Cycle 9 Abstract Catalog (based on Phase I Submissions)
Generated on: Wednesday January 05, 2000

Proposal Category: GO
Scientific Category: COS
ID: 8559
Title: The Role of Dark Matter in Cluster Formation and Galaxy Evolution
PI: Richard Ellis
PI Institution: California Institute of Technology

The outer regions of massive clusters represent transitional areas of great cosmological importance where field galaxies encounter the steep potential wells of dark matter and baryonic hot gas. Little is known about either the dark matter profile at large radii or the morphological properties of infalling galaxies at those redshifts where strong evolution is observed in the cluster cores. The former is central to understanding the puzzling high baryonic fraction observed in cluster cores with clear implications for the mean mass density, Omega_o. Understanding the mass distribution on large scales will also help separate cosmological field galaxy evolution from that driven by the environment. To address these questions we propose a wide-field imaging survey of the rich cluster Cl0024+1654 (z=0.40) which takes advantage of an extensive galaxy redshift survey we have compiled. We have designed an efficient sampling strategy which will simultaneously track the gravitational shear to at least simeq5h_50^-1 Mpc using proven mass reconstruction techniques developed with ground and HST-based data and connect this dark matter profile with the radial dependence of star formation, dynamical and morphological properties of recently-arrived cluster members.

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Proposal Category: GO
Scientific Category: COS
ID: 8560
Title: Large Scale Structure at z ~ 0.9
PI: Lori Lubin
PI Institution: California Institute of Technology

We are requesting deep, broad-band red WFPC2 images of three fields within a

supercluster at z ~ 0.9 in order to study the morphological properties of galaxies within a high-redshift large scale structure. Because significant evolution has already been observed in galaxy populations at this redshift, these observations will provide a crucial link between the global properties of large scale structure and galaxy-scale physics. The target supercluster contains two clusters which have already been well-studied by the proposers with Keck and HST. CL1604+4304 and CL1604+4321 are typical of Abell richness class 1 to 3 clusters. They are separated by 4100 km s^-1 and by only 7 h_0.7^-1 Mpc. This system is one of only two superclusters that are known at z ~great 0.9. The proposed HST fields cover the outskirts of the two clusters, as well as the very central supercluster region. These data will be combined with previous HST observations of the cluster cores to generate a complete sample of distant galaxies in a nearly contiguous area corresponding to 1 Mpc * 10 Mpc. The HST imagery, combined with a Palomar/Keck program to obtain photometric and spectroscopic coverage of the same region, will allow us to quantify the morphology--density relation over a wide range of local environments and to study the relationship between galaxies, clusters, and their surrounding large scale structure in the high-redshift universe.

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Proposal Category: GO
Scientific Category: COS
ID: 8561
Title: The Ionizing Flux from Star-Forming Galaxies
PI: Matthew Malkan
PI Institution: University of California

Meaningful upper limits on the amount of ionizing radiation from galaxies in the current epoch have been obtained (by HUT) for only 3 galaxies. The contribution of normal galaxies to the cosmic UV background flux is even more uncertain at earlier times. We propose to determine the emission of normal, intermediate-redshift, star-forming galaxies in the FUV. If their average escaping ionizing flux is even 1/10 of their strong mid-UV flux, they are a comparable or even larger source of the background than AGN. Even a small contribution from the numerous normal galaxies has far-reaching implications for the strength, spectrum, and spatial homogeneity of the diffuse ionizing flux. This ionization controls the properties of the young IGM, from the Ly-alpha forest to protogalaxies. The STIS/FUV-MAMA imager can provide an extremely sensitive measurement of the pure Lyman-limit continuum from the

brightest galaxies at 1.1 <= z <= 1.7. Our integrations will be deep enough to provide detections or highly significant (50Sigma) upper limits, for more than three times as many galaxies as have been previously published (and those were only at low redshift). If the average ratio of Lyman limit/mid-UV fluxes is even as small as a few percent, these proposed observations will underlinedetect it.

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Proposal Category: GO
Scientific Category: COS
ID: 8562
Title: Probing the Large Scale Structure: Cosmic Shear observations with STIS
PI: Peter Schneider
PI Institution: Max-Planck-Institut f. Astrophysik

The distortion of light bundles from distant galaxies probes the statistical properties of the intervening inhomogeneous (dark) matter distribution. Its tidal gravitational field distorts the observable image shapes thereby causing a coherent ellipticity pattern (Cosmic Shear). The statistical properties of this pattern reflect those of the large-scale matter distribution in the Universe. Cosmic Shear can therefore probe the LSS without any reference to the relation between dark and luminous matter. Owing to the small magnitude of this effect, a reliable measurement of Cosmic Shear requires superb imaging of very faint objects. From our detailed and successful preliminary work on existing parallel imaging data with STIS, we have demonstrated that STIS provides the required image quality for this program due to its good pixel sampling and its small PSF anisotropy. We propose an imaging Parallel Program for Cycle 9, similar to that carried out in Cycle7. We propose to dedicate one and two orbit parallel opportunities to imaging with the 50CCD `Clear' filter. By combining the results from these two programs, we expect to measure the Cosmic Shear on the STIS angular scale with high precision. Comparison with light tracing through very large N-body simulations will allow us to constrain the cosmological parameters and fix the normalization of the dark matter power spectrum with high accuracy.

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Proposal Category: GO
Scientific Category: CS
ID: 8563

Title: Determining the Duplicity of Nearby T Dwarfs (Methane Brown Dwarfs)
PI: J. Davy Kirkpatrick
PI Institution: Infrared Processing and Analysis Center

Knowing the binary fraction of T-type dwarfs (methane brown dwarfs) is crucial to accurate determinations of the T-dwarf space density and mass function, especially since equal-magnitude binaries can introduce significant biases in photometric distance estimates. Because a recent study of slightly hotter L dwarfs indicates that 30\ equal-magnitude binaries, we believe that T dwarfs may show a similar tendency to form equal-mass pairs. Characterization of the T-dwarf multiplicity fraction is necessary if properties of the first few discoveries are to be adequately applied to larger samples uncovered later. We propose to image ten newly discovered T dwarfs using the incomparable resolution of WFPC2, where colors from the F814W and F1042M filters will provide discrimination of background sources. This imaging program will not only be able to split close binaries, but will also be capable of detecting wider companions up to four magnitudes fainter than the T dwarf primary. This will enable us to probe to temperatures around 500K, much cooler than any brown dwarf previously identified and squarely in the regime occupied by young, high-mass planets.

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Proposal Category: GO
Scientific Category: GAL
ID: 8564
Title: Measuring the Evolution of the UV Upturn
PI: Thomas M. Brown
PI Institution: Goddard Space Flight Center

We propose far-ultraviolet observations of CL1358+62, a rich, well-studied cluster of galaxies at z =0.33. These observations will provide the first completely unambiguous measurement of far-UV emission in quiescent ellipticals at moderate redshift. Theoretically, the strength of far-UV emission (relative to flux at longer wavelengths) is the most rapidly evolving feature in elliptical galaxies. Models suggest that this ``UV upturn'' can change by a factor of 25 over a few Gyr, and it is expected to fade rapidly with increasing redshift. Surprisingly, the Faint Object Camera (FOC) found strong far-UV emission in four elliptical galaxies at z=0.375, suggesting no

evolution in this diagnostic between our own epoch and one 4 Gyr earlier. However, the FOC measurement was particularly susceptible to systematic errors, and it was limited to a small number of galaxies in just one cluster. In contrast to the FOC results, recent Space Telescope Imaging Spectrograph (STIS) observations at z=0.55 obtained very weak detections of ellipticals at higher redshift, as expected for ellipticals much younger than those in our own epoch. Observations with the STIS far-UV camera are not subject to the uncertainties of the FOC measurements, because the STIS camera is blind to flux at longer wavelengths. Our observations of CL1358+62 will unambiguously test the apparent lack of evolution in the UV upturn over the past 4 Gyr.

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Proposal Category: GO
Scientific Category: GAL
ID: 8565
Title: Where Does Lyman Alpha Escape from Galaxy Disks?
PI: William Keel
PI Institution: University of Alabama

The frequent detection of Lyman Alpha emission at high redshifts underscores the need to understand how it arises in nearby galaxies. Despite the obstacles posed by radiative transfer, we find empirically that significant Lyman Alpha emerges from some nearby galaxies. Data on M33, in particular, suggest that much of this escape could be from the diffuse ISM rather than from H II regions specifically, an idea with some theoretical attraction as well. This proposal examines the structure of known Lyman Alpha emission from the starburst disk of PG 0119+229, to separate the contributions of discrete and diffuse sources of this line.

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Proposal Category: GO
Scientific Category: HS
ID: 8566
Title: High Resolution UV/X-ray Spectroscopy of SMC X-1
PI: Saeqa Vrtilek
PI Institution: Smithsonian Astrophysical Observatory

We propose simultaneous observations of the X-ray pulsar SMC X-1 and its B0 companion SK160 with HST/STIS, Chandra, and ground-based optical telescopes. We will search for correlation between orbital phase and ``bleaching'' of

important P Cygni lines by X-ray photoionization (Hatchett-McCray effect). We will model the simultaneous X-ray, ultraviolet, and optical continuum emission at different phases of the superorbital period to measure changes in mass accretion rate, disk structure, and disk size. Using the Time-Tag mode, we will search in the ultraviolet for aperiodic variability near 0.1-0.2 Hz throughout the lines and continuum and for the 0.7 second X-ray pulsar period. Using the Chandra ACIS-S in CC mode we will conduct pulse-phased spectroscopy of the X-ray emission. Our multiwavelength observations will enable us to analyze the density structure and composition of the wind; set limits on the size, shape, rotation, and precession of the disk; and determine the effects of X-ray illumination on the disk, the star, and the stellar wind.

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Proposal Category: GO
Scientific Category: HS
ID: 8567
Title: Confirming the parallax of the neutron star RX J185635-3754
PI: Frederick Walter
PI Institution: State University of New York

Cycle 6 and 7 observations of the isolated neutron star RX J185635-3754 have revealed a motion of 0.8 arcsec in 2.5 years. This is a combination of the annual parallax and the proper motion. A third observation, planned for this fall, will formally yield sufficient information to solve for the parallax and proper motion independently. This first ever measurement of the distance of an isolated neutron star has important ramifications for astrophysics and for nuclear physics. The magnitude of the expected parallactic shift is less than one PC pixel, and must be measured against a far larger shift due to the proper motion. While this parallactic shift is in principle measurable for distance up to about 100 pc, these real data are subject to subtle instrumental effects which may skew the results. Given the scientific importance of obtaining an accurate distance, we request a fourth epoch observation to confirm the parallax.

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Proposal Category: GO
Scientific Category: ISM
ID: 8568
Title: A Seminal Spectroscopic and Imagery Investigation of the

Brightest Wolf-Rayet Shell Nebula: NGC 6888
PI: Reginald Dufour
PI Institution: Rice University

We propose to obtain HST WFPC2 imagery and STIS UV-optical-NIR spectroscopy of several regions in the brightest Wolf-Rayet Shell Nebula (WRSN), NGC 6888. The physical conditions in the wind-driven and/or stellar ejected plasma (temperature, density, ionization, and composition) of WRSN, which are dominated by strong stellar winds from hot massive stars in an advanced state of evolution, often involve emission from both shock-ionized and photoionized gas in close proximity. These new observations will comprise the first combined spectroscopy and imagery of a WRSN at a resolution sufficient (i.e., ~ 10^15 cm) to separate and individually analyze these two emission regions. We also expect to obtain the first determination of the abundance of carbon - a key element in the He-C-N nucleosynthesis chain - in WRSN, of which several are known to be nitrogen- and helium-enriched by mass loss during its previous red supergiant phase. These observations will also be used to evaluate the contribution of stellar wind-driven shock emission as a source of temperature fluctuations, important for accurate abundance determinations within this and other types of nebulae, such as planetary nebulae and H ii regions.

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Proposal Category: GO
Scientific Category: QAL
ID: 8569
Title: A New Survey for Low-Redshift Damped Lyman-Alpha Lines in QSO MgII Systems
PI: Sandhya Rao
PI Institution: University of Pittsburgh

-0.15 truein Studies have shown that most of the observable neutral gas mass in the Universe resides in QSO damped LyAlpha (DLA) systems. However, at low redshift (z<1.65), DLA can only be found by searching in the UV with HST. Such searches are crucial since z<1.65 corresponds to ~ 3/4 of the age of the Universe. The identification of significant numbers of low-redshift DLA systems is imperative if we ever hope to effectively study this cosmologically massive component of neutral gas. To this end, we recently reported on the results of our initial HST survey to study low-redshift DLA absorbers in QSO MgII systems. We discovered 14 DLA systems and had a success rate of ~14\

these results and our improved understanding of the selection criteria for successful DLA searches, we propose a new survey for low-redshift DLA lines in QSO MgII systems. With our new revised selection criteria, we can empirically show that our success rate would be ~35\ Specifically, we propose to observe the LyAlpha line of 71 MgII systems. We estimate that we will discover ~25 new DLA systems with redshift z<1.65. Finding these systems will facilitate the type of research that can be done with DLA systems. By boot-strapping from the MgII statistics, we will be able to further improve the determination of the low-redshift statistical properties of DLA (their incidence and cosmological mass density) and open up new opportunities for studies at low redshift.

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Proposal Category: GO
Scientific Category: QAL
ID: 8570
Title: HS 1543+5921: A bright quasar seen through a nearby star-forming dwarf galaxy
PI: Regina Schulte-Ladbeck
PI Institution: University of Pittsburgh

-0.15truein Recently, the nearby star-forming dwarf galaxy SBS 1543+593 (z=0.009) was discovered to be superimposed upon the bright quasar HS 1543+5921 (z~0.8, m_B=16.8). Very few such alignments are known, making HS 1543+5921/SBS 1543+593 a unique system for absorption-line studies with HST. In order to investigate the properties of SBS 1543+593 and determine the utility of future work, we request 2 orbits for a small pilot project. First, we propose to obtain a STIS spectrum which will allow us to determine the HI column density in the sight-line through the dwarf. Second, we propose to obtain a near-UV image of SBS 1543+593 with WFPC2 (to be used with ground-based images). The image will allow us to ascertain the dwarf galaxy's morphological type (spiral or irregular), details of its star formation, and investigate whether amplification bias due to the gravitational lens effect plays a role in the appearance of this improbable alignment. An exciting discovery which might result from this study is that SBS 1543+593 gives rise to a damped LyAlpha (DLA) absorption line in the spectrum of the background quasar. DLA absorbers are the reservoirs of most of the observable neutral gas mass in the Universe at higher redshifts, yet few have been directly matched with galaxies so far. There is a clear need to seize the opportunity presented

by HS 1543+5921/SBS 1543+593, since a positive outcome would increase the sample of well-resolved nearby DLA galaxies.

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Proposal Category: GO
Scientific Category: QAL
ID: 8571
Title: Metallicity and D/H abundance in Low-z LyAlpha Absorbers towards PG 1211+143
PI: J. Michael Shull
PI Institution: University of Colorado, Boulder

Our Cycle 7 STIS/G140M observations along the sightline toward PG 1211+143 reveal numerous LyAlpha absorption lines including 2 very strong LyAlpha absorbers (cz = 15,300 and 19,550 km s^-1) with associated Si III absorption. These are the first definite detections of metals in a low-z LyAlpha forest cloud; simple photoionization models suggest metallicities in the range 1--10\ sim10^17 cm^-2 in each system, we should be able to detect deuterium LyAlpha at 10--20 mAngstrom\ equivalent width, thereby testing models of D/H astration as a function of IGM metallicity, an issue of cosmological significance. We propose to obtain a 25-orbit (S/N ~ 25) STIS/E140M spectrum (1150-1740 Angstrom) at 10 km s^-1 resolution to detect or limit D I (LyAlpha) and to measure metal absorption lines (C IV, Si IV, N V, C II, Si II) observable down to below 10^-2 solar abundance (4 mAngstrom\ EW limit). This sightline is one of two prime FUSE targets for long-duration exposures in the extragalactic D/H program. FUSE will detect higher Ly-series lines and the Lyman break (accurate H I column density) and measure key metal lines (C III Lambda977, O VI Lambda1032,1038). Thus, the FUSE and STIS programs are highly interdependent.

