Title: Solving the problem of the White Dwarf Cooling Sequence End in M4: an efficent approach
PI: Luigi Bedin
PI Institution: Universita di Padova

The end of the white dwarf (WD) cooling sequence (WDCS) has never been observed, despite the importance that it has in providing an age estimate of old stellar systems, independent from the standard method of the main sequence turn off. The best targets for this investigation are the closest stellar

clusters, and, among them, globular clusters are the most interesting ones. Being the oldest stellar aggregates, they allow to probe the advanced WD cooling phases, and the independent age estimate coming from the end of their WDCS has an important cosmological impact. M4 is the best target for this investigation. Despite huge observational efforts, we still miss the end of its WDCS. The ACS camera offers a unique opportunity to identify it. Coupled with already existing observations, we here prove that we can finally reach it with only 10 HST orbits. This is probably the last opportunity we have for a large number of years. The data we are requesting here, will also be used to complete other two programs of great astrophysical impact: the observational detection of the main sequence hydrogen burning limit, and the measurement of the geometrical distance of M4.

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Proposal Category: GO
Scientific Category: COOL STARS
ID: 10147
Title: Detecting the elusive low mass companion around epsilon Indi
PI: Michael Endl
PI Institution: University of Texas at Austin

We propose coronagraphic NICMOS observations of the nearby (d = 3.6 pc) K5V star epsilon Indi (HD 209100) to search for the unknown companion which causes a low amplitude radial velocity (RV) trend in our 11 years of precise Doppler measurements. This RV data set places a lower limit of 4.5 AU for the orbital semimajor axis of this companion. Moreover, the fact that the RV trend is lacking any sign of curvature over this long time period clearly points towards a much larger orbital separation. Epsilon Indi also has a T dwarf (binary) companion at a separation of 1400 AU. However, these brown dwarf companions are too distant from the primary to induce the observed RV variation. It is also unlikely that this nearby star has an unknown stellar (M dwarf) companion. The RV signal is thus most probably caused by a yet unknown giant planetary or brown dwarf companion at a separation of more than 5 AU. Because epsilon Indi is so near to the Sun, it constitutes an ideal target for high contrast imaging with NICMOS in its coronagraphic mode. Indeed, NICMOS coronagraphy is capable of detecting objects down to 15 Jupiter masses at separations greater than 2.3 arcseconds (S/N=25) - precisely the separation and mass range indicated by our Doppler spectroscopy. Only 2 orbits of HST/NICMOS observations could directly image the coolest and lowest mass companion ever found around a solar-type star.

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Proposal Category: GO
Scientific Category: GALAXIES
ID: 10148
Title: The Masses of the Ultraluminous X-Ray Sources
PI: Joel Bregman
PI Institution: University of Michigan

Ultraluminous X-ray sources are non-nuclear sources in normal disk galaxies that are second only to AGNs in point-source luminosity. These enigmatic objects are either stellar mass black holes that are super-Eddington emitters, or sub-Eddington emission from 1E3-1E4 Msolar black holes. We can distinguish between these models by a direct determination of the mass of the primary, which requires knowing the spectral type of the secondary, its period, and its orbital velocity around the black hole. We propose to obtain UV spectra to

determine the spectral type of two ULX secondaries (optical counterparts), to infer the masses and radii of the secondaries and their suitability for radial velocity studies. For another ULX secondary, we already obtained a UV spectrum showing it to be a B0I star, so we propose three additional observations, which will yield the characteristic orbital velocity, help constrain the period, and reveal if the primary is a 1E3-1E4 Msolar black hole, which would produce velocities > 1000 km/sec.
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Proposal Category: GO
Scientific Category: AGN/QUASARS
ID: 10149
Title: The Coevolution of Supermassive Black Holes and Galaxies at z~3
PI: Chien Peng
PI Institution: University of Arizona

The existence of strong correlations between the mass of supermassive black holes and galaxy bulge properties implies that there is an intimate connection between their formation and evolution. How do supermassive black holes grow and how did the correlations come about? Is the growth of supermassive black holes coeval with the growth of the bulge, and is a bulge necessary for AGN activity at high z? We propose to use HST NICMOS to image 9 low-luminosity broad-line AGNs at z~3 in the restframe B-band, identified through the Lyman-break technique. This sample is unique because the AGN luminosities are comparable to Seyfert-like nuclei at z~3, and thus are some of the lowest that have been selected optically. Because of the low total luminosity of the sample, the hosts are likely to be Lyman-break galaxies, which are believed to be the progenitor galaxies of the local Hubble sequence. The goal is to directly detect their host galaxies and to separate the AGN, in order to study the host galaxy morphology and luminosity. From measurement of the bulge luminosity and black hole mass (through available spectra), we will study the black hole-bulge coevolution out to z~3. We will also compare the luminosity and morphology of these faint AGN hosts with the more luminous and massive host galaxies found in previous HST studies of quasars.
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Proposal Category: GO
Scientific Category: COSMOLOGY
ID: 10150
Title: NICMOS observations of A1689
PI: Narciso Benitez
PI Institution: Instituto de Astrofisica de Andalucia (IAA)

The potential of galaxy clusters as ``cosmic telescopes'' has been known for a long time, but practical results in the pre-ACS era have been scarce due to two main problems: the uncertainty in determining the magnification distribution of the cluster (the ``optics'' of the instrument) and the presence of numerous bright cluster galaxies which cover the field of view and hinder the detection of background galaxies. We have developed techniques to solve these two problems working with our ACS observations of A1689, the most powerful lens in the sky, and for the first time we have been able to determine the "specifications" of a cosmic telescope with a useful level of precision, thanks to the detection and identification of more than 100 multiple images with reliable redshift information. We propose to observe the high magnification region in the A1689 field in the F110W band with a 3x3 mosaic of NIC3 pointings; the resulting image will reach a limiting magnitudes

of 29.5, surpassing in depth the UDF NICMOS observations and providing an unique dataset with multiple scientific returns.
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Proposal Category: GO
Scientific Category: QUASAR ABSORPTION LINES AND IGM
ID: 10151
Title: Testing the Warm-Hot Intergalactic Medium Paradigm
PI: J. Howk
PI Institution: University of California - San Diego

Cosmological hydrodynamical simulations predict that ~30%-40% of the low-redshift baryons reside in a collisionally ionized phase (log T ~ 5 to 7) of the intergalactic medium (IGM) associated with large-scale, unvirialized filaments of galaxies. Recent surveys of O VI gas have lent some support to the presence of this warm-hot intergalactic medium (WHIM), but the results are significantly limited by uncertainties in the ionization mechanism (photo- vs. collisionally ionized) and metallicity of the gas. We are pursuing a large program to test predictions of the WHIM and to improve existing measurements of the OVI absorbers. The primary goals are (i) to increase the redshift path for detection of the hottest IGM, previously only accessible through X-ray absorption studies, using EUV absorption from Ne VIII and Mg X, and (ii) to constrain the IGM physics using UV absorption from H I Ly-alpha, C III, C IV, and O VI. Our team has been awarded a FUSE Legacy program to probe the moderate-redshift WHIM using unique ionization diagnostics in the restframe EUV waveband, including O V, Ne VIII and Mg X. Here we propose to complement our FUSE Legacy program with STIS intermediate-resolution echelle-mode observations of five moderate-redshift ($0.45 < z < 0.98$) AGNs. The unique combination of FUSE EUV and STIS UV spectra will allow us (1) to test the current models of the WHIM by studying the ionization mechanisms responsible for producing highly-ionized metals in the IGM and determining the frequency of genuine high-temperature metal absorbers in the low-redshift IGM; (2) to investigate the relationship between WHIM and large-scale galaxy structures using galaxy redshift measurements obtained with DEIMOS on Keck and IMACS at Las Campanas Observatory; and (3) to determine the ionization state and metallicity of O VI absorbers in order to accurately assess their contribution to the total baryon budget. Finally, we will make high-level science products derived from these data freely available to the general astronomical community.
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Proposal Category: SNAP
Scientific Category: COSMOLOGY
ID: 10152
Title: A Snapshot Survey of a Complete Sample of X-ray Luminous Galaxy Clusters from Redshift 0.3 to 0.7
PI: Megan Donahue
PI Institution: Michigan State University

We propose a public, uniform imaging survey of a well-studied, complete, and homogeneous sample of X-ray clusters. The sample of 73 clusters spans the redshift range between 0.3-0.7. The samples spans almost 2 orders of magnitude of X-ray luminosity, where half of the sample has X-ray luminosities greater than 10^44 erg/s (0.5-2.0 keV). These snapshots will be used to obtain a fair census of the the morphology of cluster galaxies in the cores of clusters, to detect radial and tangential arc candidates, to detect optical jet candidates, and to provide an approximate estimate of the shear signal of the clusters

themselves, and potentially an assessment of the contribution of large scale structure to lensing shear.
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Proposal Category: GO
Scientific Category: ISM AND CIRCUMSTELLAR MATTER
ID: 10153
Title: Multi-wavelength Observations of Symbiotic Stars in Outburst
PI: Charles Keyes
PI Institution: Space Telescope Science Institute

To investigate the cause and nature of classical symbiotic outbursts, we initiated a program of multi-wavelength observations of these events. As evidence is mounting that collimated outflows (jets) may be associated with symbiotic outbursts, we also investigate conditions needed for jet production - a question with broad astrophysical relevance. The first target for our campaign - the 2000-2002 outburst of Z Andromedae - confirmed the utility and need for coordinated multi-wavelength observations to make progress in understanding the nature of the outburst mechanisms in symbiotic stars. FUSE data were the cornerstone of that project (which included data from the VLA, MERLIN, ground-based spectroscopy and photometry, Chandra, and XMM, but not HST). Our Z And observations have motivated us to propose a new scenario that we term the "combination nova" which is triggered by a disk-instability. To test this new model, we received HST Cycle 12 and FUSE Cycle 4 time (through approximately 6/2004) to continue the multi-wavelength approach with observations at several epochs during the outburst of a second target-of-opportunity (TOO). That TOO has not yet been triggered. We propose here to continue this TOO observing opportunity into Cycle 13 (to 7/2005). FUSE Cycle 5 observations (to mid-2005) were recently approved. Coordinated XMM and VLA observations are also approved. The evolution of the UV spectrum throughout the outburst plays a vital role in distinguishing between the outburst models currently in contention for describing outburst behavior. Analysis of our first campaign has shown that HST observations can play a fundamental role in the multi-wavelength approach. The combination of high-resolution STIS and FUSE-band emission and absorption features, time-tagged observations, and continua provide a unique opportunity to probe the structure and ionization conditions in the outburst material that can not be accomplished with either ultraviolet region alone.
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Proposal Category: GO
Scientific Category: COSMOLOGY
ID: 10154
Title: Morphology of z ~ 7-10 galaxies viewed through gravitational telescopes
PI: Roser Pello
PI Institution: Observatoire Midi-Pyrenees

The aim of these observations is to obtain deep z/ACS and H/NICMOS images in the core of two lensing clusters, A1835 and AC114, where a few z ~ 7-10 galaxy candidates have been selected from our ultra-deep JHK imaging program with Isaac/VLT. Spectroscopic observations have allowed to confirm 2 of these candidates thanks to the detection of faint emission lines identified as Lyman alpha at z=7.2 and 10. Our HST project is focused on two main goals: (1) the morphological confirmation of galaxy candidates lying near critical lines, and (2) the determination of the physical scales involved in star-forming

regions at z ~ 7-10. These goals should have important implications on our present knowledge of the galaxy formation process in the early Universe.
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Proposal Category: GO
Scientific Category: ISM AND CIRCUMSTELLAR MATTER
ID: 10155
Title: A Mini-Survey of Interstellar Abundances in the Magellanic Clouds
PI: Daniel Welty
PI Institution: University of Chicago

Studies of the interstellar medium in the Magellanic Clouds explore somewhat different environmental conditions from those typically probed in our own Galactic ISM. Apart from a few studies of individual sightlines, however, little is known about the abundances and depletions in the ISM of the LMC and SMC. HST spectra of three SMC stars indicate that Si and Mg (generally thought to be major dust constituents) are essentially undepleted in the SMC gas --- even for components with severe depletions of Fe and Ni. Similar "anomalous" Si depletions have now been seen in cycle 12 STIS spectra of one LMC star, though "normal" Si depletions are seen toward a second. Intriguingly, the "anomalous" Si depletions are all found for sightlines which probe regions where the 2175 A extinction bump is either absent (most of SMC) or very weak (LMC2). We therefore propose a mini-survey of interstellar absorption lines toward 13 stars distributed throughout the LMC and SMC --- which would more than double the number of Magellanic Clouds sightlines with extensive and accurate interstellar abundance information. A single STIS E230M setting will include lines from Zn II, Si II, Fe II, Ti II, Cr II, Ni II, and several trace neutral species --- allowing the abundance/depletion pattern to be determined at many locations in the two galaxies. The analysis of these spectra will have significant implications for (1) making models of interstellar dust grains (which currently rely heavily on silicates); (2) understanding the relationships between depletions, dust, and H_2 (which may be somewhat different in the Milky Way, LMC, and SMC); and (3) interpreting the gas-phase abundances observed for more distant low-metallicity systems, such as the QSO absorption-line systems (which exhibit some similar properties).
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Proposal Category: GO
Scientific Category: SOLAR SYSTEM
ID: 10156
Title: Saturn's Auroral Energy Deposition Coordinated with Cassini UVIS
PI: John Clarke
PI Institution: Boston University