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Proposal Category: GO
Scientific Category: QAL
ID: 8572
Title: Identifying Normal Galaxies at 1.3 < z < 2.5
PI: Lisa Storrie-Lombardi
PI Institution: California Institute of Technology

Studies of faint, distant galaxies have greatly advanced in recent years. It is now possible to observe hundreds of galaxies out to z=1 and in the range 3

< z < 4.5, yet the redshift range 1 < z <3 remains largely unexplored. Galaxies selected by MgII absorption lines detected in quasar spectra are associated with normal galaxies up to redshifts z=1.2. We are extending this work to z = 2.5. We are already obtaining deep ground-based optical and near-infrared (VRIJK') images of fields around quasars with MgII absorbers. We propose obtaining far-UV and CCD images of our QSO fields with STIS. The aims of the observing program are: (1) Identify galaxies which produce MgII absorption using the Lyman drop-out technique. The 912Angstrom\ Lyman break is observed at 2100Angstrom\ -- 3200Angstrom\ for 1.3 < z < 2.5 so these galaxies will be absent from far-UV images below 2000Angstrom. (2) Obtain high resolution images to study MgII galaxy morphology. This can be accomplished extremely efficiently with STIS 50CCD imaging. Our main scientific goals are: (1) Find garden variety L^* galaxies at z ~ 2 when the Universe is 20-25\ as were found in the Steidel & Dickinson (1995) sample of MgII absorbers at z < 1.2. (2) Study the evolutionary history of MgII selected galaxies. If they are not typical L^* galaxies at z ~ 2 as they are at lower redshifts, we will determine the redshift at which this change occurs.

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Proposal Category: GO
Scientific Category: SF
ID: 8573
Title: Newborn Planets and Brown Dwarf Companions in IC 348
PI: Kevin Luhman
PI Institution: Harvard-Smithsonian Center for Astrophysics

We propose to use deep WFPC2 images to search for young giant planets and brown dwarfs around ~100 low-mass stars and brown dwarfs in the nearby cluster IC 348. This cluster's age, 1-10 Myr, makes it perfectly suited for detecting such companions. While stars in star-forming regions such as Orion and Taurus are still surrounded by thick proto-planetary disks, the stars in IC 348 are old enough for most of the disks to have dissipated, yet young enough so that the newly-formed brown dwarfs and giant planets are still very luminous. By observing intrinsically faint, low-mass primaries, we should detect companions down to 3 and 7 M_ Jup at separations of 90 and 30 AU. When the results of this program are combined with other studies of planets at smaller separations around older, more massive primaries, we will better understand the properties of planetary systems as a function of primary mass and how they evolve from birth to the age of the solar system. Furthermore, because low-mass stars and

brown dwarfs exist in such large numbers, this program is important in determining the frequency of planetary systems in the universe.

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Proposal Category: GO
Scientific Category: SP
ID: 8574
Title: Proper Motions in Baade's Window
PI: Carl Grillmair
PI Institution: SIRTF Science Center/California Institute of Technology

We propose to obtain third epoch WFPC2 observations of a rich field in Baade's Window. In just three orbits, we will be able to measure very accurate proper motions for ~ 13,000 Galactic bulge stars down to V = 23. Such a large number of stars, combined with color information, a relatively long baseline, and the high spatial resolution of HST, will enable an unprecedented opportunity to model the structure and dynamics of the Galactic bulge and bar populations. In addition, by selecting stars on the basis of their proper motions, we will be able to refine the color-magnitude distributions of stars in the bulge and the bar, and thus the corresponding initial mass functions and chemical enrichment histories.

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Proposal Category: GO
Scientific Category: SP
ID: 8575
Title: Leo A --- Evidence for the ``Delayed Formation of Dwarfs" Scenario?
PI: Regina Schulte-Ladbeck
PI Institution: University of Pittsburgh

Did all galaxies form at high redshift, or was the formation of certain galaxies delayed until recent (z<1) cosmological epochs? The delayed-formation -of-dwarfs hypothesis discusses how the faint blue galaxies came to be and where they are now: they represent copious dwarf galaxies that burst into stars at 0.5<z<1, but immediately faded due to supernova-induced gas loss. So far, however, no galaxy has proven to have formed at these redshifts. Cycle 4 HST observations revealed that a delayed dwarf might be lurking in our own backyard. The resolved stellar content of Leo A, a dIrr in the Local Group, is consistent with star formation beginning only a few billion years ago.

However, the presence of an ancient stellar substratum cannot be ruled out by these observations; the horizontal branch is at their detection limit, and they point in a crowded region heavily populated with young stars which makes the discrimination of horizontal branch stars impossible. We here propose to exploit the capabilities of WFPC2 to obtain color-magnitude diagrams of Leo A's halo. The clear signature of ancient stars lies in the horizontal branch, and requires photometry that can only be done with very deep, high-resolution images. Using synthetic CMDs, we will model the data to derive when Leo A first started to form stars. This will allow us to determine unambiguously whether Leo A is evidence for the ``delayed formation of dwarfs."

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Proposal Category: GO
Scientific Category: SP
ID: 8576
Title: The Star-Formation History of the Large Magellanic Cloud
PI: Tammy Smecker-Hane
PI Institution: University of California, Irvine

Accurately determining the star-formation rate (SFR) and chemical evolution of the Large Magellanic Cloud (LMC) can give us a solid foundation for understanding the evolution of intermediate-mass galaxies and, potentially, the origin of ``faint blue galaxies" commonly found in redshift surveys. We propose to continue a WFPC2 imaging survey of field stars in the LMC to obtain color-magnitude diagrams (CMDs) that allow us to determine its SFR from 1 to 15 Gyr ago with unprecedented accuracy. Our goal is to measure 20\ SFR, averaged over 1 Gyr intervals, at the 2 Sigma level in each region surveyed. We imaged one region at the center of the bar and one region in the disk in Cycle 7, and the resulting CMDs revealed clear differences in their evolution. We now propose to image a third region, in the bar-disk interface, to begin to quantify the evolution of the bar, disk, and halo of the LMC, and to define the spatial extent of star bursts. Our project has generated the best CMDs ever obtained for a galaxy other than the Milky Way. To derive the SFRs, we compare observed and model CMDs using statistically rigorous techniques that we have pioneered, and to surmount the age-metallicity degeneracy inherent in CMDs, we have begun an ambitious project to directly measure stellar abundances by obtaining spectra with ground-based telescopes of ~ 100 red giant stars in each LMC region.

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Proposal Category: GO
Scientific Category: SS
ID: 8577
Title: Ozone, Condensates, and Dust in the Martian Atmosphere
PI: Philip James
PI Institution: University of Toledo

We propose to utilize the unique capabilites of STIS and WFPC2 in order to study the spatial and seasonal variations in ozone, condensates, and dust in the Martian atmosphere. The data obtained promise to be critical in addressing recent breakthroughs in understanding the basic radiative, transport, and microphysical processes that provide for both long-term and short-term balance within the global Mars climate system. Observations will be obtained between late November 2000, when the solar elongation of Mars first exceeds 50degrees, through June 2001 at which time the angular size of the planet will be almost 21 arc seconds and the effective resolution at the sub-earth point will be 15 km/pixel. The season on Mars during this period is summer in the northern hemisphere, providing an opportunity to revisit the equatorial cloud belt previously discovered by HST and further examine the important interplay between water vapor and clouds during this season. These observations are distinct from, but complementary to those that will be made by the Mars Climate Orbiter.

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Proposal Category: GO
Scientific Category: SS
ID: 8578
Title: First Spectroscopy of an Asteroid and its Satellite: (45) Eugenia and S/1998 (45) 1
PI: William Merline
PI Institution: Southwest Research Institute

We recently made the first-ever discovery of a satellite of an asteroid from the Earth, using adaptive optics (Merline et al. 1999a, 1999b). We propose here to acquire the first separate, comparative, and simultaneous spectra of an asteroid and its satellite. We will employ the UV-capabilities and high-spatial-resolution properties of STIS to study (45) Eugenia, and its satellite, S/1998 (45) 1, by obtaining medium-resolution spectra over the range 2900--10300 Angstrom, using only two grating settings, on a single HST

orbit. We will determine whether the spectra, and hence surface compositions, are similar or different in a parent-satellite pair, and to test hypotheses concerning satellite production mechanisms. From the orbital parameters, determined using our ground-based adaptive-optics images, we have already determined that (45) Eugenia has a surprisingly low density of 1.2 g cm^-3. We know the spectrum of Eugenia is a (Tholen) FC-type, which is similar to the common C-types, but differs by the lack of a UV-band or UV-dropoff and by subtle, but measurable differences in the spectral slope. Both the UV-region and the existence of subtle absorption features in the near-IR (~ 0.9 Mum) are diagnostic of the specific differences between F-, C-, and (Bus') X-class. HST spectroscopy is the only way to separate the pair, because ground-based adaptive optics is not available in the UV and cannot yet provide adequate resolution in the visible.

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Proposal Category: GO
Scientific Category: SS
ID: 8579
Title: A Search for the Martian Dust Belts
PI: Mark Showalter
PI Institution: NASA Ames Research Center

It has been long believed that Mars should be encircled by two faint rings of dust, one originating from each of its moons Phobos and Deimos. Similar dust rings have recently been associated with all the inner small moons of Jupiter. On May 28, 2001, Earth will pass through Mars' equatorial plane within weeks of its opposition, providing a unique opportunity to detect these rings via direct imaging. Using WFPC2, we will be able to detect rings with normal optical depths of sim10^-8, which is well within the range of the Martian rings' predicted densities and 10--100 times fainter than the known Jovian rings. The rings have been predicted to show some interesting dynamical properties, including large asymmetries and inclinations. A positive detection will enable us to test these predictions, serving as an effective test of models developed to account for the faint rings of Jupiter and Saturn as well. It will also provide both photometric and dynamical constraints on the dust size distribution, enabling us to distinguish between several models of the rings' dynamics and evolution.

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Proposal Category: GO

Scientific Category: SS
ID: 8580
Title: Pre-Cassini/Huygens Studies of Titan's Surface, Troposphere and Stratosphere
PI: Eliot Young
PI Institution: Southwest Research Institute

Titan, Saturn's largest satellite, has an opaque atmosphere in UV and visible wavelengths due to aerosols and methane gas. We propose a data-dense suite of observations to (a) map the three-dimensional distribution of methane and aerosols in Titan's troposphere and stratosphere (up to 100 km), with the possibility of detecting moving weather patterns, (b) provide a history of the distribution of haze in preparation for Cassini and Huygens observations, and (c) map Titan's surface albedo with unprecendented spatial resolution and signal/noise. This proposal represents the most sensitive look at Titan's troposphere to date. The results of this proposal (i.e., the distribution of haze and methane) are important parameters in the planning of Cassini ISS and VIMS observations. In addition, the detection of ephemeral clouds in the troposphere (suggested from IR spectra) would help determine the direction of tropospheric winds, a critical parameter in planning the Huygens probe tr

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Proposal Category: SNAP
Scientific Category: CS
ID: 8581
Title: A search for low-mass companions to ultracool dwarfs
PI: Neill Reid
PI Institution: University of Pennsylvania

We propose to use the unparalleled resolution and sensitivity of WFPC2 to search for very low-mass (VLM) companions to a complete sample of 120 late-M and L dwarfs, drawn mainly from the 2MASS and SDSS surveys. Our primary goal is to determine the multiplicity of M < 0.1 M_\odot dwarfs. In particular, we aim to identify binary systems suitable for long-term astrometric monitoring and mass measurement, and systems with cool, sub-1000K companions. With a dynamic range of Delta m_I ~ 5 mag. for separations Delta > 0arcs3, these observations are capable of detecting companions with mass ratios M_Sec / M_Pri > 0.4. Most of our targets are at distances between ~10 and 40 parsecs. Given a binary fraction and semi-major axis distribution similar to M dwarfs,

approximately 20\ are expected to be resolved. With detection limits extending well below the hydrogen-burning limit to Gl229B-like temperature, these observations, supplemented by ground-based imaging and spectroscopy, will provide a definitive measurement of the binary fraction and mass-ratio distribution in VLM dwarfs.

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Proposal Category: SNAP
Scientific Category: QAL
ID: 8582
Title: UV Detectability of Bright Quasars in the Sloan Fields
PI: Wei Zheng
PI Institution: The Johns Hopkins University

He II Ly alpha absorption at 304(1+z) Angstrom\ is a far more sensitive tracer of the intergalactic medium (IGM) than its H I counterpart. The recent detections of such absorption in four quasars, albeit with limited data quality and a small sample size, demonstrate the great potential of such a probe. The lines of sight toward the majority of z~ 3 quasars are intercepted by Lyman-limit systems, and these quasars' UV flux is cut off before reaching the He II Ly alpha feature. As a result of the SDSS, a number of bright (V<18), z>2.5 quasars are being identified. We propose a STIS snapshot survey to confirm the UV detectability of about 50 such quasars, in order to select the candidates for follow-up spectroscopic observations with STIS, COS, or FUSE. Future high-quality HST spectra of these new quasars will enable us to map the 70\ strict constraints on cold-dark-matter models of structure formation in the universe and reveal the evolution of the IGM from the epoch when the first generation of galaxies were formed down to z ~ 3.

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Proposal Category: SNAP
Scientific Category: SS
ID: 8583
Title: Imaging Snapshots of Asteroids
PI: Alex Storrs
PI Institution: Space Telescope Science Institute

We propose to obtain WFPC2 images of the fifty largest main belt asteroids that have favorable apparitions during cycle 9. The images will be searched for companion bodies, as well as mineralogical variegation on the resolved

main bodies. Images in the F439W, F673N, F791W, F953N, and F1042M filters will define the 1 micron Fe^2+ feature and the possible 0.7 micron hydration feature. This will allow interpretation of compositional differences between the primary and secondary bodies, as well as any brightness variations across the disk(s) as being due solely to albedo. Because of the restriction that moving target snapshots be done under gyro control, we expect to miss 1/3 of the targets. We therefore request that each candidate be put in the snapshot pool twice, and so request 100 ``targets'' for these fifty asteroids.

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Proposal Category: GO
Scientific Category: COS
ID: 8584
Title: Calibrating the Metallicity Dependence of the Cepheid PL Relation
PI: Robert Kennicutt
PI Institution: Steward Observatory

Uncertainty in the metal abundance dependence of the Cepheid PL relation remains as one of the largest sources of systematic error in the Cepheid distance scale and in the extragalactic distance scale as a whole. We propose to directly test and calibrate the metallicity dependence of the PL relation, by obtaining independent Pop II based distances to a sample of 6 Cepheid host galaxies with (Cepheid) metal abundances (0.2--2 Z_\odot), using the tip of the red giant branch (TRGB) method. The TRGB method offers the optimal combination of precision and metallicity insensitivity for this test. When combined with currently available Cepheid and TRGB distances, these data will provide: (1) A robust empirical calibration of the Cepheid metallicity dependence; (2) Hard limits on the systematic error in H_0 from metallicity effects; (3) Empirical constraints on theoretical models of Cepheids; (4) Tight limits on other systematic errors in Cepheid distances as functions of distance, stellar crowding, and extinction; (5) A valuable Pop II based cross-check on the zeropoint of the Pop I distance ladder.