An in-depth study of Saturn's magnetosphere and auroral processes has begun in Jan. 2004 with coordinated HST STIS images of Saturn's aurora while the approaching Cassini measures the solar wind. This program is expected to establish the degree of solar wind control of Saturn's aurora. The beginning of the Cassini orbiter tour of the Saturn system in July 2004 will offer new opportunities for collaborative science. The energetics of Saturn's auroral processes can best be studied via low resolution UV spectra of the emissions and the auroral "color ratio". The geometry of the initial Cassini orbits provides the best observing geometry for UVIS measurements of auroral energetics when it is close to Saturn on the night side. At such times, it

will be possible to have simultaneous observations of Saturn's southern / dayside aurora with HST STIS and the northern / nightside aurora with Cassini UVIS. Both the distributions of the auroral emissions and the energy of the precipitating particles can be measured simultaneously at conjugate points north and south. This proposal is to conduct one such simultaneous observation, which will demonstrate the potential for future cycles. We request 5 HST orbits to observe a large fraction of one complete Saturn rotation at the same time as Cassini UVIS. The rotational coverage has been shown to be of central importance in recent STIS images of Saturn's auroral activity, which is concentrated in an "active sector" connected with the strongest SKR radio emissions.
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Proposal Category: GO
Scientific Category: GALAXIES
ID: 10157
Title: Bulges or disks in the centers of late-type spirals?
PI: C. Carollo
PI Institution: Eidgenossiche Technische Hochschule (ETH)

In a simple view of the Hubble sequence, smaller bulges should be rescaled versions of bigger bulges. Bulges however have been found to change their structural properties with decreasing luminosity, approaching at the faintest end a disk-like, exponential light profile. This indicates a complex mass-dependent bulge formation history. Particularly, the intermediate-to-small size bulges have been suggested to form due to secular evolution processes within their host disks. However, the alleged small bulges may even be 'simply' denser inner regions of the disks. Two major ingredients are missing in order to (a) understand the nature of bulges in the disk-dominated galaxies, (b) establish whether and which secular evolution processes actually occur, and (c) in which mass range they are preferentially active: (1) High-resolution numerical simulations of disk secular evolution, to provide a quantitative basis for interpreting real data; (2) Observational diagnostics which can break the degeneracy between very cold, dense disks and relatively hot bulges, and to compare with the simulations. We are carrying out a large N-body + SPH simulations campaign to settle the first issue. Stellar kinematics are the ideal observational diagnostics. We have acquired ground kinematic data for the medium-sized bulges. However, both the spectroscopic and the spatial resolution requirements necessary to trace the relative contributions of cold and hot motions become very stringent at the faint-end of the bulge sequence: only the HST can provide radially-extended kinematics for the smallest bulges. We therefore ask for STIS/G750M spectroscopy to measure internal resolved stellar kinematics for two small bulges selected from our previous HST imaging program. Even just these two "data-points" in this unexplored mass-regime will allow significant progress in the understanding of the origin of the Hubble sequence: Complemented by our ground-study of the medium-sized bulges, they will allow us to establish whether the ratio of cold-to-hot motions in bulges in the intermediate-to-small mass regime depends on the bulge mass, and, by comparing with our simulations, to constrain the initial conditions and physical parameters that allow disk secular evolution processes to grow central bulges similar to those that are observed along the entire Hubble sequence.
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Proposal Category: GO
Scientific Category: COSMOLOGY
ID: 10158

Title: ACS Observations of the Gravitational Lens B1608+656: Characterizing the Einstein Ring
PI: Christopher Fassnacht
PI Institution: University of California - Davis

We request time to obtain ACS deep images of the B1608+656 gravitational lens system to fully characterize its enclosing Einstein ring with high signal-to-noise ratio (SNR). These data will allow us to determine the gravitational potential of the lens, locally, to several percent accuracy and, combined with the three independent time delays, measure H_0 to much better than 10% precision. For this goal, we have developed powerful new lens modeling codes that make use of the full brightness distribution of the Einstein ring in lens systems. The B1608+656 system is ideal for our new code. It has precisely measured time delays, a well-determined stellar velocity dispersion, and an Einstein ring that is not dominated by the lensed nuclear emission of the background source. When combined with high-SNR images of Einstein rings, the new modeling codes provide qualitatively different and much improved analysis of the ring emission than was previously possible. The proposed ACS observations will reach the SNR at which the new modeling code can be fully exploited (SNR=5 per pixel). Our simulations show that these new data will allow us to reduce the total uncertainties in H_0 derived from the system by at least a factor of two, to the 5-7% level for this system.
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Proposal Category: GO
Scientific Category: COSMOLOGY
ID: 10159
Title: Characterizing the Sources Responsible for Cosmic Reionization
PI: Richard Ellis
PI Institution: California Institute of Technology

Our group has demonstrated the role that massive clusters of galaxies, acting as powerful cosmic lenses, can play in locating sources with modest mass and star formation rate beyond redshifts z~5-6 likely to be representative of those responsible for cosmic reionization. The large magnifications, possible in the critical regions of well-constrained clusters, bring sources into view that would lie at or beyond the limits of conventional exposures such as the UDF. Recently, using deep ACS and NICMOS imaging, we have located a low mass source at z=7.05 whose UV continuum slope is apparently steeper than for normal star-forming galaxies. We propose a deep ACS grism exposure to confirm the nature of this source and further ACS and NICMOS imaging of well-studied clusters to locate further examples. The grism spectroscopy will conclusively determine the UV SED of this source and our 3-color survey will constrain the redshift, star-formation rate, and SED of additional 6<z6.5, with more than 2.5 Msun/yr of star formation (our survey limit). Before the advent of the next generation of observational facilities, our search technique may represent the only way to reliably select and characterize the likely population of galaxies during the epoch of reionization.
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Proposal Category: GO
Scientific Category: AGN/QUASARS
ID: 10160
Title: The nuclear scattering geometry of Seyfert galaxies
PI: Andrew Robinson

PI Institution: Rochester Institute of Technology

Orientation-based unification schemes are now well-established as the basis for understanding the relationships between different classes of AGN. However, our recent study of the optical polarization properties of Seyfert 1 galaxies indicates that scattered light emerging from these objects often follows a different path to that in Seyfert 2's, indicating that the simplest unification geometry is incomplete. We have developed a generic scattering model for Seyfert nuclei which includes a compact, equatorial scattering region located within the circum-nuclear torus and the 'classic' polar scattering region outside it. We propose to test this model by using NICMOS to make NIR imaging observations that will allow us to isolate the two scattering regions within individual objects.

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Proposal Category: GO
Scientific Category: SOLAR SYSTEM
ID: 10161
Title: Fresh ammonia-ice on Jupiter: The northern equatorial region.
PI: Michael Wong
PI Institution: University of California - Berkeley

The proposed multi-band imaging of one of the most dynamic regions on Jupiter will complement recent space-based infrared datasets and will provide crucial constraints to models of Jovian atmospheric dynamics. NICMOS is sensitive to the jovian troposphere at and above the visible cloud decks. We selected six NICMOS filters with varying levels of atmospheric opacity to observe cloud features as they rotate from the central meridian to the limb, a strategy that will maximize the vertical resolution of our retrievals of cloud heights, haze opacity, and gaseous ammonia concentration. With these filters and the excellent NICMOS spatial resolution (nearly an order of magnitude improvement over Galileo NIMS images of the northern equatorial region), we will determine the smaller-scale structure of fresh NH3 clouds and provide cloud heights as constraints for models of convection and dynamics associated with 5-micron hotspots. HST is essential for this project, since no other observatory can provide the necessary spatial resolution, and no ground-based or space-based telescopes can observe the ammonia bands we have selected.

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Proposal Category: GO
Scientific Category: ISM AND CIRCUMSTELLAR MATTER
ID: 10162
Title: Resolving the Thermal Conduction Front in the Bubble S308
PI: You-Hua Chu
PI Institution: University of Illinois at Urbana - Champaign

Heat conduction is one of the most fundamental processes in the interstellar and intergalactic media. Many astronomical systems contain cool (<10^4 K) gas in contact with hot (10^6 -10^8 K) gas; at the contact surfaces, heat conduction occurs and may play an essential role in the thermal structure and evolution of the system. Observations of thermal conduction fronts have been extremely limited. Conventionally observations use absorption lines of collisionally ionized high ions as tracers of 1-3x10^5 K gas in the conduction front. Such observations allow the determination of column densities but not the relative locations of these tracer ions. Emission-line observations of a clear-cut, edge-on conduction front are needed to study the physical structure

of a thermal conduction front. We have identified a clean-cut, edge-on conduction front in the circumstellar bubble S308, using XMM-Newton X-ray observations and ground-based optical images and spectra. We request HST STIS spectroscopic observations of the NV and CVI emission lines in the transition region from the hot interior gas to the cool nebular shell. These observations, combined with our complementary observations at optical, FUV, and X-ray wavelength, allow us to determine the spatially-resolved temperature profile of a thermal conduction front. Comparisons with models further allow us to assess the efficiency of thermal conduction.
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Proposal Category: GO
Scientific Category: HOT STARS
ID: 10163
Title: Weighing the Most Luminous Main-Sequence Star in the Galaxy
PI: Anthony Moffat
PI Institution: Universite de Montreal

NGC 3603 is the most massive, visible giant HII region in our Galaxy and virtually a clone of R136, the famous supercluster in the core of the 30 Dor region in the LMC. NGC 3603 harbors three young, extremely luminous, hot stars which mimic the spectral appearance of WN6ha stars. As tailored atmosphere analysis reveals, these stars are unevolved, very massive stars on the main sequence. In fact, these stars have the potential of being the most massive main sequence stars known in our Galaxy. One of these WN6ha stars is a double-eclipsing binary with a 3.772(3)d period. We propose here to use HST/STIS to carry out, for the first time, repeated, high-quality spectroscopy of this binary in order to derive Keplerian orbits for both components and thus directly measure their masses. Additional photometry will considerably refine the solution for the inclination angle. Whether or not the mass of the WN6ha (and possibly also its companion) star significantly exceeds 60 M_sol, the current directly-observed, upper limit of main sequence stars, will allow us to put models for massive stars to the test. As a by-product of our observations, we will also monitor the two remaining WN6ha stars in NGC 3603. At least one of them shows strong indications for binarity.
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Proposal Category: GO
Scientific Category: ISM AND CIRCUMSTELLAR MATTER
ID: 10164
Title: HD 62542: Probing the Bare, Dense Core of an Interstellar Cloud
PI: Daniel Welty
PI Institution: University of Chicago

The line of sight to HD 62542 is remarkable for its unusual UV extinction, high column densities of various molecules, and apparent dearth of diffuse atomic gas. The main interstellar cloud appears to be a small, dense (n_H ~ 500--1000 cm^-3), molecular knot whose more diffuse outer layers have been stripped away by stellar winds and shocks. As such, it provides an ideal venue for investigating the properties of dense, molecular gas --- with minimal confusion from any associated diffuse gas. We propose to obtain high resolution, moderately high S/N STIS spectra of C I, CO and its isotopomers, C_2, C II, O I, and many other atomic species. Those data will be used to compare various diagnostics of the physical conditions (e.g., C I and O I fine structure exciattion, CO and C_2 rotational excitation), to determine the

relative abundances of the various CO isotopomers (fractionation), and to determine the depletions of various elements in dense gas (the predicted severe depletions have likely been masked by associated diffuse gas in other cases). Understanding the fractionation and excitation of CO in this relatively simple case will aid in understanding its behavior in other more complex regions (important because CO and its isotopomers are often used to trace and characterize molecular gas when H_2 cannot be measured).
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Proposal Category: GO
Scientific Category: SOLAR SYSTEM
ID: 10165
Title: Determination of orbits and colors for two new binaries in the Koronis asteroid family
PI: William Merline
PI Institution: Southwest Research Institute

We propose to measure color and orbital properties of two asteroid binaries in the Koronis family discovered in our SNAP-9747 survey. The best previously studied asteroid binary system, Ida/Dactyl, is also in the Koronis family. Differential space weathering measured on the Ida and Dactyl surfaces has been a powerful constraint on models of satellite formation mechanisms and satellite survivability. HST offers the unique opportunity for similar measurements of these much smaller, main-belt binaries. The new satellites are believed to have formed through different collisional mechanisms than Ida/Dactyl. Further, with a set of 4 relative position measurements for each of the two systems, added to the discovery snapshots, we will determine and compare the densities of the primaries with Ida (a large, 31.5 km, asteroid with density 2.6+-0.5 g/cm^3, measured by the Galileo flyby). In contrast, (17246) and (22899) are 4.5 km bodies that are likely to have been restructured since the family-forming event by subsequent collisions. As all are members of the same family, differences in density would constrain bulk composition and internal structure (e.g. shard vs. rubble-pile). Hence, these measurements are likely to further elucidate the mechanisms for formation of satellites.
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Proposal Category: GO
Scientific Category: SOLAR SYSTEM
ID: 10166
Title: ACS and WFPC2 Stellar Photometry in the Kepler Mission Target Field
PI: William Borucki
PI Institution: NASA Ames Research Center

We will observe three regions at the Galactic Equator (GE) to determine the areal density of background stars down to apparent visual magnitude 25. Eclipsing binary stars of this magnitude may confound Kepler photometric data, which are intended to detect transits of Earth-size planets across foregroud parent stars. The GE is the region of greatest areal density of target stars, but there is no information on the numbers of 25th magnitude stars there. The Kepler mission is obligated to do everything possible to avoid false positive claims of Earth-size planets, because following missions, such as the Terrestrial Planet Finder will rely on Kepler findings to optimize their designs. The proposed observations will guide the Kepler team in their efforts to avoid false positives. For example, the data could indicate that it would be better for Kepler to abandon the area of greatest target

opportunity in order to reduce the risk of false positive claims.
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Proposal Category: GO
Scientific Category: ISM AND CIRCUMSTELLAR MATTER
ID: 10167
Title: Imaging of Ices in Circumstellar Disks
PI: Alycia Weinberger
PI Institution: Carnegie Institution of Washington