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Proposal Category: GO
Scientific Category: COS
ID: 8585
Title: Cosmological Parameters from Type Ia Supernovae at High Redshift

PI: Saul Perlmutter
PI Institution: Lawrence Berkeley Laboratory

HST can directly measure the cosmological parameters, Omega, Lambda, and thus the curvature, Omega_k, using Type Ia supernovae (SNe Ia) as calibrated standard candles. Observations of SNe Ia spanning a large redshift range are key to decoupling Omega and Lambda. In Cycle 7 (and 7-NICMOS) we studied 12 SNe in the redshift range z~ 0.35--0.85; the forthcoming measurement of Omega and Lambda is expected to have uncertainty ~11\ embarked on a program to extend the redshifts to z~1.2, starting with 2 SNe. We here propose to continue the painstaking work of obtaining a statistically significant sample across this redshift range, by studying 2 more SNe at z~ 1.2, and filling in the redshift gap with 3 SNe between z~ 0.85--1.0. Measurement of these additional high redshift SNe will dramatically shrink the major-axis of the error ellipse in the Omega_M---Lambda plane, and unambiguously determine whether the universe contains a significant vacuum energy density. These data will provide powerful constraints on SN Ia evolution and on absorption by intergalactic ``gray'' dust; it would be very difficult for either evolution or dust to alter corrected peak magnitudes in the same way as cosmology predicts over the redshift range 0<z<1.2. Results of these proposed observations will further give the first real limits on whether the universe is spatially flat.

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Proposal Category: GO
Scientific Category: CS
ID: 8586
Title: WFPC2 Observations of Astrophysically Important Visual Binaries
PI: Howard E. Bond
PI Institution: Space Telescope Science Institute

This is a continuation of a Cycle 7-8 Long-Term project. The program consists of annual or biannual WFPC2 observations of three visual binary stars that will ultimately yield fundamental astrophysical results, once their orbits and masses are determined. Our targets are the following: (1) Procyon (P=41 yr), for which our first WFPC2 images yielded an extremely accurate angular separation of the bright F star and its very faint white-dwarf companion. Combined with ground-based astrometry of the bright star, our observation

significantly revised downward the derived masses, and brought Procyon A into excellent agreement with theoretical evolutionary tracks for the first time. The mass of Procyon B, however, implies a completely unexpected chemical composition for the white dwarf, and now poses a sharp evolutionary puzzle. With the continued monitoring proposed here, we will obtain masses to an accuracy of better than 1\ dwarfs. (2) G 107-70, a close double white dwarf (P=19 yr) that promises to add two accurate masses to the tiny handful of white-dwarf masses that are directly known from dynamical measurements. (3) pmbMu Cas (P=21 yr), a famous metal-deficient G dwarf for which accurate masses will lead to the stars' helium contents, with cosmological implications.

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Proposal Category: GO
Scientific Category: GAL
ID: 8587
Title: Stroemgren Photometry of Globular Clusters in M87: Breaking the Age-Metallicity Degeneracy
PI: Patrick C\^ote
PI Institution: California Institute of Technology

A remarkable achievement of HST has been the demonstration that the globular cluster (GC) systems of most, and possibly all, luminous galaxies show bimodal distributions in broadband color and, by implication, age and/or metallicity. Whatever its origin, this bimodality (which is observed in giant galaxies that span a wide range in Hubble Type and local environment) must hold a fundamental clue to the process of galaxy formation. Although several models for the observed bimodality have been suggested (e.g., spiral-spiral mergers, two phase collapse models, and hierarchical growth via dissipationless mergers), a definitive test of these scenarios has proved elusive due to the lack of reliable age estimates for the two GC populations in even a single galaxy. In other words, the models make very different predictions regarding the ages of the two GC populations, but the measured broadband colors suffer from the well-known ``age-metallicity degeneracy" of old stellar systems. We propose to break this degeneracy by using WFPC2 to obtain narrow-band photometry in the Stroemgren uvby filters for ~ 10^3 GCs in M87, the supergiant elliptical galaxy at the dynamical center of the Virgo cluster. Our technique hinges on the ability of Stroemgren photometry to decouple the effects of age and metallicity for large samples of GCs, and will provide the

first strong constraints on the various galaxy formation models.

Proposal Category: GO
Scientific Category: GAL
ID: 8588
Title: Gamma-Ray Bursts and their Host Environments
PI: Andrew Fruchter
PI Institution: Space Telescope Science Institute

We propose to use the unique high-resolution optical and ultraviolet capabilities of HST as well as the resolution and sensitivity of Chandra to investigate the physics of gamma-ray bursts (GRBs) and the nature of their host galaxies. Our approach is three-pronged: 1) rapid HST ultraviolet spectroscopy and Chandra imaging obtained within two days of an outburst will allow us to probe the physics of the relativistic fireball and the nature of the ISM surrounding the GRB; 2) long-term optical monitoring of the optical transient (OT) will permit us to test the hypothesis that GRBs are frequently highly collimated and to determine whether supernovae underlie GRBs; 3) Chandra and HST observations of "dark" GRBs will allow us to probe one of the greater mysteries surrounding GRBs, the nature of the bursts without optical counterparts. The ultraviolet and x-ray observations will also obtain the metal and rmH_2 column densities to a number of OTs, as well as the extinction law of the dust in these hosts. The late-time optical images will elucidate the physics of the afterglow, as well as the morphology, structure and luminosity function of the host galaxies. This comprehensive set of observations will provide new insights into the astrophysics of GRBs and their high redshift host galaxies.

Proposal Category: GO
Scientific Category: GAL
ID: 8589
Title: Orbital Structure and Black Hole in NGC 3379
PI: Karl Gebhardt
PI Institution: UCSC/Lick Observatory

The stellar orbital structure and the mass of the central black hole in dynamically hot galaxies are direct insights into their formation and evolution---both of the black hole and galaxy. We propose to use gas

kinematics to determine the central black hole (BH) mass in NGC 3379 to high accuracy. Detailed modeling including this BH mass and previous HST and extensive ground-based data will measure the stellar orbital distribution throughout the galaxy. Recent work suggests that elliptical galaxies tend to have tangentially biased orbits near their centers, consistent with results from BH binary simulations in galaxies. However, knowledge of the central BH mass is one of the limiting factors for providing accurate measurements of the orbital structure. In addition, this data will allow us to compare the mass measured from gas to that measured from stellar kinematics using our previous analysis. An urgent need in BH physics is cross checks between gas and stellar BH masses, particularly in systems where the gas mass promises to be accurate. NGC 3379 is a rare example of a system that lends itself to this comparison. Finally, accurate BH masses are necessary ingredients to characterize the relation, if one exists, between their masses and those of the host galaxy.

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Proposal Category: GO
Scientific Category: GAL
ID: 8590
Title: UV Imaging and Spectroscopy of Luminous Blue Compact Galaxies from z=0 to z=1
PI: James Lowenthal
PI Institution: University of Massachusetts

Are Lyman Break Galaxies (LBGs) at redshift z~3 centrally-concentrated, massive starbursts at the bottoms of deep potential wells of dark matter, or isolated, irregular, low-mass starburst galaxies? One significant barrier to deeper understanding of LBGs is the lack of available UV data on local star-forming galaxies for comparison. To address that lack, we propose STIS FUV imaging and spectroscopy of two well-defined samples of low-mass starburst galaxies, one in the local universe (z<0.1) and another at intermediate redshifts (0.2 < z < 0.7). Both samples show optical sizes, morphologies, emission line widths, and luminosities comparable to those of LBGs at z=3, and are therefore probably the best local analogs and testbeds for further study of LBGs. Our main goals are to: (1) explore the morphologies, surface brightness distributions, and half-light radii of nearby starforming galaxies in the FUV, near Ly-alpha; (2) search for systematic differences among UV, optical, and near-IR morphologies and structural parameters; (3) investigate the intrinsic emission and absorption spectra near Ly-alpha\ of starbursting

dwarf galaxies, with special attention to Ly-alpha\ profiles and interstellar and stellar photospheric absorption from Si II, O I, C II, Si IV, and C IV; (4) measure their FUV-optical colors and dust extinction properties; and (5) test the hypothesis that low-mass starbursts are the local counterparts of LBGs.

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Proposal Category: GO
Scientific Category: GAL
ID: 8591
Title: The Smallest Nuclear Black Holes
PI: Douglas Richstone
PI Institution: University of Michigan

Small nuclear black holes are the last major unexplored part of BH parameter space. We propose to search for the smallest BHs that HST can possibly find. Past studies have concentrated on massive, distant spheroids, overlooking many BH candidates on our own doorstep. The minimum detectable BH mass can be driven down by nearly two orders of magnitude by focusing on the nearest galaxies. We can easily reach down to 10^5 M(sun), the probable mass of the ``first born'' objects that (in other cases) grow or merge up to the quasar mass range. This strategy also favors disklike ``pseudobulges'', which probably formed differently from classical spheroids and which therefore provide a fresh perspective on the relationship between BHs and their embryonic environments. Our complete sample of 20 nearby galaxies includes all unstudied objects within 7.5 Mpc, brighter than M_B = -17, with well defined, unobscured centers. STIS long-slit spectra will be used to measure BH masses using both gas and stellar kinematics, comparing the results whenever practical. Emission-line and broad-band images are sought to characterize the central morphology of gas and stars. Of prime importance is the maser galaxy NGC 4258, which provides a unique chance to calibrate both stellar-- and gas-- dynamical BH masses against the impressively accurate maser BH mass.

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Proposal Category: GO
Scientific Category: GAL
ID: 8592
Title: Pixel Microlensing of M87
PI: Joseph Silk

PI Institution: University of California, Berkeley

Resolving the nature of dark matter, at least some of which is baryonic, is an urgent problem. If baryonic dark matter is associated with luminous baryonic matter, MACHOs (massive compact objects) are the preferred candidate as inferred from gravitational microlensing of LMC stars. Given the uncertainties in the dynamical modeling of the dark components of the halo, a broad mass range for MACHO candidates merits consideration, from 0.01 M_\odot to 1 M_\odot. This includes the mass range of brown dwarfs and M dwarfs, whose contribution towards the dark mass is unknown. We propose to use HST to undertake a pixel microlensing study of M87 in order to: 1) probe the lower end of the M87 IMF via star-star lensing, 2) possibly obtain the first evidence of MACHOs in the halo of a galaxy other than our own, and 3) search for intracluster MACHOs. The program is challenging, but very feasible, with the HST. Over a period of 30 days and with half orbit exposures in each of two colors at a rate of one per day, we will observe approximately 1-2 events per day for a MACHO of mass 0.1 M_\odot, with about 5 points of the lightcurve above 3Sigma. This provides a moderately high event significance threshold of S/N >= 10. The key factor that makes this project possible with the HST is the small pixel scale of the WFPC2, coupled with the small, stable PSF and superior photometric capabilities.

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Proposal Category: GO
Scientific Category: HS
ID: 8593
Title: Sakurai's Novalike Object: Real-Time Monitoring of a Stellar Thermal Pulse
PI: Howard E. Bond
PI Institution: Space Telescope Science Institute

This is a continuation of a Cycle 7-8 Long-Term program. Sakurai's novalike variable (V4334 Sgr) presents a ``once-in-a-lifetime'' opportunity for real-time observations of a star undergoing a final helium thermal pulse. The star rose from obscurity to become an 11th-magnitude, hydrogen-deficient red giant in 1995-96, and currently it is undergoing episodes of atmospheric dust formation which make it drop to quite faint magnitudes at random intervals. If it follows the pattern of the similar object V605 Aql, it will soon begin evolving back to high temperature. During the subsequent few years, it would

then begin to (re)-ionize its large, faint planetary nebula, and we should be able to witness the re-establishment of a fast stellar wind as the effective temperature increases. This is a Target-of-Oppurtunity proposal. When the star does start to become hot again, we will start using STIS to monitor the spectroscopic development of the star in the UV at regular intervals, continuing over the next 3 Cycles. We will also use WFPC2 once a year to monitor expansion of the ejecta. In combination with ground-based monitoring (optical, IR, and mm), we will thus produce the first detailed case study of a thermal pulse, as the star re-traces its evolution across the HR diagram from the AGB to the planetary-nebula phase.

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Proposal Category: GO
Scientific Category: ISM
ID: 8594
Title: H-deficient condensations in PNe -- a key to discrepancies in abundance determinations
PI: Xiao-wei Liu
PI Institution: University College London

own and other galaxies rests on emission line nebulae. Our recent CNO abundance determinations for PNe using optical recombination lines (ORLs) have yielded abundances systematically higher than the `standard' values deduced from UV/optical collisionally excited lines (CELs), with discrepancies covering a wide range from 1--20. In the extreme case of NGC 6153, multi-waveband analysis has yielded CNO and Ne abundances from ORLs which are all about a factor of ten higher than the CEL values. Temperature fluctuations and density inhomogeneities fail to explain all the available data. Instead our analysis indicates that NGC 6153 may have experienced a recent ejection of H-deficient knots, similar to those observed in the `born-again' PN A 30. We propose to obtain deep STIS long-slit spectra for the well-resolved H-deficient knots of A 30 and to search for such knots in NGC 6153. The data will yield the spatially resolved temperature, density and ionization structure of the knots in A 30, and, for the first time, accurate ORL C and O abundances for them. The results will lead to a much better understanding of the physics of such knots and their effects on abundance determinations. The observations of NGC 6153 will allow us to test if the observed central peaking of its ORL C and O abundances is a consequence of a central concentration of similar

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Proposal Category: GO
Scientific Category: ISM
ID: 8595
Title: Does the D/H Ratio Vary in Local Interstellar Gas?
PI: Meena Sahu
PI Institution: NASA/Goddard Space Flight Center

Measurements of the D/H ratio in the Local Interstellar Cloud (LIC) are consistent with 1.5 +/- 0.1* 10^-5, while for other clouds within ~ 100 pc, the measurement uncertainties are larger. Current data provide limited information on whether the D/H ratio varies between the LIC and the other clouds. We propose to determine if the D/H ratio varies, by high-precision D/H measurements and by devising strategies to reduce both random and systematic errors. STIS E140H & E230H mode (R~ 150,000) data will resolve the velocity components and allow reliable determinations of component-to-component variations. Two target white dwarfs (WDs) HZ 43 and GD 153 are chosen because EUVE data show low H i column densities, thereby reducing the probabilities of multiple velocity components and saturation of the D i line. The WDs have pure-H atmospheres, so contamination of the interstellar lines by photospheric metal lines is not an issue. Physically realistic NLTE models will be used to accurately predict the WD Lyman-Alpha contributions. HST-STIS, with its higher velocity resolution (compared to GHRS & FUSE), wider wavelength coverage, and better scattered light corrections (compared to GHRS) is the facility best suited for this project. We have demonstrated the capabilities of STIS in our study of the G191-B2B sightline, which is the only published STIS measurement of the D/H ratio to date.
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Proposal Category: GO
Scientific Category: QAL
ID: 8596
Title: Environmental Pollution: The Outflow in the Archetypal Galaxy-Quasar Pair NGC3067/3C232
PI: Max Pettini
PI Institution: Institute of Astronomy

Galactic-scale outflows are now known to be a common occurrence in star-forming galaxies, in the nearby universe and at high redshift. These

superwinds have fundamental astrophysical implications for regulating star formation, determining the evolution of the host galaxies, disseminating the products of stellar nucleosynthesis over large volumes, and are probably responsible for many of the metal absorption lines seen in QSO spectra. In order to understand the physical process involved, we have been developing detailed chemo-spectro-dynamical models which, however, suffer from a lack of direct observational constraints. We propose to remedy this situation by detecting the hot gas from NGC3067, a galaxy with concentrated nuclear star formation giving rise to an outflow seen in X-rays, in STIS G140M spectra of the background QSO 3C232. Although this is one of the best studied QSO-galaxy pairs, there have been no high-resolution observations yet targeted at absorption lines of highly ionized species, as requested here. In addition, STIS spectroscopy of the nuclear regions of the galaxy will establish the age and properties of the stellar population, so far only known from imaging data. By bringing together X-ray, UV and optical data we will obtain the first quantitative description of a galactic outflow, its relation to the star-formation activity in the galaxy, and its effects on the interstellar and intergalactic medium.

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Proposal Category: SNAP
Scientific Category: AGN
ID: 8597
Title: The Fueling of Active Nuclei:, Why are Active Galaxies Active?
PI: Michael Regan
PI Institution: Carnegie Institution of Washington

Accretion onto massive black holes is believed to be the energy source for AGN. However, evidence for black holes in quiescent galaxies has also been reported; why are these galaxies inactive? One possibility is that active galaxies are better at providing fuel to the nuclear region than quiescent galaxies. For the ISM to fuel a massive black hole it must lose significant amounts of angular momentum. Although angular momentum can easily be removed by stellar bars, recent ground-based studies of Seyferts show that the fraction of bars in active galaxies is no higher than in normal galaxies. Other possible fueling mechanisms such as ``bars-within-bars'' or nuclear spirals cannot be investigated from the ground because they are relatively small features in the ISM. Recent HST observations using optical - near-

infrared color maps to probe the morphology of the ISM at high resolution have shown that the majority of Seyfert galaxies have nuclear dust spirals. We propose to obtain WFPC2 snapshots of a sample of primarily quiescent galaxies which we will combine with existing NICMOS images to form color maps to determine if quiescent galaxies also have a large fraction of nuclear dust spirals. This will allow us to determine if nuclear spiral arms are the distinguishing feature that makes active galaxies active. Since the database created will be invaluable for other studies of spiral galaxies, we are waiving our proprietary period.

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Proposal Category: SNAP
Scientific Category: AGN
ID: 8598
Title: Snapshot Survey of Extended OIIILambda5007Angstrom\ Emission in Seyfert Galaxies
PI: Henrique Schmitt
PI Institution: Space Telescope Science Institute

We propose a snapshot survey of narrow band OIIILambda5007Angstrom\ images for a well defined sample of 88 Seyfert galaxies (29 Seyfert 1s and 59 Seyfert 2s), 18 of which already have data in the archive, selected from a mostly isotropic property, the 60Mum flux. These data will be used: 1) to determine the origin of the misalignment between the accretion disk axis and the host galaxy plane axis, which can be due to mergers with other galaxies, or by the self induced radiation warping; 2) to compare the size and shape of the NLR of Seyfert 1s and Seyfert 2s, and to study the frequency of conically shaped Narrow Line Regions (NLR) in Seyfert galaxies, which are usually unresolved from ground-based observations; 3) estimate the importance of shocks to the ionization of the NLR. We aim to provide a critical test of the applicability and limitations of the Unified Schemes that currently are the framework for understanding Seyfert galaxies and their luminous counterparts.

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Proposal Category: SNAP
Scientific Category: GAL
ID: 8599
Title: A Census of Nuclear Star Clusters in Late-Type Spiral Galaxies
PI: Torsten Boeker

PI Institution: Space Telescope Science Institute

Recent HST observations have revealed that many spiral galaxies have a prominent star cluster in their dynamical center. Such a cluster can plausibly have significant influence on the formation and/or evolution of the galaxy bulge, which is an important new aspect in the ongoing discussion about the origin of the Hubble sequence. While existing HST data indicate that nuclear clusters can occur in spirals of all types, statistics for cluster frequency, size, and luminosity as a function of Hubble type are incomplete. There is a particular lack of data for late type spirals, because most HST studies were biased towards earlier Hubble types. To fill this gap, we propose a WFPC2 I-band snapshot survey of a well-defined sample of nearby, face-on spiral galaxies of type Scd or later. Given the sizes of known nuclear clusters (R_eff~ 0.2^), HST provides an order of magnitude contrast improvement over ground-based imaging, crucial for an unambiguous identification of the cluster. The data will also yield cluster sizes and unblended luminosities, which are impossible to obtain from the ground. This program will be the first systematic census of nuclear star clusters in late-type spirals. As such, it will provide a valuable catalog for follow-up spectroscopy to study the stellar populations, masses, and ages of these clusters, all of which are important diagnostics for understanding their formation mechanism and possible influence on the surrounding bulge.

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Proposal Category: SNAP
Scientific Category: GAL
ID: 8600
Title: Dwarf Elliptical Galaxy Snapshot Survey III
PI: Henry C. Ferguson
PI Institution: Space Telescope Science Institute

We propose to extend our V and I snapshot survey of nearby dwarf elliptical (dE) galaxies to include a sample of 30 bright dE (M_V < - 15.7) with significant globular cluster (GC) populations. This survey will provide important information on the globular cluster systems of such galaxies and the properties of their cores and nuclei. The high resolution of HST allows us to identify globular cluster candidates and classify more accurately a galaxy as nucleated or non-nucleated. Our results from the Cycle 6 survey show that dE have globular cluster specific frequencies (S_N) similar to those of giant

ellipticals. Nucleated dE have higher S_N than non-nucleated dE, and show a trend of increasing S_N with fainter luminosities. We have also studied the spatial distribution of the globular clusters and an interesting (lack of a) trend is emerging. The globular cluster surface densities follow the luminosity profiles of the underlying galaxies, on average, and there is no segregation by luminosity. This is an interesting result, if confirmed, because the dynamical friction timescales for dE galaxies are significantly shorter than a Hubble time. With better statistics, analysis of the cluster spatial distribution can place constraints on the ages of the clusters and the dark matter, and offer tests of the universality and evolution of the globular cluster luminosity function.

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Proposal Category: SNAP
Scientific Category: GAL
ID: 8601
Title: A Snapshot Survey of Probable Nearby Galaxies
PI: Patrick Seitzer
PI Institution: University of Michigan

The census of galaxies in the Local Volume of space is very incomplete, particularly at the faint end. We propose to continue our very successful snapshot survey to use the high spatial resolution of HST to determine whether selected galaxies are nearby on the basis of resolution into stars, and the magnitudes and colors of the brightest stars. In the first 2 months of the cycle 8 proposal, data was obtained on 18 candidates, and 15 (83 \ on the magnitudes of the brightest stars. We are rapidly increasing the number of confirmed galaxies within 4 Mpc. Our sample is chosen from the survey by team members Karachentsev & Karachentseva (KK98) of some 260 nearby dwarf galaxy candidates. Our F606W & F814W snapshot survey will concentrate on 125 unobserved candidates. One HST orbit per galaxy results in a distance from the magnitude of the tip of the red giant branch (TRGB) and is sufficiently deep to identify the brightest stellar population if the galaxy is within 4 Mpc. Keck, VLT, and other large telescopes will be used for spectroscopic follow-up for abundances and kinematics. The survey has already discovered two possibly isolated dwarf galaxies not associated with any galaxy or group. Since the sample to be observed is chosen from an all sky sample, we will be able to determine if there is a significant number of such isolated dwarf galaxies.

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Proposal Category: SNAP
Scientific Category: HS
ID: 8602
Title: A Snapshot Survey of the Sites of Recent, Nearby Supernovae
PI: Alex Filippenko
PI Institution: University of California at Berkeley

During the past few years, the Lick Observatory Supernova Search (LOSS) and the Beijing Astronomical Observatory Supernova Search (BAOSS) have found a total of 76 supernovae (SNe), 62 of them in relatively nearby galaxies (cz <= 6000 km s^-1). Most of the nearby objects were discovered before maximum brightness. All have follow-up photometry and spectroscopy; they include some of the best-studied SNe to date. We propose to conduct a WFPC2 snapshot survey in V and I of the sites of the nearby SNe, which have precisely known positions, to obtain high-resolution information on their local environment. For example, we will see whether SNe of a given kind tend to occur close to star clusters, or in dusty regions, or in old (red) stellar populations. This will give important clues to the nature of their progenitor stars, with ramifications for many areas of astronomy (e.g., stellar evolution, nucleosynthesis, cosmology). For some of the most recent or unusually long-lived SNe, the new HST data will provide late-time photometry that is superior to what we can obtain from the ground. This proposal is similar, but complementary to, our archival proposal in which existing HST images from other programs are used to glean information about the environments of SNe. To make the data readily available to other researchers studying these SNe, we waive the entire proprietary period.
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Proposal Category: SNAP
Scientific Category: HS
ID: 8603
Title: Secular changes in the temperatures and radii of extreme helium stars
PI: Simon JEFFERY
PI Institution: Armagh Observatory

Extreme helium stars (EHEs) are luminous stellar remnants evolving rapidly to

become white dwarfs. They represent an important stage in the evolution of at least some low-mass stars, and are closely related to the R Coronae Borealis variables. Models do not agree about their origin, nor about what fraction of normal stars pass through this phase, in which the stars have been completely stripped of their outer layers. The models do predict that EHEs are contracting and provide rate predictions and evolutionary lifetimes. First and second epoch IUE observations have shown that these contraction rates can be measured. We propose HST/STIS observations of 15 EHEs which, together with IUE data, will give a 20-year baseline of ultraviolet spectrophotometry. These observations will provide effective temperatures and angular radii with an internal accuracy for individual stars of $~1\ precision which cannot be achieved from optical or other diagnostics. From these measurements we will measure precise contraction rates for a larger sample of targets and obtain direct tests of the evolution models. Building on the IUE archive, the higher quality of HST data will provide a foundation dataset for establishing fundamental quantities (e.g. extinction) and for studying evolutionary changes in EHEs into the next century and beyond.

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Proposal Category: SNAP
Scientific Category: SP
ID: 8604
Title: Stellar Populations Across the Small Magellanic Cloud: History and Structure
PI: Eline Tolstoy
PI Institution: European Southern Observatory

The Small Magellanic Cloud (SMC) is an extraordinary galaxy. It is the nearest example of a low metallicity, star-forming dwarf irregular, contains a wide range of stellar ages, and is distorted by interactions with the Milky Way and its close companion, the Large Magellanic Cloud. We propose to investigate the structure and evolutionary history of the SMC by obtaining a series of 50 three-color SNAPshots with WFPC2 of selected SMC regions. With this polling of SMC field star properties, we will produce color-magnitude diagrams (CMDs) in the U, V and I bands which will reach V~23.5 in regions too crowded to be observed accurately from the ground. We will use these data for investigations of two major topics: (1) the star formation history of the SMC, by quantitative matching between models and data using a sophisticated numerical approach which properly accounts for errors and other uncertainties. (2) the

structure of the SMC along our line of sight. The galaxy is thought to be considerably distended in this direction and we will put constraints on this from the width of the observed lower main sequence. In addition, by obtaining accurate photometry for about 100,000 stars in each region, our CMDs will provide an excellent basis for comparisons with evolutionary tracks of low metal stars in the few solar masses range.

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Proposal Category: GO
Scientific Category: AGN
ID: 8605
Title: Stellar-Dynamical Measurements of the Black Hole Masses of Reverberation-Mapped AGN
PI: Gary Bower
PI Institution: National Optical Astronomy Observatories

The broad emission line regions of 20 AGN have been successfully reverberation mapped in intensive international monitoring campaigns, allowing model dependent determinations of the central mass. This determination depends on the hypothesis that the dynamics in this gas are dominated by gravity, consistent with the detection of the expected Keplerian decline in velocity with radius in the best studied case (NGC5548). However, when normalized by the bulge mass of the host galaxy, the central masses in these 20 AGN are over an order of magnitude less massive than the compact dark masses found in normal galaxies. If the masses determined by reverberation mapping can be independently verified, this technique could potentially be used to measure the evolution in the masses of the population of supermassive black holes over cosmic time and determine these masses in radio-quiet and radio-loud AGN spanning a huge range in luminosity. We therefore propose to use STIS to measure the stellar dynamics in the type 1 Seyfert nucleus in NGC3227, in which the measurements will be the most straightforward by far. If the reverberation mapped mass is correct, we will see its dynamical signature in these new data.

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Proposal Category: GO
Scientific Category: AGN
ID: 8606
Title: Determining the Nature of the Variable Absorption in AGN: Monitoring NGC 3783 with HST and Chandra

PI: D. Michael Crenshaw
PI Institution: Catholic University of America, STIS Science Team

About 60\ characterized by high ionization (C IV, N V), moderate widths (30 -- 300 km s^-1), significant outflow velocities (up to 2500 km s^-1), and variability on time scales as small as days. Seyferts with UV absorption also show variable X-ray ``warm absorbers'', characterized by O VII and O VIII absorption edges, which suggests a common origin. The frequent occurrence of intrinsic absorption indicates that an important component has been missing from our overall picture of active galaxies. To understand the nature and origin of this component, and thereby use it as a probe of the active nucleus, we must know its location, physical conditions, and kinematics. Variability monitoring is the key to understanding the absorbers, by providing their radial locations, densities, and evolution in ionization, column density, velocity, and coverage of the inner active nucleus. However, our search for the nature of the absorption has been hampered by the lack of an intensive UV and X-ray monitoring campaign at high spectral and temporal resolutions. HST/STIS and Chandra are ideal instruments for this pursuit, and NGC 3783 is an ideal target, because it shows extremely variable absorption and rapid continuum variability in both the UV and X-rays.

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Proposal Category: GO
Scientific Category: AGN
ID: 8607
Title: Completing the Local AGN Inventory: The AGN Content of Composite Nuclei
PI: Luis Ho
PI Institution: Observatories of the Carnegie Institution of Washington

Knowledge of the local space density of AGNs is of fundamental importance to a number of astrophysical problems. A significant fraction of nearby galaxies have nuclei whose spectra are intermediate between those of LINERs and nuclear starbursts. These ``transition objects'' may be composite systems that contain both a central AGN and circumnuclear star formation. We will test this hypothesis by using STIS to obtain spatially-resolved optical spectra of a well-defined sample of 15 nearby (<= 17 Mpc) transition nuclei selected from the extensive ground-based survey of Ho, Filippenko, and Sargent. The physical origin of these objects affects the census of AGNs in nearby

galaxies, the nature of nuclear star formation, and the possible connection between starburst and AGN activity. We will use the G430L and G750M gratings to cover the most important diagnostic emission lines in order to search for line-ratio variations across the nuclear region. If the two-component model for transition nuclei is correct, we expect the spectra to change from H II\ region-like to AGN-like as the center of the galaxy is approached. We will also use the high-resolution spectra to search for weak broad H\al\ emission, the classical signature of AGN activity, at a level of sensitivity far greater than is possible from the ground. Finally, the spectra will provide a rich source of nebular diagnostics to systematically study the physical properties of nuclear H II\ regions.