The link between the material of the interstellar medium and the ultimate composition of planets lies in the way gas and dust are processed in circumstellar disks. Planet formation models rely upon a knowledge of the disk constituents and temperature profiles to simulate how small grains eventually combine into terrestrial planets and gas giant cores. Disks around other stars may be analogs for our own early Solar System and thus allow the direct measurement of such phenomena. Only recently, however, have well-resolved images of dust disks around several late T Tauri or main sequence stars been secured. HST provides a uniquely stable platform for making such sensitive high dynamic range images. Now, for those handful of disks already resolved, we are able to go beyond the discovery phase and begin making astrophysical measurements to deepen our understanding of the course of disk evolution. We therefore propose a multi-wavelength study with NICMOS designed to discover the spatial distribution of two common Solar System materials -- methane and water ices -- in other systems.
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Proposal Category: GO
Scientific Category: ISM AND CIRCUMSTELLAR MATTER
ID: 10168
Title: Spatially Relsoved Spectroscopy of HR 4796A's Dust Ring
PI: Alycia Weinberger
PI Institution: Carnegie Institution of Washington

HST's high-contrast capabilities provide exciting imaging of circumstellar debris disks with complex structures. In particular, broad-band imaging using the coronagraphs in NICMOS and STIS has elucidated the disk morphology of HR 4796A exquisitely, but can only provide colors, not detailed compositional information on its dust. With spectra, we will measure the detailed albedo of the disk dust over a large wavelength range and search for interstellar medium-like molecules and water ice. We will also use our spatially resolved spectra for very high angular resolution profiles of the disk width to constrain models for planets circling inside the dust. We have demonstrated in a previous program how to use STIS for spatially resolved disk spectroscopy. We now propose to use our technique to study HR 4796A.
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Proposal Category: GO
Scientific Category: GALAXIES
ID: 10169
Title: Star Formation in Luminous Infrared Galaxies: giant HII Regions and Super Star Clusters
PI: Almudena Alonso-Herrero
PI Institution: Instituto de Estructura de la Materia

Luminous Infrared Galaxies (LIRGs,LIR = 10^11-10^12Lsol) and Ultraluminous Infrared Galaxies (LIR>10^12Lsol) account for approximately 75% of all the

galaxies detected in the mid-infrared in the redshift range z=0-1.5. In the local universe it is found that LIRGs are predominantly powered by intense star formation (SF). However, the physical conditions and processes governing such dramatic activity over scales of tens to a few hundred parsecs are poorly known. In the last decade HST has been playing a significant role, mainly with the discovery of super star cluters (SSCs), and more recently, giant HII regions. Based on observations of a few LIRGs, we found that these giant HII regions and associated SSCs appear to be more common in LIRGs than in normal galaxies, and may dominate the star formation activity in LIRGs. A larger sample is required to address fundamental questions. We propose an HST/NICMOS targeted campaign of a volume limited sample (v<5200km/s) of 24 LIRGs. This proposal will probe the role of giant HII regions in the overall energetics of the current star formation, their relation to SSCs, and the dependence of star formation properties on other parameters of LIRGs. Such detailed knowledge of the SF properties of LIRGs in the local universe is essential for understanding galaxies at high redshift.

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Proposal Category: SNAP
Scientific Category: SOLAR SYSTEM
ID: 10170
Title: Atmospheric Variability 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, months, and years. Uranus is rapidly approaching equinox in 2007, with another 4 degrees of latitude becoming visible every year. Recent HST observations during this epoch (including 6818: Hammel, Lockwood, and Rages; 7885: Hammel, Karkoschka, and Marley; 8680: Hammel, Rages, Lockwood, and Marley; and 8634: Rages, Hammel, Lockwood, Marley, and McKay) have revealed strongly wavelength-dependent latitudinal structure and the presence of numerous visible-wavelength cloud features in the northern hemisphere. Long-term ground-based observations (Lockwood and Thompson 1999) show seasonal brightness changes whose origins are not well understood. Recent near-IR images of Neptune obtained using adaptive optics on the Keck Telesccope together with images from our Cycle 9 Snapshot program (8634) show a general increase in activity at south temperate latitudes as well as the possible development of another Great Dark Spot. 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: HOT STARS
ID: 10171
Title: Ultraviolet Spectrum of the Binary Millisecond Pulsar J0437-4715
PI: George Pavlov
PI Institution: The Pennsylvania State University

PSR J0437-4715 is the nearest and the brightest millisecond (recycled) pulsar, and the only one detected at near-optical wavelengths. We detected it with the HST STIS/FUV-MAMA detector and found that its FUV spectrum is consistent with being emitted from the neutron star surface with a temperature of about 0.1

MK, surprisingly high for such an old object. We also found evidence of an emission line at 1372 A, tentatively interpreted as a Zeeman component of the hydrogen Ly-alpha line in a magnetic field of 700 MG. Unfortunately, the spectrum was imaged in a region of strong detector background, which strongly hampered the spectral and timing analyses. We propose to re-observe the pulsar with the FUV-MAMA, placing the target in a low-background region, and also observe it with the NUV-MAMA to obtain the spectrum and pulsations in a broad UV range. The spectral analysis will allow us to measure the temperature of the full neutron star surface and test the origin of the heating of old neutron stars. Confirmation of the spectral line would lead to a first direct measuremnt of the magnetic field and radius of a spin-powered neutron star and uniquely constrain the equation of state of superdense matter. The NUV spectrum and pulsations will also probe the magnetospheric emission and the thermal structure of the cool white dwarf companion.
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Proposal Category: GO
Scientific Category: STAR FORMATION
ID: 10172
Title: Our Galaxy's most promising Super Star Cluster candidate, Westerlund 1: Tip of the Iceberg?
PI: Richard de Grijs
PI Institution: University of Sheffield

Recent ground-based observations have revealed that the highly reddened Galactic cluster Westerlund 1 is the current best and by far the nearest "Young Massive Star Cluster" (YSC) candidate, i.e. a young (< 10 Myr), dense and massive (> 10,000 Mo) object of which until recently 30 Doradus in the LMC was believed to be the nearest example. However, extrapolations of the locally derived cluster luminosity function indicate that perhaps up to a hundred similar objects should exist within the Galaxy. The close-up view of a YSC provided by Westerlund 1 allows us to obtain an unprecedented glimpse of the process of massive cluster formation, evolution and fate, which are among the very key issues in modern astrophysics. Utilising deep ACS and NICMOS imaging and sophisticated N-body and Monte Carlo simulations, we will address key questions regarding Westerlund 1's nature, formation and dynamical evolution. These include, What are the initial conditions with which Westerlund 1 was born? To what degree was mass segregation really primordial? Has the binary fraction changed during the short cluster lifetime? Do we expect the cluster to have a population of stellar-mass black holes? Does the cluster harbour an intermediate-mass black hole in its core? Is Westerlund 1 unique as a Galactic YSC? How similar is the cluster to the massive "Arches" and "Quintuplet" Galactic Centre clusters, and to 30 Doradus? With an expected life-span of > 100 Myr, it is conceivable that there should be more YSCs like Westerlund 1 in the Galactic disk. Our dynamical simulations will help us determine the ultimate fate of such clusters, allowing us to at least begin to answer the question of Westerlund 1's uniqueness in the context of the Galaxy's stellar populations.
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Proposal Category: SNAP
Scientific Category: AGN/QUASARS
ID: 10173
Title: Infrared Snapshots of 3CR Radio Galaxies
PI: William Sparks
PI Institution: Space Telescope Science Institute

Radio galaxies are an important class of extragalactic objects: they are one of the most energetic astrophysical phenomena and they provide an exceptional probe of the evolving Universe, lying typically in high density regions but well-represented across a wide redshift range. In earlier Cycles we carried out extensive HST observations of the 3CR sources in order to acquire a complete and quantitative inventory of the structure, contents and evolution of these important objects. Amongst the results, we discovered new optical jets, dust lanes, face-on disks with optical jets, and revealed point-like nuclei whose properties support FR-I/BL Lac unified schemes. Here, we propose to obtain NICMOS infrared images of 3CR sources with z<0.3 as a major enhancement to an already superb dataset. We aim to deshroud dusty galaxies, study the underlying host galaxy free from the distorting effects of dust, locate hidden regions of star formation and establish the physical characteristics of the dust itself. We will measure frequency and spectral energy distributions of point-like nuclei, expected to be stronger and more prevelant in the IR, seek spectral turnovers in known synchrotron jets and find new jets. We will strongly test unified AGN schemes and merge these data with existing X-ray to radio observations. The resulting database will be an incredibly valuable resource to the astronomical community for years to come.
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Proposal Category: SNAP
Scientific Category: GALAXIES
ID: 10174
Title: Dark-matter halos and evolution of high-z early-type galaxies
PI: Leon Koopmans
PI Institution: Kapteyn Astronomical Institute

Gravitational lensing and stellar dynamics provide two complementary methods to determine the mass distribution and evolution of luminous and dark-matter in early-type (E/S0) galaxies. The combined study of stellar dynamics and gravitational lensing allows one to break degeneracies inherent to each method separately, providing a clean probe of the internal structure of massive galaxies. Since most lens galaxies are at redshifts z=0.1-1.0, they also provide the required look-back time to study their structural and stellar-population evolution. We recently analyzed 5 E/S0 lens galaxies between z=0.5 and 1.0, combining exquisite Hubble Space Telescope imaging data with kinematic data from ground-based Keck spectroscopy, placing the first precise constraints on the dark-matter mass fraction and its inner slope beyond the local Universe. To expand the sample to ~30 systems -- required to study potential trends and evolution in the E/S0 mass profiles -- we propose to target the 49 E/S0 lens-galaxy candidates discovered by Bolton et al. (2004) from the Sloan Digital Sky Survey (SDSS). With the average lens rate being 40% and some systems having a lensing probability close to unity, we expect to discover ~20 strong gravitational lenses from the sample. This will triple the current sample of 9 E/S0 systems, with data in hand. With the sample of 30 systems, we will be able to determine the average slope of the dark-matter and total mass profile of E/S0 galaxies to 10% and 4% accuracy, respectively. If present, we can simultaneously detect 10% evolution in the total mass slope with 95% confidence. This will provide unprecedented constraints on E/S0 galaxies beyond the local Universe and allow a stringent test of their formation scenarios and the standard cosmological model.
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Proposal Category: SNAP
Scientific Category: HOT STARS

ID: 10175
Title: STIS Snapshot Survey of Boron Abundances in Early-B Stars
PI: Charles Proffitt
PI Institution: Catholic University of America

Boron abundances in massive stars provide a unique constraint for new theoretical models of stellar evolution that include rotation. We propose to use STIS to measure the B III doublet near 2066 Angstroms in a large sample of early-B stars. A high priority will be placed on obtaining abundances for several stars in each of a number of different young clusters, assocations, and star forming regions. This will allow quantitative comparision with theoretical predictions of rotationally driven mixing in early B stars as function of mass, age, and rotation rate. Since boron abundance measurements are not possible for large vsin(i) values, and sin(i) is not known for individual stars, a large sample is required to statistically test the predictions of boron depletion as a function of the true rotation rate. For bright nearby stars (25 targets) we will use the G230MB grating and obtain very high S/N (>200:1). This avoids the need for an ND filter which would discard 99% of the photons. Spectral synthesis techniques will allow us to derive accurate abundances despite the moderate resolution of this grating, even for stars with relatively high vsin(i) values. This is especially important in testing rotational models, as current abundance measurements are mostly for stars with much lower than average rotation rates. For fainter, more distant stars (27 targets) we will use the E230M or E230H grating with the 0.2x0.2 aperture.

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Proposal Category: GO
Scientific Category: STAR FORMATION
ID: 10176
Title: Coronagraphic Survey for Giant Planets Around Nearby Young Stars
PI: Inseok Song
PI Institution: University of California - Los Angeles

A systematic imaging search for extra-solar Jovian planets is now possible thanks to recent progress in identifying "young stars near Earth". For most of the proposed young (<~ 30 Myrs) and nearby (<~ 60 pc) targets, we can detect a few Jupiter-mass planets as close as a few tens of AUs from the primary stars. This represents the first time that potential analogs of our solar system - that is planetary systems with giant planets having semi-major axes comparable to those of the four giant planets of the Solar System - come within the grasp of existing instrumentation. Our proposed targets have not been observed for planets with the Hubble Space Telescope previously. Considering the very successful earlier NICMOS observations of low mass brown dwarfs and planetary disks among members of the TW Hydrae Association, a fair fraction of our targets should also turn out to posses low mass brown dwarfs, giant planets, or dusty planetary disks because our targets are similar to (or even better than) the TW Hydrae stars in terms of youth and proximity to Earth. Due to the recent cancellation of SM4, HST will inevitably degrade into a 2-gyro mode soon and high contrast survey programs like our own cannot be carried out with two gyros. This means that the HST cycle 13 may be the last chance to find young Solar System analogs in the coming decade. Should HST time be awarded and planetary mass candidates be found, proper motion follow-up of candidate planets will be done with ground-based AOs.