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Proposal Category: GO
Scientific Category: AGN
ID: 8608
Title: Simultaneous HST, Chandra, and FUSE Spectroscopy of NGC 4151
PI: Gerard Kriss
PI Institution: Space Telescope Science Institute

Absorption by warm, ionized gas at UV and X-ray wavelengths is proving to be a common feature in Seyfert 1 galaxies, showing its presence in well over half the galaxies observed. In some cases, like NGC 4151 and NGC 3516, the absorption is seen over a wide range of ionization states, and it is optically thick at the Lyman limit, thick enough to potentially collimate the ionizing radiation in these objects and produce ``ionization cones" visible in emission -line images. Thus understanding this warm absorbing gas and its origin may help us to understand how radiation is collimated in AGN, and it may provide additional clues to the differences and similarities between Type 1 and Type 2 AGN. The proximity and brightness of NGC 4151 make it a key object for understanding the structure of AGN. We propose to obtain simultaneous spectroscopy of the absorbing gas in NGC 4151 using the STIS echelle modes on HST, FUSE, and Chandra. These observations will allow us to determine the ionization states of each of the 8 kinematic components present in the absorbing gas in NGC 4151, and to resolve the persistent discrepancies between the gas columns inferred for the UV and X-ray absorption over the past two decades. The simultaneity will avoid any ambiguity due to the known variability in the UV and X-ray absorption.

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Proposal Category: GO
Scientific Category: AGN
ID: 8609
Title: Host galaxy luminosities of the most luminous QSOs
PI: Lance Miller
PI Institution: Oxford University Department of Physics

What are the factors that determine whether a galaxy is host to a luminous QSO? Recent evidence indicates that host galaxy spheroid mass is a key factor: we want to test the relationship between host galaxy and QSO luminosity at the highest feasible QSO luminosities by measuring the luminosities and profiles of host galaxies for QSOs with -25.8 > M_V > -27.6. Current data in this area are conflicting, and we aim to make a definitive experiment that takes careful account of problems caused by extended line or continuum emission around QSOs, relativistic beaming, gravitational lensing and galaxy interactions.
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Proposal Category: GO
Scientific Category: AGN
ID: 8610
Title: A Black Hole Offset from the Host Galaxy Mass Center?
PI: Carole Mundell
PI Institution: University of Maryland

It has been suggested that the central regions of many galaxies are unlikely to be in a static steady state, with instabilities caused by sinking satellites, the influence of a supermassive black hole or residuals of galaxy formation, resulting in the nuclear black hole orbiting the galaxy center. The observational signature of such an orbiting black hole is an offset of the active nucleus (AGN) from the kinematic center defined by the galaxy rotation curve. This orbital motion may provide fuelling of the AGN, as the hole `grazes' on the ISM, and bent radio jets, due to the motion of their source. The early type (E/SO) Seyfert galaxy, NGC2110, with its striking twin, `S'-shaped radio jets, is a unique and valuable test case for the offset-nucleus phenomenon since, despite its remarkably normal rotation curve, its kinematically-measured mass center is displaced both spatially (260 pc) and kinematically (170 km s^-1) from the active nucleus, as seen both in optical

and radio studies. However, the central kinematics, where the rotation curve rises most steeply, are inaccessible with ground-based resolutions. The proposed WFPC2 imaging and long-slit STIS spectroscopy of NGC 2110 will enable determination of the structure and kinematics of gas moving in the galactic potential on subarcsecond scales and investigate the origin of the off-set nucleus.

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Proposal Category: GO
Scientific Category: COS
ID: 8611
Title: UV Observations of Nearby Type Ia Supernovae
PI: Peter Nugent
PI Institution: Lawrence Berkeley National Laboratory

Two independent research groups have presented compelling evidence for an accelerating universe from the observation of high-redshift Type Ia supernovae (SNe Ia). These findings have such important ramifications for cosmology that every effort must be made to throughly test the calibrated standard candles on which they are based, improve upon our understanding of the underlying physics of the SN Ia explosion mechanism and attempt to constrain or determine their progenitors. Here we propose to obtain STIS/CCD UV spectra of five nearby ($0.02 < z < 0.08$) SNe Ia in the Hubble Flow. The spectra will be taken at weekly intervals over a range in time starting slightly before maximum light and extending to +30 days. These observations will accomplish the following three goals: (1) Calibration of the rest frame UV light curves of SNe Ia and an assessment of their potential use as distance indicators through UV light curve shape analyses. (2) Improvement in our understanding of the physics of SNe Ia, metallicity/evolutionary effects and correlations between peak brightness and UV spectral features. (3) Calibration of the SNe Ia previously observed by HST at high-redshift. For the $z > 0.8$ SNe Ia observed by both the Supernova Cosmology Project and the High-Z Supernovae Search Team this data is crucial for proper cross-filter k-corrections and calibration of the supernova photometry.

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Proposal Category: GO
Scientific Category: CS
ID: 8612
Title: Boron in the Lithium-Rich K-Giants: A Critical Test of

Deep Stellar Mixing Versus Brown-Dwarf Ingestion
PI: Ramiro de la Reza
PI Institution: Observatorio Nacional

We will observe the B I 2500Angstrom\ lines in four Li-rich K-giants using HST with STIS/G230M in order to test two different evolutionary scenarios invoked to explain the high Li abundances: the cool bottom process (CBP) versus the possible accretion of brown dwarfs/planets. This test utilizes the two following properties of boron: among the three light elements (Li, Be, and B) which are easily destroyed in stars by (p,Alpha) reactions, B is the least fragile to nuclear destruction. In addition, unlike Li which can be created under certain conditions in stellar mixing, B can only be destroyed. The hypothetical mixing mechanism, CBP, produces Li by introducing deeper mixing to hotter layers such that ^7Li is created via ^3He(alpha,Gamma)^7Be(e^-,anti-Nu)^7Li. A by-product of CBP is the total destruction of pre-existing Be and B. If B I is absent from the spectra, we will prove that deep mixing has occurred. In an accretion scenario, the increase in the Li abundance caused by the deposition of fresh material onto the red giant from a substellar mass companion will also result in an increase in the Be and B abundances. Because B is more robust to nuclear burning than Be, as well as initially being 20 times more abundant, spectroscopy of the B I lines will provide a solid and definitive test of whether the process that creates these chemically peculiar giants is a new type of internal mixing, or the ingestion of a substellar mass companion.

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Proposal Category: GO
Scientific Category: CS
ID: 8613
Title: Coordinated Observations of Stellar Flares on AD Leo
PI: Suzanne Hawley
PI Institution: University of Washington

We will obtain high resolution HST/STIS spectra of the dMe star AD Leo during periods of quiescence and during flares to study the physics of atmospheric heating in flare stars. The HST observations will form an essential part of a large, coordinated observing campaign including FUSE, EUVE, and ground-based observations (both multicolor photometry and high resolution optical spectroscopy). The STIS spectra, in combination with data from the other

satellites, will allow us to determine the structure (during quiescence) and evolution (during flares) of the temperature and density in the corona, transition region, and chromosphere. These data will provide strong empirical constraints on our current generation of flare evolution models. The uniquely high spectral resolution of the STIS data will also allow us to directly observe the dynamic effects of the chromospheric shocks that are predicted by the models. In addition, we will search for significant red-shifted emission in the hydrogen Lyman-Alpha line during the flare rise phase, which is a signature of an energetic proton beam. The existence and role of proton beams in both solar and stellar flares is currently a subject of considerable debate.

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Proposal Category: GO
Scientific Category: CS
ID: 8614
Title: NUV Extension of the Arcturus Project: Probing the Onset of Chromospheric Heating
PI: Kenneth Hinkle
PI Institution: National Optical Astronomy Observatories

Two stars have multi-wavelength atlases at resolutions (R>= 100,000) high enough to resolve dynamically interesting line structure: the Sun (G2 V) and Arcturus (K2 III). These canonical atlases provide an astrophysical test bench for studying the effects of temperature, gravity, and metalicity in cool stars. We have produced high resolution spectral atlases of the Sun from 22 Mum through the visible, as well as a high resolution spectral atlas of Arcturus from 5 Mum through 0.9 Mum. These atlases are widely used for line identification, calibrating atomic data, testing model atmospheres, studying stellar granulation, etc. We are currently finishing a major new digital atlas of the Sun and Arcturus from 3600--9000 Angstrom\ at R=150,000 (to be published next year as an ASP monograph). We propose to extend the spectral coverage of these atlases down to 2124 Angstrom, using existing STIS spectra of Alpha Cen A (as a solar proxy) and new STIS observations of Arcturus. The NUV spectrum is astrophysically important because it encompasses the transition from the photosphere through the temperature minimum into the chromosphere. Modeling the spectroscopic transition from absorption to emission lines will provide important semi-empirical constraints on the poorly understood nonradiative heating processes that give rise to chromospheres in

evolved stars.

Proposal Category: GO
Scientific Category: CS
ID: 8615
Title: Ultraviolet Spectroscopy of R Coronae Borealis Stars -- Broad Lines from an Accretion Disc?
PI: David L. Lambert
PI Institution: University of Texas at Austin

STIS spectra of three R Coronae Borealis (RCB) stars will provide novel data on hot gas near these stars; such data can be obtained only from HST. RCBs are hydrogen-deficient and fade at unpredictable times as a carbon soot cloud obscures the star. Optical spectra taken when a star has faded reveal an emission line spectrum containing sharp (FWHM ~eq 15 km s^-1) and broad (FWHM ~eq 250 km s^-1) lines. The lattter are of much higher excitation than the former. For R CrB, it has been suggested that the broad lines arise from an accretion disk around a compact secondary. These optical lines are visible only during the infrequent extreme fadings of a RCB. Although IUE spectra reveal high-excitation emission lines at maximum light, the IUE spectra lack the spectral resolution to distinguish broad from sharp lines. STIS spectra will resolve the broad-line from a sharp-line component, and, in the case, of R CrB, where repeat visits are requested, be used to search for velocity variations as the companion orbits the RCB. In addition, the line intensity ratios will provide new estimates of the physical conditions of the gas emitting the broad lines. This proposal may help to answer the question -- How are RCBs formed? And this answer may show that, although RCBs are rare, many low mass stars evolve through the RCB on their path to extinction as a white dwarf.

Proposal Category: GO
Scientific Category: CS
ID: 8616
Title: Masses of Pre-Main Sequence Binaries
PI: Michal Simon
PI Institution: State University of New York

We propose to continue to map the orbits of young star binaries in the Taurus

and Ophiuchus star forming regions. Our goal is to measure their masses dynamically. This is important because there are still no low mass young stars with reliably known masses so calculations of their evolution to the main sequence are uncalibrated.

Proposal Category: GO
Scientific Category: HS
ID: 8617
Title: Ultraviolet Spectroscopy of Hot Horizontal-Branch Stars in the Globular Cluster M13
PI: Bradford Behr
PI Institution: California Institute of Technology

Blue horizontal-branch (BHB) stars in the metal-poor globular clusters M13 and NGC 6752 have recently been found to exhibit remarkable metallicity enhancements and helium depletion relative to the canonical cluster composition. These abundance anomalies are most likely due to diffusion processes --- radiative levitation of the metals, and gravitational settling of helium --- in the stable radiative atmospheres of these hot stars. With available ground-based facilities, we have observed stars in M13 as hot as 19000 K, but beyond this point we are constrained by low V- and B-band flux and an insufficient number of visible-wavelength spectral lines. We therefore propose HST/STIS spectroscopic observations in the wavelength range 1700--3100 Angstrom\ to extend the abundance measurements in M13 to yet hotter stars. Such measurements will provide a new and important confrontation between theory and observations of the diffusion mechanisms, and will also offer insights into poorly-understood aspects of CMD morphology, including the BHB `gaps' and overluminous BHB stars observed in many clusters.

Proposal Category: GO
Scientific Category: HS
ID: 8618
Title: FGS parallaxes of magnetic CVs
PI: Klaus P. Beuermann
PI Institution: Universitaets-Sternwarte Goettingen

Trigonometric parallaxes of cataclysmic variable (CVs) are needed to obtain reliable information on luminosities, accretion rates, and on radii and masses

of the stellar components. They are also needed to derive the space density, an important ingredient for theories of CV evolution. Photometric and spectroscopic parallaxes of CVs are notoriously uncertain because the stellar components have properties different from single field stars. Obtaining trigonometric parallaxes of CVs will allow us to understand to what extent the other methods are applicable to CVs and why they fail in certain cases. Trigonometric distances are also needed for those CVs to which the other methods can not be employed, e.g. because the secondary star, serving as a standard candle, is not detectable. In summary, trigonometric parallaxes are essential to our understanding of CVs. We propose to obtain accurate trigonometric parallaxes of three magnetic cataclysmic variables (CVs) which are among the brightest of their class, are not accessible to other methods of distance determinations, and have largely defied physical interpretation so far. We will: (1) clarify the nature of the enigmatic system EX Hya; (2) measure the radius (and thereby the mass) of the white dwarf in EF Eri, obtain tight limits on the magnitude of its (near-)degenerate secondary star, determine the mass-transfer rate supposedly driven by gravitaional radiation; and (3) decide on the nature of AH Men, one of the brightest long-period (probable) Intermediate Polars.

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Proposal Category: GO
Scientific Category: HS
ID: 8619
Title: Critical spectroscopic variations in Eta Carinae
PI: Kris Davidson
PI Institution: University of Minnesota

The very massive, unstable, persistently enigmatic star Eta Carinae has implications for several branches of astrophysics. While HST has produced a series of remarkable discoveries concerning this object, the nature of the central star remains elusive. Now, however, recent developments offer, for the first time, an approach that can settle certain long-standing questions which have been obstacles to understanding this unique object. A 5.5-year spectroscopic and X-ray cycle has been confirmed. STIS now provides the most promising and very likely the only way to test whether Eta Car is a 5.5-yr binary system. If it is, STIS will also allow us to constrain the parameters, needed to assess the companion star's possible role in past outbursts and ejecta. If the data conflict with binary models, then the 5.5-yr effect is

probably a thermal cycle which will give novel information about the star's structure. In addition to the periodicity, a large, almost unprecedented brightening, first noticed in HST data, has occurred since 1997 and merits followup observations. We sense a breakthrough in the periodicity and the brightening, if Eta Car can be observed repeatedly with STIS through the current 5.5-year period, 1998.0---2003.5.

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Proposal Category: GO
Scientific Category: HS
ID: 8620
Title: Taking a glance at the beating heart of 4 Draconis
PI: Boris T. Gaensicke
PI Institution: Universitaets-Sternwarte Goettingen

4 Dra is a unique triple system containing a magnetic cataclysmic variable (AM Her-type) and an M3 III giant. Even though the M-giant completely dominates the optical emission of the system, we can learn much from 4 Dra about the accretion physics in and the evolution of AM Her stars, because: (a) 4 Dra is the second brightest AM Her star in the ultraviolet, (b) 4 Dra is one of the very few cataclysmic variables with a good HIPPARCOS parallax (d~180 pc), and, in addition, (c) 4 Dra is so far the only bright CV for which an estimate of the age, ~10^8 yrs could be derived. We propose an in-depth HST/STIS echelle study of the AM Her star in 4 Dra. Our scientific goals are twofold. (1) We will derive the fundamental properties of the accreting magnetic white dwarf, such as its photospheric temperature, the temperature and the size (lateral extent) of the accretion-heated pole cap, and the chemical composition of the accretion-enriched atmosphere. (2) We will use the HST/STIS echelle spectra for Doppler mapping of the UV line emission. The HST maps of LineCIV1550 and LineHeII1640 emission will probe the velocity field and ionization structure in the complete accretion flow, including the irradiated face of the donor star, the ballistic gas stream from that star to the white dwarf magnetosphere, the threading region between the stream and magnetosphere, the magnetically controlled flow down to the standoff shock, and the surrounding heated regions at the white dwarf surface.

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Proposal Category: GO
Scientific Category: HS
ID: 8621

Title: The Galactic Abundance Gradients of Boron and Iron
PI: David L. Lambert
PI Institution: Department of Astronomy, University of Texas

This proposal aims to provide the first measurement of the Galactic abundance gradients for Boron and Iron. Boron abundances will be obtained for 5 B-type stars (with Galactocentric distances between 4--15 kpc) from the B iii 2066Angstrom\ line. Optical spectroscopy of these (and other B-type) stars has yielded abundance gradients of -0.07 dex kpc^-1 for N & the Alpha-elements (O,Mg,Si). Determination of Boron abundances require UV spectra and HST/STIS. It is significant that stellar nucleosynthesis which is the leading source of oxygen (via Type II SN) is unlikely to be a major contributor to B synthesis (spallation being the leading candidate). Hence, a measurement of the B abundance gradient provides novel information on the gradient of cosmic ray flux in the Galaxy. The same STIS spectra will also provide Fe iii lines that will be used to obtain the first estimate of the present abundance gradient for iron (thought to originate predominantly in Type I SN). Recent advances in modelling the chemical evolution of the Galactic disk have led to definite predictions of the spatial variation of the Alpha/Fe ratio in competing Galaxy formation scenarios, viz. the biased infall and biased outflow models. This study should yield differential Fe abundances accurate to +/-0.1 dex -- which will allow a Alpha/Fe gradient to be compared directly with theory, as a critical test of formation models.

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Proposal Category: GO
Scientific Category: ISM
ID: 8622
Title: The Interstellar Isotopic Ratio of Boron toward Omicron Persei and Nearby Sight Lines
PI: David L. Lambert
PI Institution: University of Texas at Austin

The isotopic ratio ^11B/^10B will be determined for diffuse interstellar material along lines of sight to 40 Persei, o Persei, Zeta Persei, and X Persei that pass close to the star-forming region IC 348. High-resolution spectra of the Li, i 6707Angstrom\ line toward o and Zeta Per show remarkably different isotopic ratios for lithium. Particularly striking is the ratio ^7Li/^6Li ~eq 3 for o Per while Zeta Per shows a quasi-solar (~eq 10) ratio.

The significance of the very low ratio for o Per is that it is essentially the value predicted for production by relativistic cosmic rays through spallation reactions; it is the only interstellar or stellar measurement that approaches this theoretical value. This discovery provides a novel opportunity to measure the isotopic B ratio of gas with a Li concentration dominated by spallation induced by relativistic cosmic rays. Feasibility of isotopic measurements has been demonstrated by our GHRS observations of the interstellar B, ii 1362Angstrom\ resonance line that provided the first extra-solar measurement of the ratio. Comparison of the observed and predicted isotopic B (and Li) ratio will test the relative importance of B synthesis by cosmic rays and Type II supernovae, and test proposals that invoke high-fluxes of high-energy particles in star-forming regions as major players in light element synthesis.

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Proposal Category: GO
Scientific Category: ISM
ID: 8623
Title: HST, Chandra, and FUSE Studies of Interstellar Material toward HD 24534 (aka X Persei)
PI: Theodore P. Snow
PI Institution: University of Colorado

We are proposing new HST/STIS high-resolution UV spectroscopic observations of the reddened star HD 24534 (aka X Persei), in order to: (1) establish accurate gas-phase column densities for elements other than carbon and oxygen (for which high-quality data already exist), for the purpose of deriving (in conjunction with FUSE and Chandra observations) absolute depletions of several key elements; and (2) further pursue molecular abundances toward this star, to supplement HST/GHRS data obtained earlier which showed that this line of sight supports a rich chemistry. The depletion work will focus on magnesium, silicon, and iron, while the molecular observations will entail searches for vibrationally excited H_2, an important indicator of cloud physical conditions; and sulfur- bearing species (such as SO, CS, and SH), which represent an important unknown in current models of interstellar cloud chemistry. HD 24534 is the best possible target for this work, because it is the brightest star available that lies behind a translucent line of sight with high molecular abundances, and because it is also an x-ray source whose spectrum is ideally suited for the measurement (through x-ray absorption and scattering) of total (gas plus dust) abundances in the line of sight. This

will be the first line of sight for which depletions have been determined independent of any assumed ``cosmic'' abundance standard such as the sun or other stars.

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Proposal Category: GO
Scientific Category: ISM
ID: 8624
Title: Imaging and Spectroscopy of Dusty Circumstellar Disks
PI: Alycia Weinberger
PI Institution: University of California Los Angeles

Understanding the properties and evolution of dusty disks in the circumstellar environments of young stars is a key element in furthering our concepts of the formation mechanisms of extra-solar planetary systems. In the past year, the advent of NICMOS and STIS coronagraphy has given rise to the first reflected light imaging, other than for Beta Pic, of dusty circumstellar disks with spatially resolved morphological structures. NICMOS has taken a first step in imaging these new disks, elucidating their geometries, morphologies, and bulk photometric properties, while increasing the number of such known systems from one to half a dozen. These dusty disks vary in physical size by over two orders of magnitude and exhibit radial anisotropies in their brightness distributions which may be indicative of dynamical confinement or sculpting of the disk particles by unseen planetary bodies. STIS follow-on imaging and spectroscopy are needed to provide further insight into the nature of the disk particles. With spectra, we will measure the albedo of the disk dust and search for complex molecules and water ice. With coronagraphic images, we will investigate the scattering phase function and hence the composition of the disk dust as well as measure the disk sizes and shapes with high precision. Such observations are of fundamental importance in establishing the physical basis for emergent theories of disk evolution and planet-building.

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Proposal Category: GO
Scientific Category: QAL
ID: 8625
Title: The Metallicity of Gas in the Local Universe: Beyond the Milky Way
PI: David V. Bowen

PI Institution: Princeton Observatory

We wish to obtain STIS spectra of three QSO/AGN which lie behind nearby galaxies, to measure the metallicity of the interstellar gas at the present epoch beyond the local group. We aim to provide the first steps in establishing a low-redshift anchor to the ever burgeoning abundance measurements of gas at high redshift, to quantify the range of abundances seen in the galaxies today, and thereby examine whether our galaxy might simply be metal rich in comparison. Our data will also provide valuable information for discriminating between competing models of galaxy evolution. The three probes are the best available for obtaining UV data with sufficient quality to reliably measure column densities and Doppler parameters; Q1219+047 passes 21 \h\ through the outer H I disk of M61, where there are no sites of current star formation; Mrk 205 shines through the inter-arm region of NGC 4319, and can be used to construct the first UV absorption-line atlas of a galaxy beyond the Magellanic Clouds; and Q1543+489 directly intercepts an intergalactic H I cloud associated with two nearby galaxies. In this latter case, direct measurement of the cloud's metallicity and hydrogen column density will also enable us to constrain the ionization parameter of the UV background radiation field.

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Proposal Category: GO
Scientific Category: QAL
ID: 8626
Title: Spatially Resolved Spectroscopy of APM08279+5255
PI: Sara Ellison
PI Institution: Institute of Astronomy

We propose to obtain spatially resolved, high resolution spectra of the z=3.911 BAL quasar, APM 08279+5255. This ultra-luminous QSO is a triply imaged gravitationally lensed system with image separations of 0 nd38 -- 0 nd15. Ground-based observations of this bright source have revealed a rich absorption spectrum caused by both intervening material and the complex QSO environment and BAL flows. The proposed STIS spectrum, which will spatially resolve the individual quasar images, is a unique opportunity to probe the numerous intervening systems on sub-kpc scales, providing: o a sensitive probe of the structure of intervening galaxy halos and metal line systems on scales of ~ 0.2 -- 1.6 kpc h^-1, their

kinematics and spatial extents, o multiple sightlines through the complex BAL flow on parsec scales, yielding information on ionization, kinematics and metal enrichment, We also request 5 orbits with WFPC2 in order to detect and measure the centroid of the lensing galaxy; this will provide the necessary information to remove the degeneracy in the present gravitational lensing models.

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Proposal Category: GO
Scientific Category: SF
ID: 8627
Title: TESTING THEORIES OF WIND/JET PRODUCTION IN YSOs
PI: Nuria Calvet
PI Institution: Smithsonian Astrophysical Observatory

We propose to use STIS ultraviolet spectroscopy to test theories of jet/wind production from the accretion disks of low-mass young stellar objects, providing new insight into disk physics, accretion energy balance, and jet collimation. STIS observations of the Fe II ultraviolet lines in absorption will probe lower-density and lower-temperature material than optical forbidden and permitted emission lines, and thus provide unique information on jet/wind launching and acceleration. Velocity-resolved spectra will distinguish between X-wind models, in which all the mass ejection occurs from the inner disk edge, and disk wind models, where the flow originates from a much larger area of the disk. Our results will provide important new constraints on the best-studied, best-understood astrophysical jet systems.

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Proposal Category: GO
Scientific Category: SF
ID: 8628
Title: High Density (~ 10^9 cm^-3) gas in the jet formation region of T Tauri stars
PI: Ana I. Gomez de Castro
PI Institution: Instituto de Astronom'\ia y Geodesia

Outflow is ubiquotous during star formation however the mechanism which drives it, is still uknown. The key observational information about how outflow is initiated is contained within a region of angular size smaller than 0.1 arcsec (for the nearest stars) which is not accessible to direct imaging. It has been

shown that the jet density increases towards the source but the commonly used optical forbidden lines cannot probe densities higher than ~ 10^6 cm^-3. An analysis of the ultraviolet tracers of shocked material carried out by us and based on data from the HST Archive has shown that jet emission is also detected from the UV semiforbidden lines of C iii and Si iii . The infered electronic density of the emitting gas is ~ 10^9 - 10^10 cm^-3

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Proposal Category: GO
Scientific Category: SP
ID: 8629
Title: The Search for ``True'' Starburst Dust and the Importance of Metallicity on Properties of O & B Stars
PI: Fred C. Bruhweiler
PI Institution: The Catholic Univ. of America

Much of what we know about starburst (SB) galaxies, at low and high redshift, depends upon the nature of the SB dust extinction and the intrinsic physical parameters of OB stars versus metallicity. Typically SBs, unlike our Galaxy, exhibit extinction laws with no 2200Angstrom\ peak. There is little information on the effects of dense star-formation on dust extinction properties. Specifically, no UV-visual extinction studies exist for the dense star-forming regions of 30 Dor (LMC) and NGC 346 (SMC), which represent prime laboratories for studying these effects. These regions have the highest concentration of young O stars in these galaxies, where 30 Dor is the nearest example of a definite starburst. Using the 2-D capability of STIS, we will a.) perform the first UV-visual extinction study of the dense regions of 30 Dor (in and around R136) and NGC 346, b.) produce unreddened OB star flux distributions in 30 Dor and NGC 346, c.) use these results to derive effective temperature, luminosity, and mass-loss rate correlations with spectral type and metallicity, and d.) explore if the extinction for the cores of 30 Dor and NGC 346 can be used to generate ``true'' starburst extinction laws.

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Proposal Category: GO
Scientific Category: SP
ID: 8630
Title: The Deepest Far-UV Imaging Survey of Globular Clusters: NGC 6752 and NGC 6397
PI: Michael Shara

PI Institution: American Museum of Natural History

A few very close binaries can drive the dynamical evolution of an entire globular cluster. We propose the deepest UV imagery ever obtained on globular clusters to search for cataclysmic variables (CVs). CVs should be relatively easy to find in globular cores with HST, but there is a remarkable dearth of detected CVs in globular clusters relative to the large numbers predicted by tidal capture theory. This calls into serious doubt all of our understanding of globular cluster dynamical evolution. If most CVs in globular clusters are much fainter than canonical classical and dwarf novae, then tidal capture theory (and our claim to understand cluster evolution) can be salvaged. We propose to image the globular clusters NGC 6752 and NGC 6397 in the passband where CVs emit most of their radiation: the far UV, and at Lyalpha. Using the FUV-MAMA detector on STIS, we will reach an equivalent optical limiting magnitude of M_V = 13 at S/N=10 which is sensitive enough to detect even the faintest known CVs. If few or no faint CVs are found, then theorists will have run out of phase space and simple tidal capture theory will be shown to have made an incorrect prediction. This would force a major revision in our theory of tidal capture, and our understanding of globular cluster dynamical evolution.

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Proposal Category: SNAP
Scientific Category: AGN
ID: 8631
Title: Bright Quasar Close Lensing Search II
PI: Michael Gregg
PI Institution: University of California, Davis

enlargethispage0.25in We propose to expand our Cycle 8 second generation HST snapshot survey of bright quasars, optimized to find lenses with component image separations < 1". Most models of quasar lensing predict distributions which peak at separations in the range 0arcs5 to 1", yet the observed distribution of lenses peaks at 1arcs3. The lack of systems with close separations is difficult to reconcile with a flat universe, preferred by theory (inflation) and the observational determinations of the cosmological constant from type Ia supernovae. Our Cycle 8 survey improves over the earlier pre-refurbishment snapshot survey of quasars (Bahcall et al.\ 1992; Maoz et al.\ 1993) in several important respects. With the restored PSF and

the image quality of STIS, the new images are considerably more sensitive to the presence of both close separation and faint lens components. Our snapshots are guided, multiple exposure observations, allowing a much better final data product. We are also obtaining exposures in both Clear and LongPass modes, providing immediate color information to gauge the chances that a pair of close images is consistent with lensing. At the time of this writing, about 80 of our 300 allocated snapshots have been taken. The early returns are exciting: we have one small (0arcs6) separation lens, plus 3 additional lens candidates at larger separations. Encouraged by these results, we propose to expand the survey in Cycle 9.

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Proposal Category: SNAP
Scientific Category: GAL
ID: 8632
Title: A UV Atlas of Nearby Galaxies
PI: Mauro Giavalisco
PI Institution: Space Telescope Science Institute

We propose a snapshot survey of local galaxies at UV wavelengths with WFPC2 and the F300W filter. The aim of the project is to build a reference UV Atlas of normal galaxies, whose optical images are well known, with the highest possible degree of information, covering all the morphological types and luminosity classes. The F300W passband is significantly bluer than the Johnson U, its transmittance is not limited by the atmosphere, and it offers adequate throughput for this project. The sample is extracted from the Revised Shapley-Ames Catalog and includes 130 galaxies with a redshift distribution centered around ~ 1500 km/sec and FWHM~ 500 km/s. At these redshifts the field-of-view of WFPC2 covers ~ 23 kpc, or approximately the Holmberg diameter of a large spiral galaxy. No systematic imaging of local galaxies at wavelengths bluer than the B band are currently available and the general properties of the various Hubble types in the UV are essentially unknown. Still, this information is crucial for a variety of studies, which include star-formation activity and evolution, nuclear activity, the physics of the ISM, the evolution of galaxy morphology. The WFPC2 UV Atlas will provide a unique reference data set which will be valuable for a wide variety of future observations, both ground--based and with HST. This project is a service to the community, and we waive the proprietary period.

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Proposal Category: SNAP
Scientific Category: HS
ID: 8633
Title: The Physical Parameters of the Hottest, Most Luminous Stars as a Function of Metallicity
PI: Philip Massey
PI Institution: National Optical Astronomy Observatories

We have obtained excellent, new ground-based blue optical and HAlpha spectra of a sample of very early-type stars in the Magellanic Clouds in order to measure their physical properties, and compare these to the extensive data that exists for higher metallicity Galactic stars. What we lack is knowledge of the stellar wind terminal velocities for our stars, necessary to constrain the stellar models. These can only be measured with STIS/FUV on HST. In addition, we will obtain higher spatial resolution data on the HAlpha line for six of our stars for which nebular contamination is significant even with long -slit subtraction in out ground-based data. These new HST data will allow us to understand how the spectral type to effective temperatures depend upon metallicity (necessary in determining IMFs), as well as allow us to explore the astrophysically interesting regime of stars of extreme temperatures, masses and luminosities. Together with the optical data, they will also provide important information about the strengths of stellar winds at extreme luminosities and the calibration of the Wind Momentum - Luminosity Relationship at lower metallicities.