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Proposal Category: GO
Scientific Category: ISM AND CIRCUMSTELLAR MATTER
ID: 10177
Title: Solar Systems In Formation: A NICMOS Coronagraphic Survey of Protoplanetary and Debris Disks
PI: Glenn Schneider
PI Institution: University of Arizona

Until recently, despite decades of concerted effort applied to understanding the formation processes that gave birth to our solar system, the detailed morphology of circumstellar material that must eventually form planets has been virtually impossible to discern. The advent of high contrast, coronagraphic imaging as implemented with the instruments aboard HST has dramatically enhanced our understanding of natal planetary system formation. Even so, only a handful of evolved disks (~ 1 Myr and older) have been imaged and spatially resolved in light scattered from their constituent grains. To elucidate the physical processes and properties in potentially planet-forming circumstellar disks, and to understand the nature and evolution of their grains, a larger spatially resolved and photometrically reliable sample of such systems must be observed. Thus, we propose a highly sensitive circumstellar disk imaging survey of a well-defined and carefully selected sample of YSOs (1-10 Myr T Tau and HAeBe stars) and (> app 10 Myr) main sequence stars, to probe the posited epoch of planetary system formation, and to provide this critically needed imagery. Our resolved images will shed light on the spatial distributions of the dust in these thermally emissive disks. In combination with their long wavelength SEDs the physical properties of the grains will be discerned, or constrained by our photometrically accurate surface brightness sensitivity limits for faint disks which elude detection. Our sample builds on the success of the exploratory GTO 7233 program, using two-roll per orbit PSF-subtracted NICMOS coronagraphy to provide the highest detection sensitivity to the smallest disks around bright stars which can be imaged with HST. Our sample will discriminate between proposed evolutionary scenarios while providing a legacy of cataloged morphologies for interpreting mid- and far-IR SEDs that the recently launched Spitzer Space Telescope will deliver. This project cannot be done from the ground, and becomes untenable for HST after Cycle 13 under the anticipated use of two-gyro pointing control mode.
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Proposal Category: GO
Scientific Category: STAR FORMATION
ID: 10178
Title: Imaging Polarimetry of Young Stellar Objects with ACS and NICMOS: A study in dust grain evolution
PI: Dean Hines
PI Institution: Space Science Institute

The formation of planetary systems is intimately linked to the dust population in circumstellar disks, thus understanding dust grain evolution is essential to advancing our understanding of how planets form. By combining (1) the high resolution polarimetric capabilities of ACS and NICMOS, (2) powerful 3-D radiative transfer codes, and (3) observations of objects known to span the earliest stellar evolutionary phases, we will gain crucial insight into the initial phases of dust grain growth: evolution away from an ISM distribution. Fractional polarization is a strong function of wavelength, therefore by comparing polarimetric images in the optical and infrared, we can sensitively constrain not only the geometry and optical depth of the scattering medium,

but also the grain size distribution. By observing objects representative of the earliest evolutionary sequence of YSOs, we will be able to investigate how the dust population evolves in size and distribution during the crucial transition from a disk+envelope system to a disk+star system. The proposed study will help to establish the fundamental time scales for the initial depletion of ISM-like grains: the first step in understanding the transformation from small submicron sized dust grains, to large millimeter sized grains, and untimely to planetary bodies.
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Proposal Category: GO
Scientific Category: GALAXIES
ID: 10179
Title: A Coordinated NICMOS and XMM Experiment to Observe the Variability of Sgr A*
PI: Farhad Yusef-Zadeh
PI Institution: Northwestern University

The massive black hole Sgr A* at the Galactic center has recently shown not only quiescent emission at near-IR wavelengths, but also flare activity with quasi-periodicity of 17 minutes. Our research group has been granted two blocks of observing time with XMM-Newton to monitor the spectral and temporal properties of Sgr A*. Simultaneously with these X-ray observations, we will also monitor Sgr A* at radio, submillimeter, near-IR, and gamma-ray wavelengths. We propose to use NICMOS in parallel with the XMM observations to provide evidence of a well-defined minimum periodicity in the spectrum of flare periodicities. This, combined with periodicity in the near-IR line emission, would strengthen the claim that the emitting gas resides at the innermost stable circular orbit around the GC black hole, thus measuring the spin parameter of a massive black hole. Current groundbased near-IR data suggest a spin parameter of ~0.5. In addition, the correlation pattern of emission over a wide spectrum would elucidate a key issue of how to explain the low luminosity of Sgr A*. The NICMOS on HST is the only instrument that can accurately measure the 17 minute quasi-periodic variability of Sgr A* because of the long time baseline over which HST can observe Sgr A* in parallel with XMM-Newton.
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Proposal Category: GO
Scientific Category: GALAXIES
ID: 10180
Title: Ultracompact Blue Dwarfs: Galaxy Formation in the Local Universe?
PI: Michael Corbin
PI Institution: Computer Sciences Corporation

Recent observations suggest that very low-mass galaxies in the local universe are still in the process of formation. To investigate this issue we propose to obtain deep ACS HRC images in the U, V and I bands of a sample of 11 "ultracompact" blue dwarf galaxies (UCBDs) identified in the Sloan Digital Sky Survey. These objects are nearby ($z < 0.009$), actively star-forming, and have extremely small angular and physical sizes ($d < 6$" and $D < 1$ kpc). They also tend to reside in voids. Our WFPC2 images of the prototype object of this class, POX 186, reveal this tiny object to have a highly disturbed morphlogy indicative of a recent (within 10^8 yr) collision between two small (~ 100 pc) clumps of stars that could represent the long-sought building blocks predicted by the Press-Schechter model of hierarchical galaxy formation. This collision

has also triggered the formation of a "super" star cluster (SSC) at the object's core that may be the progenitor of a globular cluster. POX 186 thus appears to be a very small dwarf galaxy in the process of formation. This exciting discovery strongly motivates HST imaging of a full sample of UCBDs in order to determine if they have morphologies similar to POX 186. HST images are essential for resolving the structure of these objects, including establishing the presence of SSCs. HST also offers the only way to determine their morphologies in the near UV. The spectra of the objects available from the SDSS will also allow us to measure their star formation rates, dust content and metallicities. In addition to potentially providing the first direct evidence of Press-Schechter building blocks, these data could yield insight into the relationship between galaxy and globular cluster formation, and will serve as a test of the recent "downsizing" model of galaxy formation in which the least massive objects are the last to form.
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Proposal Category: GO
Scientific Category: GALAXIES
ID: 10181
Title: ACS/NICMOS Imaging of Bright Lyman Break Galaxy Candidates from SDSS
PI: Misty Bentz
PI Institution: Ohio State University

The recent surprising discovery of six unusually bright (r~20 mag) Lyman break galaxy (LBG) candidates with z=2.45-2.80 in the Sloan Digital Sky Survey (SDSS) raises a number of questions that only HST can address. Specifically, what is the true nature of these objects, and what role if any is played by gravitational lensing? We propose to use the superior resolution and sensitivity of ACS and NICMOS to obtain deep images of these objects and their environments. Compared to SDSS images, HST will allow us to determine their morphologies (extended, point-source, or lensed), the appearance of their environments (rich or poor), and to detect any faint foreground groups or clusters that might be responsible for lensing these objects. All outcomes would be intruiging. If the objects are lensed, it increases from 1 (MS1512-cB58) to 7 the number of normal LBGs bright enough to study individually. If they are instead unlensed point sources, they will represent a new class of previously unidentified absorption-line quasars. Finally, if they are unlensed and extended star-forming galaxies, they are at least 4mag brighter than L_* LBGs, thus making them the most luminous star-forming objects yet seen, representing a heretofore unknown extreme population of objects.
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Proposal Category: GO
Scientific Category: HOT STARS
ID: 10182
Title: Towards a Comprehensive Understanding of Type Ia Supernovae: The Necessity of UV Observations
PI: Alex Filippenko
PI Institution: University of California - Berkeley

Type Ia supernovae (SNe Ia) are very important to many diverse areas of astrophysics, from the chemical evolution of galaxies to observational cosmology which led to the discovery of dark energy and the accelerating Universe. However, the utility of SNe Ia as cosmological probes depends on the degree of our understanding of SN Ia physics, and various systematic effects such as cosmic chemical evolution. At present, the progenitors of SNe Ia and

the exact explosion mechanisms are still poorly understood, as are evolutionary effects on SN Ia peak luminosities. Since early-time UV spectra and light curves of nearby SNe Ia can directly address these questions, we propose an approach consisting of two observational components: (1) Detailed studies of two very bright, young, nearby SNe Ia with HST UV spectroscopy at 13 epochs within the first 1.5 months after discovery; and (2) studies of correlations with luminosity for five somewhat more distant Hubble-flow SNe Ia, for which relative luminosities can be determined with precision, using 8 epochs of HST UV spectroscopy and/or broad-band imaging. The HST data, along with extensive ground-based optical to near-IR observations, will be analyzed with state-of-the-art models to probe SN Ia explosion physics and constrain the nature of the progenitors. The results will form the basis for the next phase of precision cosmology measurements using SNe Ia, allowing us to more fully capitalize on the substantial past (and future) investments of time made with HST in observations of high-redshift SNe Ia.

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Proposal Category: GO
Scientific Category: HOT STARS
ID: 10183
Title: A Deep Far-UV Search for the Interacting Binary Population in M80
PI: Christian Knigge
PI Institution: University of Southampton

We propose to carry out a deep, far-ultraviolet (FUV), time-resolved survey for cataclysmic variables (CVs) and other dynamically-formed objects in the globular cluster (GC) M80. This will include a search for FUV counterparts to the 17 Chandra sources in our field of view, which include 2 LMXBs and 5 X-ray selected CV candidates. Our goal is to confirm these sources as interacting binaries and find any additional CVs below the Chandra detection limit. We will achieve this with 6 orbits of FUV imaging with the ACS/SB, plus one additional orbit of NUV imaging with ACS/HRC. Since crowding is not a problem in the FUV, this will yield time-resolved FUV photometry of all blue objects in the cluster core. Our CV census will be both deep enough to be essentially complete and ``broad'' enough to involve all of the following CV characteristics: (1) UV brightness; (2) blue FUV spectral shape; (3) strong CIV and HeII emission; (4) short time-scale ($\sim$ minutes) variability (flickering, WD spin); (6) intermediate time-scale ($\sim$ hours) variability (orbital variations); (7) long time-scale ($\sim$ weeks) variability (dwarf nova eruptions). We will thus uncover the interacting binary population in M80. In addition, our survey will detect numerous blue stragglers and hot white dwarfs, as well as any other blue objects in the central regions of this cluster.

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Proposal Category: GO
Scientific Category: HOT STARS
ID: 10184
Title: A New Class of Bright Ultraviolet Variable Sources in the Globular Cluster NGC 1851
PI: David Zurek
PI Institution: American Museum of Natural History

Our reductions of archival STIS/FUV-MAMA data (AR9225) have discovered 13 completely unexpected and unexplained Ultraviolet bright variables. Eleven of the variables have been identified with evolved stars (Horizontal Branch or

Asymptotic Giant Branch). The total number and nature of these systems is completely unknown. If these variables are binaries the implication is that the binary fraction (up to 25%) in NGC 1851 is the highest in all Galactic globular clusters. The radial distributions of the variables and the blue horizontal branch stars imply a common origin and perhaps an explanation of the bi-modal morphology of the horizontal branch in the color magnitude diagrams of globular clusters. These variables may be the tip of the iceberg and a critical clue concerning the infamous "second parameter". We propose to observe NGC 1851 on three occasions with the same setup as the archival data to determine the total number and periods of the ultraviolet variables.

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Proposal Category: SNAP
Scientific Category: COOL STARS
ID: 10185
Title: When does Bipolarity Impose itself on the Extreme Mass Outflows from AGB Stars? An ACS SNAPshot Survey
PI: Raghvendra Sahai
PI Institution: Jet Propulsion Laboratory

Essentially all well-characterized preplanetary nebulae (PPNe) -- objects in transition between the AGB and planetary nebula evolutionary phases - are bipolar, whereas the mass-loss envelopes of AGB stars are strikingly spherical. In order to understand the processes leading to bipolar mass-ejection, we need to know at what stage of stellar evolution does bipolarity in the mass-loss first manifest itself? Our previous SNAPshot surveys of a PPNe sample (with ACS & NICMOS) show that roughly half our targets observed are resolved, with well-defined bipolar or multipolar morphologies. Spectroscopic surveys of our sample confirm that these objects have not yet evolved into planetary nebulae. Thus, the transformation from spherical to aspherical geometries has already fully developed by the time these dying stars have become preplanetary nebulae. From this new and surprising result, we hypothesize that the transformation to bipolarity begins during the very late AGB phase, and happens very quickly, just before, or as the stars are evolving off the AGB. We propose to test this hypothesis quantitatively, through a SNAPshot imaging survey of very evolved AGB stars which we believe are nascent preplanetary nebulae; with our target list being drawn from published lists of AGB stars with detected heavy mass-loss (from millimeter-wave observations). This survey is crucial for determining how and when the bipolar geometry asserts itself. Supporting kinematic observations using long-slit optical spectroscopy (with the Keck), millimeter and radio interferometric observations (with OVRO, VLA & VLBA) are being undertaken. The results from this survey (together with our previous work) will allow us to draw general conclusions about the onset of bipolar mass-ejection during late stellar evolution, and will provide crucial input for theories of post-AGB stellar evolution. Our survey will produce an archival legacy of long-standing value for future studies of dying stars.

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Proposal Category: SNAP
Scientific Category: ISM AND CIRCUMSTELLAR MATTER
ID: 10186
Title: A Lyman-alpha Snapshot Survey of FBS and SBS Galaxies
PI: Claus Leitherer
PI Institution: Space Telescope Science Institute

Search strategies for primeval galaxies rely on the assumption that Lyman-

alpha can be powered by photoionization from hot stars. Theoretical models, however, indicate that Lyman-alpha is far from being a pure recombination line: absorption and scattering in the interstellar medium and the kinematics of outflowing gas make firm predictions for the Lyman-alpha strength difficult. Therefore observational tests are required. A sample of 42 galaxies with active star formation has been selected from the First and Second Byurakan Survey to perform such a test. The target galaxies belong to the spectral class s1, implying they are H II galaxies, blue compact dwarfs, or nuclear starbursts. This sample is optimized to address whether local starbursts are strong Lyman-alpha emitters. We propose to obtain STIS G140L spectra of the galaxies in order to detect Lyman-alpha emission with equivalent widths larger than 5 Angstroms in this statistically significant, homogeneous sample. We will utilize the existing, extensive body of ground-based data to model the stellar population and make a prediction for the Lyman-alpha emission assuming pure recombination and no radiative transfer effects by gas and dust. Comparison with the observations will provide constraints on such effects. The scientific goals are twofold: First, we make an effort to understand how an apparently simple line, such as Lyman-alpha, can be affected by radiative transfer effects and geometries in the interstellar medium of typical star-forming regions. Second, the proposed study will serve as an empirical test for the probability to succeed in detecting Lyman-alpha in more distant systems. Therefore, a high-level goal of this project is to provide guidelines for search strategies for primeval galaxies at high redshift. This project is ideally suited for execution in Snapshot mode.