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Proposal Category: SNAP
Scientific Category: SS
ID: 8634
Title: Atmospheric Variability on Uranus and Neptune
PI: Kathy Rages
PI Institution: Space Physics Research Institute/NASA Ames Research Center

We propose snapshot observations of Uranus and Neptune to monitor changes in their atmospheres on time scales of months to years. Uranus is rapidly approaching equinox in 2007, with another 4degrees\ of latitude in the northern hemisphere becoming visible every year. Recent HST images during this unique epoch (6818: Hammel, Lockwood, and Rages; 7429: Tomasko and Karkoschka; 7885: Hammel, Karkoschka, and Marley) have revealed: (i) strongly

wavelength-dependent latitudinal structure, (ii) the presence of numerous visible-wavelength cloud features in the northern hemisphere, and, (iii) in the near-IR, discrete features northward of 25degrees N that have the highest contrast ever seen for a Uranian cloud (Karkoschka 1998c; Hammel et al.\ 1999). Long-term ground- based observations (Lockwood and Thompson 1999) show seasonal brightness changes whose origins are not well understood. Recent IR images of Neptune (http://www2.keck.hawaii.edu:3636/realpublic/ao/neptune.html) obtained using adaptive optics on the Keck Telescope indicate that a new ``Bright Companion" type of feature has recently appeared in the southern hemisphere. Snapshot observations of these two dynamic planets can supply context in which to discern the nature of long-term changes in their latitudinal atmospheric bands and to track the appearance, movement, and disappearance of discrete albedo features.

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Proposal Category: GO
Scientific Category: HS
ID: 8635
Title: A test of pulsation and diffusion theory for subluminous B stars
PI: Ulrich Heber
PI Institution: Dr. Remeis-Sternwarte

The recent discovery of radial and nonradial mode pulsations in nearly 20 sdB stars makes it possible to use asteroseismology to probe the internal structure of these stars and discern their evolutionary status; this is needed for reasons as diverse as understanding the late stages of stellar evolution and the calibration of the observed ultraviolet upturn in giant elliptical galaxies as an age indicator. Central to any asteroseismological study is an identification of the pulsation driving mechanism; evidence to date suggests that this is due to the recently discovered heavy metal opacity. The necessary metal abundance has to be maintained by diffusive equilibrium between gravitational settling and radiative levitation. Abundance analyses of high resolution optical spectra have, however, revealed that the surface iron abundance is not discriminating between pulsating and non-pulsating sdB stars. We propose to extend the abundance analyses of three pulsating sdB stars and two non-pulsating sdB stars to chemical elements unobservable from the ground using echelle UV spectra; this would enable diffusion/pulsation calculations

to be tested by searching for significant differences in their surface abundance patterns. The targets are chosen to cover the full range of sdB gravities since \logg\ is the dominant parameter for both diffusion and pulsation.

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Proposal Category: GO
Scientific Category: HS
ID: 8636
Title: Metal abundances in very hot DA white dwarfs -- a test of diffusion theory
PI: Ralf Napiwotzki
PI Institution: Dr. Remeis-Sternwarte

The photospheric abundances of white dwarfs are controlled by diffusion processes like gravitational settling and radiative levitation. UV, EUV and X-ray observations revealed a large metallicity spread from star to star, which cannot be explained by state-of-the-art stationary diffusion calculations. Additional processes, e.g. a weak stellar wind, have been invoked. A contrasting pair of extremely hot DA white dwarfs, recently discovered by the HS survey, has very similar temperature and gravity, but probably very different metal abundances. HS 0505+0112 is unique because it is the only H-rich hot white dwarf known to show optical C lines. Balmer line fitting yields further evidence that the heavy element abundances of HS0505+0112 must be high. In contrast HS 0615+6535 displays Balmer lines only and fitting their line profiles is consistent with an unusually low amount of metals. We propose to determine abundances of C,N,O,Si and Fe and Ni directly from STIS UV spectra by means of fully metal line blanketed NLTE model atmospheres. Indications of mass loss will also be searched for providing us with an important check of the diffusion theory in white dwarfs. Both stars are also ideally suited for a test, whether the C, N, O line opacity can account for the Balmer line discrepancy noted for the analysis of very hot H-rich stars.

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Proposal Category: GO
Scientific Category: HS
ID: 8637
Title: Distance to the prototype WD showing signatures of a super-hot wind

PI: Klaus Werner
PI Institution: Universitaet Tuebingen, Institut fuer Astronomie und Astrophysik

We propose to determine the distance to the prototype of a new class of hot white dwarfs (WD). Their optical spectra reveal absorption lines from ultra-high ionized metals (e.g.\ IonOVIII), a phenomenon never observed before in any astronomical object. The occurrence of such features requires temperatures in the order of 10^6 K, far in excess of the stellar T_ eff. The asymmetric line profiles suggest formation in a rapidly accelerating high-speed wind (10,000 km s^-1). These stars represent the most convincing proof for on-going mass-loss from WDs. We have demonstrated that a large fraction of hot WDs shows this phenomenon, concluding that perhaps all WD go through this evolutionary stage. For the prototype we will determine stellar parameters and possible consequences of the mass-loss for WD evolution on hand of detailed NLTE modeling. The distance to the star is an essential prerequisite for this. We propose to derive the distance spectroscopically by determination of spectral type and luminosity class of the cool companion of the WD.

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Proposal Category: GO
Scientific Category: HS
ID: 8638
Title: Temperature scale and metal abundances of hot hydrogen-rich central stars of planetary nebulae
PI: Klaus Werner
PI Institution: Universitaet Tuebingen, Institut fuer Astronomie und Astrophysik

We propose UV spectroscopy of a sample of hot hydrogen-rich central stars of PNe, covering the hottest phase of post-AGB evolution (T_ eff>70 000 K). The spectra shall be analyzed with fully metal line blanketed NLTE model atmospheres in order to determine T_ eff, surface gravity, and chemical composition. The results will address the following problems: 1. The temperature scale of the hottest central stars is poorly known. Iron lines, only accessible in the UV, are ideal temperature indicators to set up a reliable temperature scale. 2. Depending on the particular star, the derived metal abundances are either dominated by current diffusion processes or they originate from dredge-up phases during previous AGB evolution. We expect that

our sample comprises different objects so that both processes/phases can be studied in detail. 2a. Those objects, which show qualitatively a metal abundance pattern which points at dredge-up phases, can be used to quantitatively check against abundance predictions of stellar evolution theory. 2b. The other objects, where gravitational diffusion and radiative acceleration determine the photospheric metal abundances, will be used to check our NLTE models which for the first time include diffusion processes self-consistently.

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Proposal Category: GO
Scientific Category: AGN
ID: 8639
Title: The Origin of Gaseous Outflows in Active Galaxies
PI: Andrew Wilson
PI Institution: University of Maryland

We have recently obtained HST PC images of the ionized gas in the Circinus galaxy, a nearby (distance 4 Mpc) Seyfert 2. The images reveal that the nuclear (i.e. the inner 2^ = 40 pc) high excitation gas is ``V-shaped'' and represents the inner part of the ``ionization cone'' seen previously on much larger scales in ground-based observations. At 10 - 15^ = 190 - 280 pc from the nucleus, there is an elliptical ring of high excitation gas, which we infer to be the end of the intrinsically circular cone viewed at its known orientation. The images thus suggest that the observed emission lies along the boundary of a conical structure, a situation which has probably originated through mass entrainment of dense gas in the galaxy disk along the edges of a low density outflow. We wish to obtain long slit observations of this structure. Our goals are: 1) to confirm or reject this picture kinematically; 2) investigate how gas is entrained into the outflow from the dense ism in the galaxy disk in the inner (< 40 pc) region of the outflow at unprecedented spatial resolution for a Seyfert galaxy (our resolution of 1 pc is comparable to or smaller than the expected radius of the inner edge of the putative blocking ``torus''); 3) distinguish between collimation of ionization photons or of gaseous outflow as the origin of the ``ionization cone''; 4) attempt to measure the mass of the nuclear black hole using a long slit spectrum of the disk HII regions.

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Proposal Category: GO

Scientific Category: COS
ID: 8640
Title: A Public STIS Survey of the Host Galaxies of Gamma-Ray Bursts
PI: Stephen Holland
PI Institution: University of Aarhus

We propose to obtain high-resolution STIS images of the fields containing every gamma-ray burst with well-localized coordinates; i.e.\ the burst has been localized to within ~ 1". The goal of this survey is to obtain a uniform sample of images of the host galaxies of these bursts. This data will be used to search for host galaxies that are too faint to be discovered by ground-based searches, to study the morphology of host galaxies, and to compare the population of galaxies that contain gamma-ray bursts to other populations of galaxies such as Lyman Break Galaxies, Damped Lyman-Alpha Absorption Systems, infrared galaxies. This survey will allow us to probe the star-formation rate in the high-redshift Universe and study the nature of stellar populations at early epochs. We intend to waive all proprietary rights to this data, and will make optimally-combined images available to the astronomical community as soon as they are produced.

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Proposal Category: GO
Scientific Category: COS
ID: 8641
Title: Testing the Accelerating Universe
PI: Brian Schmidt
PI Institution: Mt.Stromlo & Siding Spring Observatories

Type Ia supernovae provide evidence for an accelerating universe: an extraordinary result that needs to be rigorously tested. The two chief alternatives to a cosmological source for the observed shape of the high-z Hubble diagram (z >= 0.4) are dust that absorbs, but does not redden much, and intrinsic changes in the luminosity of distant supernovae due to the age of the stellar population or the chemical composition of the progenitor stars. We propose to test the generic predictions of composition models and the specific predictions of dust models through very wide wavelength coverage UBVRI observations of 7 supernovae near z = 0.5. These observations, with precise restframe UBVR from HST and restframe I from large groundbased

telescopes, will provide enough information for a definitive test of the ``grey'' dust proposal, while they also place the most stringent constraints on differences that could be attributed to chemical differences or age differences between nearby and distant samples of SN Ia. The unique restframe U-band observations proposed here will be especially important in comparing SN Ia at z=0, where we have a sample, and z=0.5, where we don't, and in interpreting the data from very high redshift supernovae with z>=1. Our goal is cosmology, our measuring tool is supernovae, and we need precise, wide wavelength measurements at z=0.5 to test the quality of this yardstick.

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Proposal Category: GO
Scientific Category: COS
ID: 8642
Title: Deep Imaging of the Probable Einstein Ring 1517+656
PI: Meg Urry
PI Institution: Space Telescope Science Institute

A short WFPC2 F702W snapshot image of the BL Lac object 1517+656 has revealed three surrounding arcs, subsequently confirmed by a longer NOT observation, making this a probable new Einstein ring. Deeper high-resolution imaging is required to determine unambiguously the nature of this intriguing source. We propose to obtain a deep STIS/CCD + F28X50LP image to map the detailed structure of the arcs, and WFPC2 F555W and F814W images to measure their colors. The STIS data will have the depth and resolution required for iterative back-mapping of the arcs, providing a unique determination of the mass distribution of the lens. The extreme narrowness of the arcs makes ground -based observations useless for this purpose. Combined with the WFPC2 data, we will have sufficient color information to constrain the photometric redshift and stellar population of each arc (impossible with the ground-based data because of the instability of the required deconvolution), as well as of other galaxies detected in the field.

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Proposal Category: GO
Scientific Category: GAL
ID: 8643
Title: Ultraviolet Properties of the Metal Rich M87 Globular Cluster System
PI: Robert O'Connell

PI Institution: University of Virginia

We propose to use STIS imaging to obtain far-ultraviolet photometry of the metal rich globular cluster system of the elliptical galaxy M87. This system represents a key link between the well understood populations of the clusters and the hot stars in elliptical galaxies, where our physical insight is presently limited. Our goal is to establish the relationship between cluster metal abundance and the production of UV-bright populations of stars on the ``extreme horizontal branch'' at T(eff) > 16000K. These stars are the source of the surprising ``ultraviolet-upturn'' phenomenon in elliptical galaxies. Our observations will fill a major gap in the present coverage of cluster metal abundances. This would be an important step in understanding the dependence of the upturn on its parent stellar population. A basic motivation is the expectation that the UV-upturn could be the most sensitive probe of the ages and abundances of elliptical galaxy populations. We plan to observe 3 fields in M87, which will provide a sample of ~ 30--50 UV-detected objects in the brightest 3 magnitudes of its cluster luminosity function. The program is technically challenging but appears feasible. Relatively long integrations are needed, under conditions of minimum dayglow emission from Earth's atmosphere.

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Proposal Category: GO
Scientific Category: GAL
ID: 8644
Title: Galaxy Recycling in Clusters
PI: Michael West
PI Institution: University of Hawaii

We propose to obtain deep WFPC2 B, V, and I images of two unusual, extended, low surface brightness plumes of material recently discovered in the Coma and Centaurus clusters. These plumes are most likely transient tidal debris resulting from the destruction of galaxies as they passed through the cores of these clusters. Over time, this debris will spread throughout the cluster potential, augmenting the intergalactic populations of stars, globular clusters, dwarf galaxies, and gas. Some of this material may also be incorporated into the halos of the central dominant galaxies. In these plumes we are witnessing the ongoing formation of the diffuse intracluster background of stellar light seen in many rich clusters, as well as the material from

which cD galaxies themselves may be built. This is recycling on a cosmic scale. Determining the nature of this recycled material is key to understanding the formation and evolution of the intergalactic stellar population, as well as the evolution of the galaxy populations in clusters. HST images of these two plumes will enable direct study of their stellar populations, specifically, the number of bright supergiants, globular clusters, and star forming regions which may be present.

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Proposal Category: GO
Scientific Category: GAL
ID: 8645
Title: A Survey of Mid-UV Morphology of Nearby Galaxies: Galaxy Structure and Faint Galaxy Evolution
PI: Rogier Windhorst
PI Institution: Arizona State Univ., Physics & Astronomy

\n Too little is known about the relation between star formation and the global physical characteristics of galaxies to interpret the morphologies of distant galaxies in terms of their evolutionary status. Faint galaxies are primarily observed by HST in their restframe mid-ultraviolet. They resemble nearby late-type galaxies, but are they really physically similar classes of objects? We propose to address this question through a WFPC2 imaging survey of 37 nearby galaxies in two mid-UV bands. Our sample is carefully selected for size and surface brightness and has a large amount of correlative data available. A wide range of Hubble types and inclinations is included, with emphasis on late-types/irregulars/peculiars. All objects have ground-based UBVRIJHK, and 15 have far-UV UIT images. The mid-UV is the missing keystone. Our proposed data set will be unique, can be applied to a wide range of problems, and will be made public immediately. Our goals are: 1. Consistently classify polychromatic structures and photometric properties of galaxies from 0.15-2.2 mu. 2. Map the spatial distribution, luminosities, and sizes of star-forming regions responsible for the UV morphology, and relate these to global galaxy properties. 3. Provide local benchmark images that we can redshift to z~1-->3 for quantitative comparison to the morphological and photometric properties of high redshift galaxies.