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Proposal Category: GO
Scientific Category: HOT STARS
ID: 10187
Title: Direct imaging of the progenitors of massive, core-collapse supernovae
PI: Stephen Smartt
PI Institution: University of Cambridge

Modern supernovae searches in the nearby Universe are discovering large numbers of SNe which have massive star progenitors (Types II, Ib and Ic). The extensive HST image archives of galaxies within ~20Mpc enables their individual bright stellar content to be resolved. As massive, evolved stars are the most luminous single objects in a galaxy, the progenitors of core-collapse SNe should be directly detectable on pre-explosion images. In our ongoing HST programme we have detected the first red supergiant progenitor of a normal type II supernova, shown that SN 1993J came from a binary system, and set direct mass-limits on three other type II supernovae progenitors. These discoveries are providing strong constraints on theoretical models of pre-supernova stellar evolution that predict which stars produce which type of supernovae. We request time to continue this successful project, and require ACS observations of future SNe which are discovered in galaxies closer than 20Mpc which have pre-explosion HST archive images available. These observations will allow the SNe to be precisely positioned on the pre-explosion frames with the required astrometric accuracy of around 0.05", and provide 3-colour photometry of the surrounding stellar populations for reddening estimations. The goal of this project is to directly identify the progenitor stars of core-collapse supernovae. We will compare the results to our own stellar evolutionary tracks in order to determine masses or restrictive mass-limits for the progenitors.

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Proposal Category: GO
Scientific Category: GALAXIES
ID: 10188
Title: In-Depth Study of The Antennae with NICMOS and ACS
PI: Bradley Whitmore
PI Institution: Space Telescope Science Institute

We propose new observations of "The Antennae" (NGC 4038/39), the nearest and youngest example of a major disk-disk merger, with NICMOS and ACS. The long overdue NICMOS observations will allow us to penetrate the dust in the Overlap Region, measure the P_alpha emission and CO band strengths of young clusters, and study supernova remnants in heavily obscured regions using [FeII] images. The high resolution (0.05" pixel) ACS observations will allow us for the first time to reliably distinguish clusters from stars based on their apparent sizes, and to potentially identify hundreds of supernova remnants that may control the energy balance and feedback mechanisms within the ISM (based on [SII] images). In conjunction with our previous WFPC2, GHRS, and STIS observations, the new data will provide answers to fundamental questions such as: How do these clusters form and evolve? How quickly are they destroyed and what fraction of the field stars were formed in clusters. How many clusters are hidden by dust? How do the clusters and associated supernovae affect the local and global ISM? What are the dynamical masses of the clusters, and are the stellar IMF's truncated? Simultaneous parallel observations will also determine whether clusters can form in the more quiescent environment of the inner tails. A better understanding of how mergers form tremendous numbers of clusters and stars in the local universe will help shed light on processes that are crucial during galaxy assembly throughout the observable universe.
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Proposal Category: GO
Scientific Category: COSMOLOGY
ID: 10189
Title: PANS-Probing Acceleration Now with Supernovae
PI: Adam Riess
PI Institution: Space Telescope Science Institute

Type Ia supernovae (SNe Ia) provide the most direct evidence for an accelerating Universe, a result widely attributed to dark energy. Using HST in Cycle 11 we extended the Hubble diagram with 6 of the 7 highest-redshift SNe Ia known, all at z>1.25, providing conclusive evidence of an earlier epoch of cosmic deceleration. The full sample of 16 new SNe Ia match the cosmic concordance model and are inconsistent with a simple model of evolution or dust as alternatives to dark energy. Understanding dark energy may be the biggest current challenge to cosmology and particle physics. To understand the nature of dark energy, we seek to measure its two most fundamental properties: its evolution (i.e., dw/dz), and its recent equation of state (i.e., w(z=0)). SNe Ia at z>1, beyond the reach of the ground but squarely within the reach of HST with ACS, are crucial to break the degeneracy in the measurements of these two basic aspects of dark energy. The SNe Ia we have discovered and measured with HST in Cycle 11, now double the precision of our knowledge of both properties. Here we propose to quadruple the sample of SNe Ia at z>1 in the next two cycles, complementing on-going surveys from the ground at z<1, and again doubling the precision of dark energy constraints. Should the current best fit model prove to be the correct one, the precision expected from the current proposal will suffice to rule out a cosmological constant at the 99% confidence level. Whatever the result, these objects will

provide the basis with which to extend our empirical knowledge of this newly discovered and dominant component of the Universe, and will remain one of the most significant legacies of HST. In addition, our survey and follow-up data will greatly enhance the value of the archival data within the target Treasury fields for galaxy studies.
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Proposal Category: GO
Scientific Category: GALAXIES
ID: 10190
Title: The Star Formation History and Metallicity Evolution of M33: A Comprehensive Study of Disk Evolution
PI: Donald Garnett
PI Institution: University of Arizona

We will obtain deep, panchromatic imaging photometry of stellar populations in four fields ranging from 0.5 to 4 scale lengths across the disk of the Local Group spiral M33. The observations are designed to detect the oldest main-sequence turnoffs in three outer disk fields, and to reach the crowding limit in the innermost field. We will combine the photometry data with information we already have in-hand on abundances from stars and H II regions in M33 to derive the star formation history and metallicity evolution of the M33 disk. The information from our four fields will allow us to obtain (1) the ages of the oldest disk stars and the radial variation of their ages; (2) the radial variation of the star formation history and its nature (e.g., constant, declining, or bursting); and (3) the metallicity distribution in each field and the time evolution of the metallicity gradient. Our team, an experienced mix of photometrists, spectroscopists, and galaxy evolution theorists, will use the results from this program to construct a comprehensive chemo-dynamical model for the M33 disk. This detailed study of M33 will be a key in developing an understanding of the formation and evolution of disks that can be applied to studies of disks at both low and high redshift, and will also yield a wealth of information on stellar populations, chemical evolution, and star clusters that will be of great value to future investigators.
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Proposal Category: GO
Scientific Category: AGN/QUASARS
ID: 10191
Title: A Fundamental Test of Accretion Physics with NGC 4203
PI: Joseph Shields
PI Institution: Ohio University

The rapid evolution of quasars indicates that supermassive black holes in galaxy nuclei spend most of their time in a relatively quiescent state. Studies of nearby galaxies demonstrate that many such black holes are accreting at a low rate, and appear as low-luminosity active galactic nuclei (LLAGNs). Theoretical arguments suggest that the mode of accretion onto a central black hole may be very different in LLAGNs as compared to high-luminosity systems. The LINER NGC 4203 provides an excellent opportunity to investigate quantitatively the accretion process in a LLAGN, and hence the typical accretion state for a supermassive black hole. Cycle 7 STIS data acquired at one position angle reveal double-peaked H-alpha emission in the nucleus that may trace an accretion disk, and spatially resolved emission that places an upper limit on black-hole mass. We propose observations with STIS to map the two-dimensional velocity field of the circumnuclear gas disk in the central regions of NGC 4203, in order to measure the black-hole mass. This

parameter is essential for testing theoretical models of accretion, determining the mass accretion rate, and estimating the radiative efficiency for accreted matter. The results will be important for making sense of LLAGNs, and for translating their measured luminosity into accretion rates that trace the growth of black holes.
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Proposal Category: GO
Scientific Category: SOLAR SYSTEM
ID: 10192
Title: Jupiter's Upper Stratospheric Hazes Probed with Ganymede
PI: Erich Karkoschka
PI Institution: University of Arizona

I propose to observe a disappearance of Ganymede behind the dark limb of Jupiter with five filters of the ACS/HRC camera. Two exposures in each filter can be taken during such an event. The images will provide the spectral variation of the altitude of the apparent limb of Jupiter. The altitude of the apparent limb is dependent on the presence of hazes in Jupiter's stratosphere. Hazes of vertical optical depths below 0.001 could be detected with these observations, providing an extremely sensitive probe of high hazes. The observations probe altitudes levels near the 1-mb pressure level, for which we have very limited data. The creation of aerosols, their growth, and their transport by winds is currently a mostly theoretical study. It would significantly benefit from constraints derived from the proposed observations. ACS/HRC is the only instrument capable of the required spatial resolution in the ultraviolet. Furthermore, a favorable geometry of Ganymede's orbit occurs only once every six years. This proposal achieves unique results with a minimum of HST time.
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Proposal Category: GO
Scientific Category: AGN/QUASARS
ID: 10193
Title: Can Narrow-Line Regions in Luminous AGN be Enormously Large?
PI: Hagai Netzer
PI Institution: Tel Aviv University - Wise Observatory

We propose to obtain long-slit optical spectra of three nearby quasars with the largest reported narrow-line regions (NLRs). These sources have been shown to be the cornerstone of a most interesting size--luminosity relationship in AGN-NLRs which, we suspect, is very problematic. A two-orbit HST/STIS observation, per source, will allow us to measure several narrow emission lines from H_beta through H_alpha and [S II] at several distances along the spatial direction. We will thus be able to classify the line excitation mechanism, estimate the gas density as a function of distance from the center, and more properly define the 'NLR size'. This will allow us to test the idea that the NLR conditions in these quasars are very different from those observed in low luminosity AGN and, specifically, that some of the narrow emission lines have a star forming origin. Together with our IR spectra of high-redshift quasars, we will be able to test the newly discovered NLR size-luminosity relationship in AGN and the AGN-starburst connection at the high luminosity end.
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Proposal Category: SNAP

Scientific Category: HOT STARS
ID: 10194
Title: Towards a global understanding of accretion physics - Clues from an UV spectroscopic survey of Cataclysmic Variables
PI: Boris Gaensicke
PI Institution: The University of Warwick

Accretion inflows and outflows are fundamental phenomena in a wide variety of astrophysical environments, such as Young Stellar Objects, galactic binaries, and AGN. Observationally, cataclysmic variables (CVs), interacting white dwarf/main sequence binaries, are particularly well suited for the study of accretion processes. Furthermore, CVs that are born with a donor more massive than the white dwarf are potential progenitors of supernovae type Ia. We are currently carrying out a STIS UV spectroscopic snapshot survey of CVs to fully exploit the diagnostic potential of these objects for our understanding of accretion physics. We analyze the STIS spectra with state-of-the-art accretion disc model spectra (SYNSPEC), testing our current knowledge of accretion disk structure, and thereby, providing new insight into the currently poorly understood process of viscous dissipation. In addition, we use our parameterised wind model PYTHON for the analysis of the radiation driven accretion disc wind spectra, assessing the fundamental question whether the mass loss rate correlates with the disc luminosity. Our survey data also identify a number of systems in which the white dwarf significantly contributes to the UV flux, permitting an analysis of the impact of mass accretion on the evolution of these compact stars. Finally, anomalous N/C emission line flux ratios unmistakably identify CVs that started out with a donor more massive than the white dwarf but failed to reach the Chandrasekhar limit. Determining the number of these "failed SNIa" will provide crucial input for the population models of this type of system, and, consequently, improve the predictions on the number of white dwarf binaries that actually do overcome the Chandrasekhar limit. While the data obtained so far are of excellent quality, the number of targets that have been observed so far is too small for a statistically significant analysis. We propose here to extend this survey into Cycle 13, building a homogenous database of accretion disc and wind outflow spectra covering a wide range of mass transfer rates and binary inclinations, and sampling the N/C abundances of at least 100 CVs.
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Proposal Category: GO
Scientific Category: GALAXIES
ID: 10195
Title: Probing the Surroundings of a Highly Luminous Redshift 6.5 Galaxy
PI: James Rhoads
PI Institution: Space Telescope Science Institute

We propose deep images of a recently discovered galaxy at z=6.535, which is among the most luminous Lyman-alpha emitting galaxies known at high redshift. The brightness and rarity of this source imply that it is associated with a high peak in the matter density distribution. (It is the brightest Lyman alpha source in 2e5 comoving Mpc3, with a luminosity of 6 L*.) Further objects in this peak are expected to be visible with HST's sensitivity. The Lyman alpha line has a large rest frame equivalent width, with a lower bound >100 Angstroms. Such a large equivalent width would be impossible for objects embedded in neutral gas, and instead requires either that (a) the universe was reionized before z=6.5 or (b) the galaxy resides in a local

ionized bubble, in which case an additional contribution to the ionizing photon budget from presently undetected neighbors is required. With 19 orbits of ACS and NICMOS imaging, we will measure this object's morphology and spectral energy distribution, thus searching for either active nuclei or old stellar populations. We will also search for possible neighbors, which could establish the first known galaxy group at z>6, and may provide sufficient ionizing flux to allow the escape of the observed Lyman alpha photons in a neutral universe. If neighbors are not found, it will lead to an upper bound on the neutral fraction in the general IGM at z=6.5.
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Proposal Category: GO
Scientific Category: COSMOLOGY
ID: 10196
Title: Morphologies of a new class of rest-frame optical selected high redshift galaxies
PI: Marijn Franx
PI Institution: Universiteit Leiden

We have obtained deep very Js, H, Ks imaging with the VLT of two fields with excellent optical imaging, in order to study high redshift galaxies. Using these Near-IR images, we identified a class of galaxies with Js - Ks color larger than 2.3. Photometric redshifts and spectroscopic follow-up showed that their mean redshift is 2.5 +- 0.7. These galaxies are complementary to Lyman break selected galaxies: the overlap is minimal, and the rest-frame optical colors of the Js-Ks selected galaxies are much redder. Their contribution to the stellar mass density is comparable to that of Lyman breaks in our fields. SED fits and Near-IR spectroscopy of the Js-Ks selected galaxies indicate median ages between 1 and 2 Gyr, a factor of 3-5 older than the ages of Lyman break galaxies estimated by similar methods. They are likely the oldest galaxies at z=2.5, and may be evolving into the most massive galaxies at z=0. We propose to obtain images of the spectroscopically confirmed Js-Ks galaxies with the NICMOS/NIC3 camera in the H band. These galaxies lie the field of MS1054-03, for which we have excellent groundbased and HST optical imaging. The increased depth and spatial resolution of the NICMOS imaging will allow us to determine the restframe optical morphologies of the Js - Ks galaxies, in order to study their intensity profiles and regularity, to decompose the largest galaxies in bulges and disks, to measure scale lengths, and to look for evidence of merging and recent star formation. This study would provide us unique insight into the nature of these red galaxies, their evolutionary history and their likely descendants at low redshift.
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Proposal Category: GO
Scientific Category: STELLAR POPULATIONS
ID: 10197
Title: The Astrophysical Parameters of Very Metal-Poor Halo Binaries
PI: Elliott Horch
PI Institution: University of Massachusetts Dartmouth

Little is currently known concerning the mass-luminosity relation (MLR) of Population II stars. In Cycle 10, we began an initial study with FGS1 to resolve a sample of known spectroscopic binaries preselected as high-velocity and/or low metallicity objects. This has resulted in significant new information about the astrophysical parameters of metal-poor stars, but was limited mainly to intermediate metallicities, not to true Population II stars.

A new sample of metal-poor spectroscopic binaries identified by Latham and his collaborators (e.g. Latham et al 2002) contains three new very metal-poor objects resolvable with FGS. We propose to observe these binaries and obtain additional observations of two very important resolved targets from our initial sample. As with that program, we will couple the already-known spectroscopic orbits with astrometric information which only FGS can deliver at present. To ensure that the most will be gained from these data, we also request observations of three metal-poor single stars to be used as calibration objects. In combination with results from our previous program, these observations can be expected to resolve the question of the location of the Population II main sequence and give valuable insight into the accuracy of isochrone fitting for determination of globular clusters ages. Due to the combination of target magnitudes and expected separations, no object in this sample can be resolved without the unique capabilities of FGS.

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Proposal Category: SNAP
Scientific Category: STELLAR POPULATIONS
ID: 10198
Title: Probing the Dynamics of the Galactic Bar through the Kinematics of Microlensed Stars
PI: Przemyslaw Wozniak
PI Institution: Los Alamos National Laboratory

The observed optical depths to microlensing of stars in the Galactic bulge are difficult to reconcile with our present understanding of Galactic dynamics. The main source of uncertainty in those comparisons is now shifting from microlensing measurements to the dynamical models of the Galactic bar. We propose to constrain the Galactic bar models with proper motion observations of Bulge stars that underwent microlensing by determining both the kinematic identity of the microlensed sources and the importance of streaming motions. The lensed stars are typically farther than randomly selected stars. Therefore, our proper motion determinations for 36 targeted MACHO events will provide valuable constraints on the dynamics of bulge stars as a function of distance. The first epoch data for our proposed events is already available in the HST archive so the project can be completed within a single HST cycle. The exceptional spatial resolution of HST is essential for completion of the project. Constraints on the total mass in the bulge will ultimately lead to the determination of the amount of dark matter in inner Galaxy.

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Proposal Category: SNAP
Scientific Category: GALAXIES
ID: 10199
Title: The Most Massive Galaxies in the Universe: Double Trouble?
PI: Mariangela Bernardi
PI Institution: Carnegie Mellon University

We are proposing an HST snapshot survey of 70 objects with velocity dispersion larger than 350 km/s, selected from the Sloan Digital Sky Survey. Potentially this sample contains the most massive galaxies in the Universe. Some of these objects may be superpositions; HST imaging is the key to determining if they are single and massive or if they are two objects in projection. The objects which HST imaging shows to be single objects are interesting because they potentially harbor the most massive black holes, and because their existence places strong constraints on galaxy formation models. When combined with

ground based data already in hand, the objects which HST imaging shows are superpositions provide valuable information about interaction rates of early-type galaxies as well as their dust content. They also constrain the allowed parameter space for models of binary gravitational lenses (such models are currently invoked to explain discrepancies in the distribution of lensed image flux ratios and separations).
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Proposal Category: GO
Scientific Category: COSMOLOGY
ID: 10200
Title: Dark Matter Constraints from the Merging Cluster 1E0657-56
PI: Christine Jones
PI Institution: Smithsonian Institution Astrophysical Observatory

We propose five orbits of ACS Wide Field Camera observations (three orbits with F814W, one with F606W, and one with F435W) to investigate the unique, high velocity merging cluster 1E0657-56 (z=0.296). Coupling the ACS images with deep Chandra observations and ground-based imaging will allow us to compare maps of the intracluster medium, the dark matter, and the galaxies from which we can directly estimate the self-interaction cross-section of dark matter, the dominant mass component in clusters and the Universe. These observations, combined with hydrodynamic simulations, will either rule out the range of cross-sections proposed to alleviate problems with collisionless dark matter or unambiguously detect and measure the self-interaction cross-section. A secondary objective is to quantify the impact of a supersonic merger on star formation and the morphological evolution of cluster galaxies. The geometry of 1E0657-56 (with the merger nearly in the plane of the sky) coupled with the subcluster velocity (4500 km/s) accurately constrains the timescale of this merger. In particular since the subcluster traversed the dense core of the main cluster only 0.15 Gyr ago, star formation induced by the core passage will be clearly visible.
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Proposal Category: GO
Scientific Category: GALAXIES
ID: 10201
Title: The Origin of Dwarf Galaxies and Steep Luminosity Functions in Clusters
PI: Christopher Conselice
PI Institution: California Institute of Technology

Clusters of galaxies contain an overdensity of dwarfs compared to the field. The origin of these dwarfs is unknown, but a large fraction of them did not form through standard collapses early in the universe. Some dwarf ellipticals in clusters have metal rich and young stellar populations while others contain old metal poor populations, suggesting multiple formation mechanisms and time scales. We propose to test the idea that dwarfs descend from galaxies accreted into clusters during the past 8 Gyrs by correlating ages and metallicities of dwarfs with their internal structures - spiral arms, bars, and disks. If dwarfs originate from more massive galaxies then these features should be common in metal rich and young dwarfs. On the other hand, if no correlation is found it would suggest that dwarfs form through in-situ collapses of gas in the intragalactic medium after the universe was reionized.
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Proposal Category: SNAP
Scientific Category: HOT STARS
ID: 10202
Title: Resolving OB Binaries in the Carina Nebula, Resuming the Survey
PI: Edmund Nelan
PI Institution: Space Telescope Science Institute

In March 2002 we carried out a small, high-angular resolution survey of some of the brightest OB stars in the Carina Nebula with FGS1r in an attempt to resolve binary systems which had thus far evaded detection by other techniques. Of 23 stars observed, 5 new OB binaries were discovered with component separations ranging from 0.015" to0.325". This yield over the spatial domain of FGS1r's angular resolution, coupled with published statistics of the incidence of OB stars in short-period spectroscopic, and long-period visual binaries suggests that the fraction of binarity or multiplicity among OB stars is near unity. Our unexpected resolution of the prototype O2 If* star HD 93129A as a 55 milli-arcsecond double is a case in point that great care must be excerised when one attemps to establish the IMF and upper-mass cuttoff at the high-mass end of the HR diagram. We propose to resume the survey to observe a larger, statistically meaningful sample of OB stars to establish a firm assessment of multiplicity at the high-mass end of the IMF in these clusters. We will also investigate the single-star/binary-star status of several astrophysically important, individual stars in order to enable a better understanding of the evolution of high-mass stars.
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Proposal Category: GO
Scientific Category: COOL STARS
ID: 10203
Title: The Deep Lamp Project
PI: Thomas Ayres
PI Institution: University of Colorado at Boulder

Space Telescope Imaging Spectrograph is the most sophisticated space-borne spectrometer ever built, probably the last of its kind for some time to come. A key virtue of STIS is that its medium- and high-resolution echelle modes provide access to broad intervals of the vacuum ultraviolet spectrum in a single shot. Another virtue is the validation of the wavelength scales by periodic observations of an onboard hollow-cathode emission line source. Tying together the different echelle orders by means of the accurately known lamp spectrum enables a wide range of studies that exploit differential comparisons of velocity diagnostics in stellar, interstellar, and even extragalactic spectra. Despite the importance of the wavelength calibrations, however, they are done only infrequently (once a year). While STIS undoubtedly must be one of the most stable orbiting spectrographs ever designed, possible thermal distortions of the instrument might cause small nonlinear deviations of the wavelength scales and thereby impact the velocity precision. The existing wavecal data sets are separated too far apart in time to isolate short-term thermal fluctuations from long-term secular behavior, and the routine WAVELINEs taken with every grating switch are too underexposed to reveal any differential behavior across the spectrum, aside from a simple zero-point offset. I therefore propose to obtain a series of deep lamp exposures in a few representative modes of the NUV and FUV MAMAs to search for and characterize short-term differential distortions of the echelle formats. This work also will provide an important dataset to test new approaches to derive the basic dispersion relations, such as the effort underway by the Physical

Modeling Group at ESA's ST-ECF. The calibration campaign can be scheduled in pure parallel mode with no loss of orbits from the Cycle 13 science program.
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Proposal Category: GO
Scientific Category: ISM AND CIRCUMSTELLAR MATTER
ID: 10204
Title: Evolution of Light Echoes of SN 1993J
PI: Ben Sugerman
PI Institution: Space Telescope Science Institute

SN 1993J is the nearest SN in the last decade, and only one of seven objects to produce confirmed light echoes. Our analyses of archival HST/WFPC2 datareve aled that the SN has illuminated at least two light-echo structures in the galaxy M81. Those echoes appear to define two sheets of dust, located roughly 260 ly and 770 ly in front of the SN, which are the first, and most efficient, 3-D probes of the ISM in M81. The echoes not only reveal the ISM's structure, but also constrain the density, composition and grain-size of its dust. Echoes are transient events, and as they change on timescales shorter than a year, continued monitoring will reveal new illuminated material, tracing interstellar and circumstellar structure. We propose a modest and highly efficient campaign by HST to image these and yet undiscovered echoes toward SN 1993J. Such observations will build the first direct 3-D map of the ISM within a million cubic parsecs of M81's spiral arm, and may glimpse the circumstellar environment affected by the projenitor's mass loss. Such results probe the nature of extragalactic dust, reveal spatio-kinematic information about the M81's disk, tightly constrain its internal extinction, and under the proper circumstances, provide an independent distance measurement to the host galaxy.
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Proposal Category: GO
Scientific Category: HOT STARS
ID: 10205
Title: Critical STIS Spectroscopy and ACS Imagery at the Top of the IMF
PI: Nolan Walborn
PI Institution: Space Telescope Science Institute

We shall observe two key massive hot stars to investigate the effects of multiplicity and rotational mixing on their parameters and evolution. (1) The prototype O2 If* star HD 93129A dominates the compact cluster Trumpler 14, one of the ionizing clusters of the Carina Nebula. It has been an anchor point for analyses of the most massive stars. Unexpectedly, it has been resolved as a 55 mas binary by FGS. The derived delta m of 0.9 implies that the companion may be similar to the O3 dwarfs HD 93128 and HD 93129B (3" from A) in Tr 14. Recent radio and X-ray data suggest that the HD 93129A system is a colliding-wind binary. We propose to resolve the system spectroscopically with STIS in both the optical and FUV. Also, we plan an orbit of very short ACS exposures on this key cluster to obtain resolved multicolor photometry of its crowded inner members for the first time. (2) The recent discovery of a CNO dichotomy among five O2 giants in the Magellanic Clouds provides a new evolutionary diagnostic for the most massive stars, which is related to their initial rotational velocities. The abundance anomalies are seen in the UV wind spectra as well as optical lines. We propose to observe the FUV spectrum of the LMC ON2 star LH10-3061 with STIS to support further analysis, since it is the only one of these stars lacking UV data.

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Proposal Category: GO
Scientific Category: AGN/QUASARS
ID: 10206
Title: What drives the outflows in powerful radio galaxies?
PI: Clive Tadhunter
PI Institution: University of Sheffield

There is increasing speculation that activity-induced outflows are an important feedback mechanism in evolution of galaxy bulges, yet uncertainties remain about the nature, dominant driving mechanism and powers of the outflows. In order to address these issues, we propose to make deep ACS and STIS observations of two compact radio sources in which we recently found unequivocal evidence for powerful emission line outflows, and in which all the potential drivers for the outflows -- quasar nuclei, relativistic jets and starbursts -- are known to be present. Using the unique capabilities of HST/ACS we will map the outflow regions in these sources at high spatial resolution and thereby determine the dominant outflow driving mechanism. In addition, by combining the morphological information from the ACS data with information on the kinematics and physical conditions derived from STIS and ground-based spectra, we will determine the mass outflow rates and powers in the outflows. This will be the first comprehensive study of the near-nuclear outflows in radio galaxies. Such studies are crucial for determining whether the activity associated with powerful extragalactic radio sources has a major impact on the evolution of the host early-type galaxies.
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Proposal Category: GO
Scientific Category: GALAXIES
ID: 10207
Title: Star Formation in Damped Lya Galaxies: Testing the Connection with the Lyman Break Population
PI: Jason Prochaska
PI Institution: University of California - Santa Cruz

The principal challenge of damped Lya (DLA) research is to identify and study the stellar components of these galaxies. Although two decades of absorption-line research has yielded the HI gas content, metallicity, velocity fields, molecular and dust content of these galaxies only a handful have been studied in emission. Therefore, it has been very difficult to compare the DLA galaxies with the successful surveys of high z galaxies discovered in emission (e.g. Lyman break galaxies; LBG). This is particulary important given that DLA systems are the probable precursors to galaxies like the Milky Way. Because the DLA systems are identified toward bright background quasars, deep observations at high spatial resolution with astable PSF are essential and only HST provides the observing capability. Recently, two major advances have greatly enhanced the prospects for measuring emission from DLA host galaxies: (1) we have developed a new spectroscopic technique for inferring the star formation rates (SFR) of the DLA which enables one to pre-select the brightest candidates; (2) the high spatial resolution of the ACS represents a major improvement over previous capabilities. We will obtain deep V-band images with the HRC+ACS of 8 high z DLA with the highest inferred apparent UV magnitudes. The complete survey will offer a robust satistical analysis of: (a) the extent and morphology of the DLA star forming regions; (b) the likelihood that the DLA and LBG correspond to the same population of protogalaxies; (c) a test of the protogalactic clump models favored by CDM

cosmology. We emphasize this program will offer a major advance over all previous studies. Finally, we will complement these HST observations with an extensive observing campaign (IFU spectroscopy and deep IR imaging) on the Keck, VLT, and Magellan telescopes to provide the most extensive dataset yet on the physical properties of high z DLA.
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Proposal Category: GO
Scientific Category: COOL STARS
ID: 10208
Title: NICMOS Differential Imaging Search for Planetary Mass Companions to Nearby Young Brown Dwarfs
PI: Wolfgang Brandner
PI Institution: Max-Planck-Institut fur Astronomie, Heidelberg

We propose to use the differential spectral imaging capability of HST/NICMOS (NIC1) to search for planetary mass companions. We target the twelve most nearby (within 30 pc), isolated (no known close companion), and young (< 1Gyr) brown dwarfs. All of them have spectral type L and show signs of Lithium absorption, which clearly proves their substellar nature and youth. Planetary mass companions with masses down to 6 Jupiter masses, and at separations larger than 3 A.U. are bright enough for a direct detection with HST/NICMOS using the spectral differential imaging technique in two narrow-band filters placed on and off molecular bands. The proposed project has the potential to lead to the first direct detection of a planetary mass object in orbit around a nearby brown dwarf.
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Proposal Category: GO
Scientific Category: HOT STARS
ID: 10209
Title: On the evolutionary status of extremely hot helium stars - are the O(He) stars successors of the RCrB stars?
PI: Thomas Rauch
PI Institution: Universitat Erlangen-Nurnberg

We propose UV spectroscopy of the four unique post-AGB stars of spectral type O(He) in order to understand the origin of their peculiar surface abundances. These stars are the only known amongst the hottest post-AGB stars (effective temperatures > 100,000 K) whose atmospheres are composed of almost pure helium. This chemistry markedly differs from that of the hydrogen-deficient post-AGB evolutionary sequence with objects which have carbon dominated atmospheres (PG1159 stars and Wolf-Rayet central stars). While PG1159 and Wolf-Rayet stars are the result of a late helium-shell flash, this scenario cannot explain the O(He) stars. Instead, they are possibly double-degenerate mergers. We speculate that the four O(He) stars represent evolved RCrB stars, which also have helium dominated atmospheres. We aim to determine the C, N, O, and Si abundances precisely, in order to proof this evolutionary link.
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Proposal Category: GO
Scientific Category: COSMOLOGY
ID: 10210
Title: Groups of Dwarf Galaxies: Pools of Mostly Dark Matter?
PI: R. Tully
PI Institution: University of Hawaii

Within 5 Mpc, there are 6 groups with well-known luminous galaxies but there also appears to be a comparable number of groups containing only dwarfs. If these dwarf entities are truly bound then M/L values are an order of magnitude higher than values found for groups with luminous spiral galaxies. There are theoretical reasons to anticipate that low mass halos may frequently be mostly dark. The dynamical influence of low mass halos is negligible in familiar groups with luminous members. By contrast, a study of the dynamics of `groups of dwarfs' may provide direct evidence of the existence of dark matter potential wells with few baryons. The goal of the present study is to gather detailed information on the 3-D distribution of dwarf galaxies suspected to lie within 7 groups of dwarfs within 5 Mpc. Distances with 7% relative accuracy can be measured with the Tip of the Giant Branch method with ACS and integrations within 1 orbit per target.

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Proposal Category: GO
Scientific Category: QUASAR ABSORPTION LINES AND IGM
ID: 10211
Title: A Combined HST/Chandra Study for Finding the Baryons in the Low Redshift Universe.
PI: Smita Mathur
PI Institution: Ohio State University

The main reservoir of low redshift baryons is still ``missing'': all the observed stellar and gaseous components add up to a factor of ten below the abundance predicted by big bang nucleosynthesis. Hydrodynamic cosmological simulations predict that a large fraction of the low redshift baryons should reside in a warm/hot diffuse intergalactic medium (IGM), detectable via an ``X-ray forest'' of high excitation metal lines, but blind searches of X-ray lines are extraordinarily difficult with present technology. A first hint of this warm-hot IGM may have been found in recent studies of OVI absorption towards background quasars. However, the significance of OVI absorbers to the total baryon budget is uncertain and UV observations alone cannot determine the physical conditions in the IGM. We propose STIS/E140M observations to search for intervening OVI absorbers towards two quasars that are bright enough in X-rays for follow-up Chandra spectroscopy. The combined UV/X-ray study provides a powerful tool to (1) assess the cosmological significance of OVI absorbers; (2) determine their physical properties using OVII/OVI and OVIII/OVI ratios; and (3) pursue detection and study of the warm-hot IGM.

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Proposal Category: GO
Scientific Category: COOL STARS
ID: 10212
Title: A Critical Test for Radiatively Driven Hot Winds in Cool Stars
PI: Alex Lobel
PI Institution: Harvard University

We propose STIS observations of the C IV resonance emission line profiles for the two brightest short-period classical Cepheid variables Delta Cep and Beta Dor, to critically test if P Cygni-type profiles form in the hot transition region plasmas of their pulsating upper atmospheres. Recent FUSE observations of the cool (non-variable) G-supergiant Alpha Aqr (and Beta Aqr) show a distinct P Cygni-type profile in warm transition region emission lines of C III. The observations reveal supersonic wind outflow velocities that exceed

~140 km/s, based on our semi-empiric radiative transfer models. The models demonstrate that optically thick supersonic winds occur in the outer atmospheres of cool giant and supergiant stars, at kinetic gas temperatures well above 80 kK. STIS observations of cool regular pulsating Cepheid variables will confirm or reject our present hypothesis that these peculiar P Cygni-type line shapes form in a supersonic accelerating wind structure that is (partly) driven by a radiative atmospheric acceleration mechanism, generally adopted for driving the much faster winds of hot luminous stars. STIS observations of the detailed line shapes of hot transition region emission lines in Cepheids can establish an important physical link between the radiation-driven wind theory of hot stars, and the acoustic/magnetic wave-driven wind theory of cool stars. The proposed high-resolution far-UV spectra of these important pulsating cool stars will be an invaluable contribution to the HST Archive.

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Proposal Category: GO
Scientific Category: HOT STARS
ID: 10213
Title: Optical identification of two nearby Isolated Neutron Stars through proper motion measuremnt.
PI: Silvia Zane
PI Institution: Mullard Space Science Laboratory

Aim of this proposal is to perform high-resolution imaging of the proposed optical counterparts of the two, radio silent, isolated neutron stars RXJ1308.6+2127 and RX J1605.3+3249 with the STIS/50CCD. Imaging both fields with the same instrumental configuration used in mid 2001 by Kaplan et al (2002; 2003), will allow us to measure the objects' position and to determine their proper motions over a time base of nearly four years. The measurement of proper motions at the level of at least few tens mas/yr, expected for relatively nearby neutron stars, would unambigouosly secure the proposed optical identifications, not achievable otherwise. In addition, the knowledge of the proper motion will provide useful indications on the space velocity and distance of these neutrons stars, as well as on the radius. Constraining these parameters is of paramount importance to discriminate between the variety of emission mechanisms invoked to explain their observed thermal X-ray spectra and to probe the neutron star equation of state (EOS). The determination of the proper motion is a decisive step toward a dedicated follow-up program aimed at measuring the objects' optical parallax, thus providing much firmer constrains on the star properties, again to be performed with the STIS/50CCD.

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Proposal Category: GO
Scientific Category: HOT STARS
ID: 10214
Title: ACS/HRC imaging of two very bright ultra-luminous X-ray sources (ULXs)
PI: Roberto Soria
PI Institution: University College London (UCL)

We propose broad- and narrow-band ACS/HRC imaging of two very bright ultraluminous X-ray sources (ULXs) in NGC 4559. Our main objectives are: to identify the optical counterparts; to determine their masses and evolutionary stages; to determine the nature of mass transfer in the ULX systems; to

determine the properties of the stellar population in the ULX fields (eg, metal abundance, age). With these observations, integrated with our Chandra, XMM-Newton, HST/WFPC2 and CHFT data, we will test the models for the nature and mechanisms of formation of the accreting black holes in ULXs. Moreover, one of the two ULXs is in a peculiar star-forming complex: we have suggested that it is an expanding wave of star-formation triggered by a dwarf galaxy plunging through the outer disk of NGC 4559. The ACS observation will also allow us to test this hypothesis.

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Proposal Category: GO
Scientific Category: AGN/QUASARS
ID: 10215
Title: STIS follow-up spectroscopy of Seyfert galaxies from Cycle 11 near-UV imaging survey
PI: Thaisa Storchi-Bergmann
PI Institution: Universidade Federal do Rio Grande do Sul

We propose a near-UV (3000-5500\AA) long-slit spectroscopic study of a sample of 23 Seyfert galaxies with bright circumnuclear U-band structures, selected from our Cycle 11 ACS near-UV snapshot survey. This survey collected HST U-band images for 78 galaxies, which also have optical and near-IR images available in the archive. We propose to enrich this image database with STIS spectra in the near-UV. The novel aspect of the present proposal is the availability of the near-UV images which will allow us to select the best slit centering and orientation to probe the circumnuclear structures. Our goal is to investigate the nature of these structures, characterizing the circumnuclear continuum and ionizing source of these galaxies at a spatial resolution of $\sim$10 parsecs, where we will probe the black hole environment. With the proposed observations, we will derive properties of the circumnuclear stellar populations of the selected galaxies (ages, masses and metallicities), evolutionary effects connecting the growth of the black hole with the growth of the galaxy bulge, as well as the relation between the black hole mass, accretion rate (luminosity) and the circumnuclear stellar population properties. This dataset will also allow us to study the effect of the bulge and black hole on the evaporation of young star clusters in these galaxies.

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Proposal Category: GO
Scientific Category: COSMOLOGY
ID: 10216
Title: Co-evolution of spheroids and black holes
PI: Tommaso Treu
PI Institution: University of California - Los Angeles

The masses of the giant black holes in galaxies are correlated with the luminosities, masses, and velocity dispersions of their host spheroids. This empirical connection of phenomena on widely different scales (from sub-parsec to kiloparsec) suggests that the evolution of a galaxy and its central black hole are closely linked. We propose to test various unified formation models, by measuring the cosmic evolution of the black hole/spheroid relations, back to z=0.37 (a lookback time of 4 Gyrs). We will obtain 1-orbit ACS images of a sample of 20 Seyfert 1 galaxies, for which we already have extensive new ground-based measures of the black hole masses and the stellar velocity dispersions. HST resolution is required for accurate measurement of the nonstellar AGN continuum, and the luminosity and effective radius of the bulge

of each host galaxy. This will complete the set of observables needed to map the co-evolution of spheroids and black-holes. The proposed sample is the minimum required to make the first measure of the black hole mass/bulge correlation and of the fundamental plane for active galaxies outside the local Universe.
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Proposal Category: GO
Scientific Category: GALAXIES
ID: 10217
Title: The ACS Fornax Cluster Survey
PI: Andres Jordan
PI Institution: Rutgers the State University of New Jersey

The two rich clusters nearest to the Milky Way, and the only large collections of early-type galaxies within ~ 25 Mpc, are the Virgo and Fornax Clusters. We propose to exploit the exceptional imaging capabilities of the ACS/WFC to carry out the most comprehensive imaging survey to date of early-type galaxies in Fornax: the ACS Fornax Cluster Survey. Deep ACS/WFC images -- in the F475W (g') and F850LP (z') bands -- will be acquired for 44 E, S0, dE, dE,N and dS0 cluster members. In Cycle 11, we initiated a similar program targeting early-type galaxies in the Virgo Cluster (the ACS Virgo Cluster Survey; GO-9401). Our proposed survey of Fornax would yield an extraordinary dataset which would complement that already in hand for Virgo, and allow a definitive study of the role played by environment in the structure, formation and evolution of early-type galaxies and their globular cluster systems, nuclei, stellar populations, dust content, nuclear morphologies and merger histories. It would also be a community resource for years to come and, together with the ACS Virgo Cluster Survey, constitute one of the lasting legacies of HST.
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Proposal Category: GO
Scientific Category: HOT STARS
ID: 10218
Title: Unveiling the nature of the 321s orbital period binary RXJ0806.3+1527
PI: GianLuca Israel
PI Institution: INAF, Osservatorio Astronomico di Roma

This porposal is aimed at studying one of the potentially most important binary system in our Galaxy, namely RXJ0806.3+1527. Our group discovered a 321s periodic modulation in its optical and X-ray flux and we poposed that it originates form the orbital motion (the shortest known) of a white dwarf around another lighter white dwarf. VLT optical spectra showed faint and broad (1500km/s FWHM) HeII (mainly) emission lines, even though the presence of H can not be completely ruled out due to spectral resolution. Moreover, recent XMM observations with the OM confirmed that the broad band energy spectrum of this source peaks in the UV band, making it one of the best target for HST studies. Here we propose to use the STIS spectroscopic capability of HST in the TIME-TAG mode. The latter mode is extremely well suited for our purposes, since will allow us, among other things, to perform, for the first time, an Orbital Phase Spectroscopy of the expected He lines (also those of C, N and O are expected) in the STIS spectra. We expect to finally probe the nature of the source by following the emission line centroid shift as a function of the orbital phase, making RXJ0806.3+1527 a single-component spectroscopic binary and opening a new perspective in the field of double degenerate systems (the emission lines of the greatest part of which are dominated by the effect of

the disk rotation).
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Proposal Category: GO
Scientific Category: STAR FORMATION
ID: 10219
Title: Are Dust Disks and Circumstellar Gas Around Young A Stars Unrelated Phenomena?
PI: James Neff
PI Institution: College of Charleston

Young stars with circumstellar material are common, but their properties vary greatly. Current studies strongly suggest that Beta Pictoris (A5 V) is an early solar system. If the high-density, high-velocity circumstellar gas falling toward Beta Pic were fueled by grazing comets or on-going erosion of debris located close to the star, we would expect to find evidence for warm dust in all Beta Pic-like systems. We have carried out detailed studies of the circumstellar environments of all nearby A-type stars. We have studied not only their circumstellar dust but also the characteristics of their circumstellar gas through absorption line spectroscopy. Based on our visible and IUE data, we identified about a dozen A-type stars with circumstellar gas. Among them, 7 have dynamic circumstellar gas similar to that found in the Beta Pic system, but none of them has detectable IRAS infrared excess. What is the origin of the dynamic circumstellar gas around young A-type stars? The STIS wavelength range covers many fine-structure lines that can only be seen at high densities, which are characteristic of circumstellar but not interstellar gas. We propose to observe these 7 stars with STIS to (a) verify the circumstellar gas detections from our previous visible and IUE studies, (b) determine the temperature and electron number density in the circumstellar gas, (c) derive accurate circumstellar gas column densities, and (d) study the possible causes of the variable circumstellar absorption lines (both red-shifted and blue-shifted have been seen in spectra of Beta Pic and our 7 target stars).
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Proposal Category: GO
Scientific Category: COOL STARS
ID: 10220
Title: Probing the Nucleosynthesis Products of the First Stars
PI: Christopher Sneden
PI Institution: University of Texas at Austin

We propose the first extensive HST study of Galactic halo stars that are deficient in heavy (i.e., neutron-capture) elements. These so-called r-process-poor stars contain the nucleosynthesis products from the earliest generations of stars, the progenitors of the halo stars. Detections of the lightest neutron-capture elements, such as Ge, along with some of the heaviest, including Pt, can only be obtained in the NUV. Our HST abundance analysis of the well-known bright (r-process-poor) giant star HD 122563 indicates a surprising drop off in neutron-capture element abundances from Ge to Pt. This is in contrast to the solar pattern seen in r-process-rich stars, and suggests that some of the very earliest generations of stars were unable to synthesize the heaviest elements. To confirm and strengthen this finding we will obtain abundance determinations for a number of neutron-capture elements in a target sample of 8 stars, spanning a wide range of metallicity. The resulting abundance distributions will provide a direct indication of the nucleosynthetic conditions (such as temperatures, densities, and neutron

fluxes) in the halo progenitors. These in turn will help to identify the characteristics (such as masses and metallicities) and nature of the first stars in the Galaxy.
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Proposal Category: GO
Scientific Category: STAR FORMATION
ID: 10221
Title: Uncovering the unknown Ly-alpha flux in classical T Tauri stars
PI: Gregory Herczeg
PI Institution: University of Colorado at Boulder

The FUV emission of CTTSs significantly impacts the chemical evolution and aids in the dispersal of gas in protoplanetary disks. Despite its importance, the dominant source of FUV emission, H I Ly-alpha at 1215.67 A, is not directly observable due to neutral hydrogen absorption in our line of sight to nearly all young stars. We have recently developed a novel technique to indirectly measure the Ly-alpha emission incident on the disk using Ly-alpha pumped molecular hydrogen emission lines, which are detected throughout the UV spectra of CTTSs. Measuring the Ly-alpha flux has a large effect of the total FUV emission from CTTSs: results from test cases demonstrate that at least 75% of the FUV emission is in this one line. The lack of accurate measurements of Ly-alpha remains a glaring weakness in chemical models of protoplanetary disks and disk dispersal. This strong emission will create a Ly-alpha dominated PDR-like disk surface at planet-forming radii close to the star. We propose using molecular hydrogen emission to reconstruct the intrinsic Ly-alpha line from three CTTSs to understand the dominant FUV emission source from these stars and its effect on protoplanetary disks.
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Proposal Category: SNAP
Scientific Category: GALAXIES
ID: 10222
Title: The Next Generation Spectral Library
PI: David Silva
PI Institution: European Southern Observatory - Germany

We propose to complete our snapshot program to produce a Next Generation Spectral Library of 600 stars for use in modeling the integrated light of galaxies and clusters. This program is using the low dispersion UV and optical gratings of STIS. The library will be roughly equally divided among four metallicities, very low ([Fe/H] < -1.5), low (-1.5 < [Fe/H] < -0.5), near-solar (-0.3 < [Fe/H] < 0.1), and super-solar ([Fe/H] > 0.2), well-sampling the entire HR-diagram in each bin. Such a library will surpass all extant compilations and have lasting archival value, well into the Next Generation Space Telescope era. Because of the universal utility and community-broad nature of this venture, we waive the entire proprietary period.
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Proposal Category: GO
Scientific Category: QUASAR ABSORPTION LINES AND IGM
ID: 10223
Title: Probing a damped Lyman-alpha system along two lines of sight
PI: Nicholas Morgan

PI Institution: Yale University

Damped Lyman-alpha absorption systems hold key information about galaxy formation and chemical evolution of the Universe. We have recently discovered that the bright (V = 15.4) z=1.07 quasar HS 2209+1914 is a gravitationally lensed double with an image separation of 1.1 arcsec and a clearly detected lensing galaxy. A strong Mg II and Fe II absorption system at z=0.51 is very suggestive of a common damped Ly-alpha absorber (DLA) in both lines of sight, presumably identical with the lensing galaxy. We propose to obtain UV spectroscopy of both QSO components, with the principal aim to confirm the DLA hypothesis and obtain the column density of neutral hydrogen along both lines of sight. This will enable future high-resolution spectroscopy to determine elemental abundances and their spatial variance between different locations in the absorber. In combination with new ground-based deep infrared images, HS 2209+1914 will be the only known DLA galaxy where spatially resolved abundance information can be directly related to the observed distribution of stellar light. Byproducts of our study will include new insights into the lensing geometry of the system, a high S/N measurement of differential extinction through the lensing galaxy, and an estimate of the lensing galaxy's extinction curve.

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Proposal Category: GO
Scientific Category: STELLAR POPULATIONS
ID: 10224
Title: Spatially Resolved mid-UV Spectra of the Centers of Local Group Galaxies
PI: Ricardo Schiavon
PI Institution: The University of Virginia

We propose to use STIS to collect medium resolution mid-UV and optical spectra from the nuclei of M31, M32 and NGC 205. The observations will provide fundamental constraints to the stellar population models we are currently developing in our Treasury Program (GO-9455, PI Ruth Peterson). The data will also be useful to constrain the stellar population content in the centers of the target galaxies. Last but not least, they will be crucial templates for studies of distant galaxies, by providing a direct assessment of spectrophotometric evolution in the mid-UV.

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Proposal Category: GO
Scientific Category: AGN/QUASARS
ID: 10225
Title: Abundances in AGN outflows: Putting Real Numbers Into Quasar Feedback Scenarios
PI: Nahum Arav
PI Institution: University of Colorado at Boulder

AGN outflows impact the evolution of supermassive black holes, host galaxies, and the surrounding IGM. To assess the importance of these processes, it is essential to obtain the physical properties of real AGN winds. Our proposed HST/STIS observations of the Seyfert 1 galaxy Mrk 509, in combination with dedicated FUSE time, are designed to obtain the first reliable determination of chemical abundances for an AGN outflow. Previous attempts to measure abundances from outflow absorption troughs did not account for velocity dependent covering factors of the absorbers. This led to large uncertainties in measuring absorption column densities, uncertainties which are magnified

when translated to abundances. To extract reliable column densities, we created an array of analysis tools for modeling high-S/N echelle data of doublets and higher multiplet lines from the same ion. After carefully reviewing all the available targets we conclude that the combination of high UV flux and unblended outflow troughs makes Mrk 509 the most promising target for obtaining abundances in AGN outflows. Our proposed Mrk 509 observations will provide the best input to date for accurately modeling the influence of AGN winds on the galactic and inter-galactic environments.
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Proposal Category: GO
Scientific Category: GALAXIES
ID: 10226
Title: The NICMOS Grism Parallel Survey
PI: Matthew Malkan
PI Institution: University of California - Los Angeles

We propose to continue our NICMOS pure parallel imaging and spectroscopic program. Our team has now built up considerable experience in optimizing the scheduling, reduction and analysis of NICMOS parallel observations. For a modest investment, our enhanced emphasis on G141 grism spectroscopy will increase the number of line-emitting galaxies detected by a factor of ~ 5-10. As our previous work demonstrated, the most frequently detected line is Halpha at 0.7<z<z<z<z6)
or if this formation was delayed up to z~1-2 by the intense UV-radiation field present at higher redshifts. The depth and high spatial resolution of the UDF are required in order to detect the low-surface-brightness stellar population associated with the galaxy halo and to separate and spatially resolve it from the central, high-surface-brightness component.
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Proposal Category: AR
Scientific Category: SOLAR SYSTEM
ID: 10322
Title: Electron Impact Simulations of Io's Atmosphere
PI: Laurence Trafton
PI Institution: University of Texas at Austin

August 1999 HST/STIS observations of Io in Jupiter's shadow by Bagenal et al. (Program 8169) revealed 1700-5000 A emission from SO2, SO, and S I that was attributed to impact excitation/dissociation by plasma torus thermal electrons. The conclusions of their analysis were limited by their simplified model of Io, necessitated by the lack of laboratory data and information on the complex geometry of Io's patchy atmosphere and volcanoes. Since then, many Galileo observations of Io have been published which make a detailed model atmosphere for this epoch possible with few free parameters. In addition, laboratory experiments have better-defined both the electron-impact and NUV absorption cross-sections of SO2. Meanwhile, we have developed the capability to simulate the emission from the interaction of plasma particles with Io's neutral atmosphere, overlaying a radiation code onto our 3-D Monte Carlo flow field model of Io without making any of the unrealistic approximations of the original analysis (i.e., uniform isothermal atmosphere; no energy lost by the exciting electrons; and no absorption by SO2). We propose to use these spectral images to constrain the remaining free parameters of this simulation to yield column abundances and atmospheric electron densities on the Jupiter-facing side of Io. The atmospheric S/SO2 abundance ratio is a diagnostic of SO2 dissociation in the internal volcanic magma that would constrain the

volcanic process. These eclipse observations are unique; and they constrain models of Io's molecular atmosphere in ways no other extant data can.
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Proposal Category: AR
Scientific Category: STELLAR POPULATIONS
ID: 10323
Title: ORIGIN OF THE GLOBULAR CLUSTER FUNDAMENTAL PLANE
PI: Dean McLaughlin
PI Institution: Space Telescope Science Institute

HST has provided many revolutionary new insights on the existence, formation and properties of star clusters in the Universe. One of the most important findings has been that star formation in almost any environment involves the formation of massive stellar clusters which look very much like what is expected of halo globular clusters when they were young. This discovery has rejuvenated ideas about globular cluster formation and star formation in general. Nonetheless, our understanding of the globular cluster formation process remains woefully incomplete. Although the integrated properties of globular clusters in external galaxies have long been studied from the ground, only with Hubble has it become possible to resolve the interiors of individual clusters in the halo of M31 and more distant galaxies. This has shown that globular clusters always have the same typical half-light radius of about 3 pc. This generalizes earlier findings for Milky Way clusters to a wide range of galactic environments and metallicities. Even more, with Hubble it is becoming increasingly clear that the same is true for young massive clusters. Phrased differently, the properties of clusters of all types define a remarkably uniform fundamental plane. While the ubiquity of this plane becomes clearer with every new Hubble observation, it remains a mystery what processes during cluster formation regulate its existence. It is also not understood why clusters (size independent of mass) and galaxies (size increases with mass) follow such different scaling relations. We will target these questions with a theoretical study of cluster formation. Using a semi-analytical approach we will study which processes and parameters are the driving force behind the observed relations. Theoretical work is badly needed to provide a coherent framework for the interpretation of the many important cluster results that Hubble has provided. Our study is therefore ideally suited for the Hubble Theory Program.
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Proposal Category: AR
Scientific Category: COSMOLOGY
ID: 10324
Title: The Morphology of Ly-alpha Emission Galaxies at z=3.11 in the GOODS-S Field
PI: Caryl Gronwall
PI Institution: The Pennsylvania State University

The discovery of large numbers of Lyman-break galaxies has revolutionized our ability to study the distant universe. Today, narrow-band surveys have finally caught up and are detecting Ly-alpha emission-line galaxies (ELGs) from z=2.4 to z=6.5. 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. As a result, these ELGs present us with a unique opportunity to study galaxies in the process of formation. We have performed several ground-based narrow-band surveys for ELGs at z~3.1, including one centered on the Chandra Deep Field

South. Spectroscopy has confirmed that our objects have broad (~450 km/s), asymmetric line profiles, consistent with that of a starburst galaxy. We propose to use archival HST ACS WFC observations of the Chandra Deep Field South from the GOODS treasury program to study the morphology of Ly-alpha ELGs at z=3.11. Our recent ground-based survey of this field contains about 10 Ly-alpha ELGs within the GOODS ACS WFC pointings. The F775W and F850LP images will detect the objects' rest-frame UV continuum, and allow us to measure their structure on sub-kpc scales. With these data we can probe the physical nature of these distant objects and derive important new insights on the nature of galaxy formation. In addition, we will directly compare the properties of our ELGs to similar objects found at higher redshift ($4 < z < 7$), and to the Lyman-break galaxies contained in the field. This sample is an important lower redshift counterpart to recent discoveries of Ly-alpha ELGs at higher redshift ($z = 4 - 7$). In addition, we will be able to directly compare the properties of the emission-line sources to Lyman-break galaxies at the same redshift in the same field discovered by the GOODS team.
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