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Proposal Category: GO
Scientific Category: HS

ID: 8646
Title: Observing the next nearby supernova
PI: John Bahcall
PI Institution: Institute for Advanced Study

If a neutrino-producing supernova (SN) explodes in the Galaxy, the Large or Small Magellanic Clouds, or a close member of the Local Group, it will be detected first by operating neutrino experiments: Super-Kamiokande, SNO, MACRO, and AMANDA. The supernova neutrino early warning system will notify photon observers throughout the world within an hour of the neutrino detection. Although the per-year probability of observing a neutrino SN (within 100 kpc) is small, the detection would be importantly scientifically and of widespread interest. The optical counterpart could be much brighter than normal extragalactic SNe. A bright nearby supernova detected by other means would also be of great interest and should activate this proposal. We propose unique STIS ultraviolet spectroscopic observations to measure the principal metallic lines, and hence the composition, velocity, and physical state, of the outermost atmosphere of the exploded star. In addition, we propose narrow- and broad-band imaging to provide information about the stellar environment and early morphology unobtainable from the ground. The data, especially images, will be valuable for public outreach and will be released immediately by NASA.

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Proposal Category: GO
Scientific Category: HS
ID: 8647
Title: HST/RXTE Observations of SXTs: Black Hole Accretion Outbursts
PI: Carole Haswell
PI Institution: Open University

UV observations of soft X-ray transients (SXTs) will be made using STIS. This is part of an extensive multiwavelength target of opportunity campaign to monitor newly discovered SXTs in outburst and throughout the subsequent decline. A high proportion of SXTs harbor black holes, so these observations provide an unrivalled opportunity to obtain high quality data from an accreting black hole. UV data is a keystone of our multiwavelength campaign because the disk regions of interest radiate predominantly in the UV. Emission

lines will allow us to probe the kinematics of the inner disk region. Multiwavelength observations will probe the physics of the accretion flow throughout the outburst. We will examine the relative strengths of the reprocessed X-ray flux emitted in the UV, and the UV flux generated by viscous heating in the accretion flow. The observations will yield detailed quantitative tests of the models for SXT outbursts. The STIS/MAMA capability to perform UV spectroscopy with 125 microsecond time resolution will be exploited with a proven HST/RXTE echo-mapping experiment. This will measure the size of the reprocessing regions in the accretion disk, and thus probe morphology changes as the decline proceeds. It is unknown what rapid UV variability we may find; recent RXTE discoveries suggest this may prove a rich source of information on the dynamics close to the event horizon.

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Proposal Category: GO
Scientific Category: HS
ID: 8648
Title: SINS: The Supernova INtensive Study--Cycle 9
PI: Robert Kirshner
PI Institution: Harvard College Observatory

Supernovae explode to create the chemical history of the Universe and energize the interstellar gas. They now occupy center stage for the extragalactic distance scale and cosmology. The SINS program has shown how HST can make unique contributions to understanding supernovae. HST is better than ever for this work: STIS is ideal for spatially-resolved observations of SN 1987A, where a rapidly developing encounter between the fast-moving debris and the stationary inner ring is underway. Observations of UV emission inside the inner ring of SN 1987A reveal the location and velocity of the reverse shock that also produces X-ray and radio emission. We also plan intensive study of illuminating objects beyond SN 1987A: a Target-of-Opportunity observation of a bright, new supernova that is certain to be discovered during Cycle 9, and the late-time observations of SN 1999by (SN Ia) and SN 1998bw, (SN Ic? and probably Gamma-ray burst). We request a 24-hour turn-around because the UV flux from supernovae changes rapidly in the first days and reveals much about the star. We will explore the UV emission from supernovae, exploit the spatial resolution of HST, and press the late-time observations of supernovae into uncharted territory. The SINS team enriches HST data with extensive ground-based support and analytic power to help understand the final and most violent

stage of stellar evolution.

Proposal Category: GO
Scientific Category: HS
ID: 8649
Title: Probing Stellar Interiors Via Convective Dredge-up in DQ White Dwarfs
PI: Judith Provencal
PI Institution: University of Delaware

The composition and structure of white dwarf stars contain a wealth of information about processes occurring in contemporary main sequence stars like our sun. We use this information to build theoretical models placing limits on the star formation history and age of the Galactic disk. One of the largest uncertainties in our models is the unknown core composition of a white dwarf. We generally assume a mixture of carbon and oxygen, but the exact ratio is unknown. This uncertainty introduces a 20\ dwarfs offer our only opportunity to directly observe the actual carbon/oxygen ratio in a white dwarf core. DQs are are otherwise normal helium-rich stars displaying carbon features in their spectra. The observed carbon in these objects results from dredge-up of the underlying core by the helium convection zone. Recent theoretical work argues that oxygen should also be present in detectable amounts in the more massive DQ stars. We propose a modest investment of HST time to determine for the first time whether a white dwarf core contains a substantial quantity of oxygen. We will search for trace amounts of oxygen in the atmosphere of a massive DQ as an important step towards resolving this question.

Proposal Category: GO
Scientific Category: ISM
ID: 8650
Title: The Interplanetary Medium Hydrogen Velocity Distribution
PI: John T. Clarke
PI Institution: University of Michigan

Neutral atoms from the interstellar medium (ISM) flow into the solar system producing a diffuse emission at 1216 Angstrom by resonant scattering of solar H Ly-alpha emission. This wind contains the velocity distribution of the local ISM, plus modifications by solar gravity, radiation pressure, and

ionization near the Sun, and the Ly-alpha emission line profile reveals these velocity signatures. Compared with the He flow at 26kms, consistent with the local ISM cloud, the H velocity of 18-21kms suggests an additional alteration of the H atom velocity distribution by charge exchange at the heliospheric interface. In cycles 1 and 4 we obtained initial GHRS echelle A Ly-alpha line profiles in 3 look directions. For cycle 9 we propose three focussed observations, taking higher sensitivity STIS echelle spectra to address the following key questions about the interplanetary H: 1) we will accurately measure the ratio of solar gravity to radiation pressure on the flow, 2) we will obtain upwind spectra close in time to FUSE spectra of the optically thin Ly-beta emission to directly measure the optical depth, and 3) we will obtain high S/N line profiles upwind to determine the extent of slowing of the inflow velocity distribution indicated in earlier HST and SOHO observations. The end goals of this program are to characterize the properties of the local ISM and its modification at the heliospheric interface.

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Proposal Category: GO
Scientific Category: QAL
ID: 8651
Title: STIS UV Spectroscopy in the Magellanic Bridge: A Typical QSO Absorption Line System?
PI: Chip Kobulnicky
PI Institution: University of Wisconsin-Madison

We are proposing STIS echelle UV absorption line spectroscopy through the Magellanic Bridge (near the SMC) to probe the temperature, ionization, and kinematic structure in a metal-poor environment like those observed in the early universe. The sightline toward the QSO B0312-770 is especially interesting because of the proximity of the absorber (~ 60 kpc) and the radio loud background source. Using 21-cm absorption and emission spectroscopy we have measured H I column densities of 10^20 cm^-2 which approach those in damped LyAlpha systems. Most importantly, we measure well-constrained spin temperatures for the absorbing neutral hydrogen components, T_S=30-200 K. By comparing the velocity structure and optical depths of common UV lines like Mg I, Mg II, Si II, Si IV, C IV, with the 21-cm diagnostics, we will identify the mixture of physical phases (hot and cold) and kinematic structure that comprise a nearby metal-poor environment for comparison to the high-z universe. If this sightline resembles the high-z UV absorbers, then the

existence of ongoing star formation in the Magellanic Bridge implies that QSOs absorption line systems may be active sites of star formation as well.

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Proposal Category: GO
Scientific Category: QAL
ID: 8652
Title: Evolution of the Extinction Curve
PI: Alain Smette
PI Institution: NASA/Goddard Space Flight Center

The extinction curve has been determined precisely in only a few galaxies: the Milky Way (MW), the Large and Small Magellanic clouds (LMC and SMC). It has also been determined towards several starburst galaxies, but its significance then depends on the precise star-gas-dust geometry. There is no general agreement on a model to explain its characteristics; laboratory experiments fail to reproduce the famous 2175Angstrom feature under the conditions of the popular silicate-graphite model. The MW, LMC and SMC extinction curves are generally used to bracket extinction curves in other galaxies. Extinction by dust influences the determination of the Hubble constant from cepheids, of Omega_\mathrm M and Lambda using Type Ia Supernovae or gravitational lenses, of the cosmological density of gas and star formation history and the origin the Cosmic Infrared Background. A larger sample of extinction curves is thus urgently needed. Recently, Jean & Surdej (1998) described a method to recover the extinction curve based on high signal-to-noise, low-resolution spectra of the multiple images of gravitationally lensed quasars. We propose to apply this method to 3 quadruply imaged quasars in order to recover the extinction curve of galaxies sampling the redshift range 0.04 <z< 0.8. We also propose to measure the HI column density along each line-of-sight in order to estimate their gas-to-dust ratio.

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Proposal Category: GO
Scientific Category: SF
ID: 8653
Title: Collimation and Physical Conditions Within the HH 30 Protostellar Jet
PI: Patrick Hartigan
PI Institution: Rice University

We propose to observe the protostellar jet HH 30 through a wide slit with STIS in order to determine the distance from the star that the jet becomes collimated, and to diagnose the density, temperature, shock structure, and ionization within the collimation region. The proposed observations will provide an image of the jet in each emission line across the entire optical spectrum with minimal contamination from the reflection nebula near the star, a marked improvement over existing narrowband images that cover only a few lines which emit over a limited range of densities and ionization states. Ratios of the new emission-line images will probe the physical conditions in the jet with HST spatial resolution and make it possible to observe the shape and location of any shocks in the flow, resolve the cooling layers behind these shocks, and trace the recombination of any ionized gas that emerges from the base of the jet. The proximity and brightness of HH 30 together with its favorable inclination angle make this an ideal object to study jet collimation. The new STIS spectra are precisely what are needed to test MHD models of jet collimation from accretion disks. Understanding how jets originate, become collimated, and form shocks has profound implications for the distribution of magnetic fields and angular momentum within accretion disks, which in turn control how stars and planets form.

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Proposal Category: GO
Scientific Category: SP
ID: 8654
Title: Confirmation of Black Hole, Planetary, and Binary Microlensing Events
PI: David Bennett
PI Institution: University of Notre Dame

We propose WFPC2 images of five MACHO Project microlensing events in order to confirm our microlensing models which indicate that these events were caused by black holes and stars with extra-solar planets. Our microlensing parallax fits for MACHO-96-BLG-5 and MACHO-97-BLG-6 indicate that the lenses are likely to be black holes of ~ 40M(sun) and ~ 8M(sun), respectively, and we can test these models by comparing the amount of stellar blended predicted by the model with the blended determined from the WFPC2 images. For the large mass black hole candidate MACHO-96-BLG-5, we propose a time series of observations to follow the declining magnification of ~ 0.4 mag over the next several years as predicted by the microlensing model. For the two extra-solar planet candidates

reported by the Microlensing Planet Search (MPS) Collaboration, MACHO-97-BLG-41 and MACHO-98-BLG-35, we propose to test the planetary microlensing models by determining the amount of blending between each source star and its neighbors. Our observations of MACHO-97-BLG-41, will serve as a first epoch for the possible observation of this triple lens system moving away from the source star. Finally, we propose to image binary lensing event MACHO-98-SMC-1 to test our ability to determine the location of the lens systems for such events.

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Proposal Category: GO
Scientific Category: SP
ID: 8655
Title: Geometric Distances of Globular Clusters (GO part)
PI: Ivan King
PI Institution: University of California, Berkeley

This is a proposal to establish a globular-cluster distance scale of unprecedented accuracy and reliability, with far-reaching impact on the distance and time scales of cosmology. Our method is to compare internal dispersions of proper motion with ground-based determinations of the dispersion of radial velocities. The prospect is a geometrically based distance scale with an accuracy of better than 2\ ability to make such measurements, and we are progressing with the conversion of them to a distance for the cluster. Our project has two parts: (1) Where possible, we use archival observations for both astrometric epochs (see accompanying AR proposal, which covers 2 clusters). (2) The present proposal covers 5 more clusters for which an archival first epoch exists but for which we lack second -epoch observations. With this proposal, the accompanying AR proposal, and other HST collaborations in which we are involved, we expect to determine accurate distances for 13 clusters, with a large range of metallicities and second-parameter characteristics. (Moreover, we intend to cover additional clusters in future ACS proposals.)

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Proposal Category: GO
Scientific Category: SP
ID: 8656
Title: The Hydrogen-Burning Limit in the Globular Cluster NGC 6397 (GO part)

PI: Ivan King
PI Institution: University of California, Berkeley

We propose a major enhancement of an earlier study of the bottom of the main sequence of NGC 6397, the globular cluster with the smallest distance modulus. In earlier work the lowest part of the MS had been lost among the numerically dominant field stars; but accurate astrometry, over a baseline of a few years, now allows an excellent proper-motion separation of faint cluster stars from the field. The purified CMD follows the main sequence to its ``end" (i.e., the terminal plunge of the LF). Just as the MS CMD gives a mass--radius relation, we show in a new way how this LF can give a mass--luminosity relation; both of these offer unique checks on theory. Our single WFPC2 field, however, had only a small number of stars in this range, too few to set firm restraints on the theories. We propose now to increase the number of such stars by a large factor by (1) getting 2nd-epoch images for three more fields in the cluster and (2), in an accompanying AR proposal, remeasuring our previous images, and others that exist, to the deeper limit that we know can be attained. The number and the magnitudes of these faintest stars will greatly strengthen the constraints that we place on structure and atmosphere theories of lower-main-sequence stars. In each field we will also measure the anisotropy of internal stellar motions, which is predicted to be large in a collapsed-core cluster such as this one.

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Proposal Category: GO
Scientific Category: SS
ID: 8657
Title: Jovian Auroral Variability Due to the Solar Wind/Magnetosphere Interaction
PI: John T. Clarke
PI Institution: University of Michigan

instrumentSTIS HST/STIS observations of Jupiter's aurora have revealed many fascinating and detailed aspects of these complex and energetic emission processes. The main UV emissions and their morphologies have been determined, with different emissions varying on time scales from seconds to days. With observations spaced months apart, and no record of the solar wind conditions near Jupiter, however, it has not been possible to determine the cause and effect relations governing the many variations. A unique opportunity to study

these complex variations will exist when the Cassini spacecraft flys by Jupiter in December 2000. We propose to perform STIS observations of Jupiter's UV aurora in two campaigns along with Cassini measurements of the solar wind before closest approach, then another campaign when Cassini is just past Jupiter and looking back at the night side aurora. The proposed series of STIS observations, covering nearly complete Jupiter rotations, will permit us to perform several known key measurements of the auroral emissions, and also to study uniquely the effects of solar wind variations on the auroral morphology.

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Proposal Category: GO
Scientific Category: SS
ID: 8658
Title: Atmospheric Escape and the D/H Ratio in Mars' Atmosphere
PI: John T. Clarke
PI Institution: University of Michigan

The highly extended upper atmosphere and the UV airglow of Mars have not been studied by any in situ spacecraft since Mariner 9 in 1972. At the same time, one of the main elements of NASA's space science program today is the study of Mars and how it has evolved over time to a hostile environment, compared with the favorable conditions on the Earth. The availability of long aperture spatially resolved UV spectra with STIS makes it possible to obtain unique information on the extended upper atmosphere of Mars by mapping the H and O dayglow emissions with altitude above the limb. We propose to make these observations just before Mars opposition near the end of HST cycle 9. Initial modeling indicates that we will have sufficient angular resolution and sensitivity to measure the scale heights of the suprathermal atom populations of H and O atoms. We also propose to determine accurate values for the D and H columns, and the D/H ratio, in the upper atmosphere of Mars. The present-day D/H ratio gives vital information leading to understanding the evolution of Mars' atmosphere, the historic escape of water into space, and potentially the remaining water abundance on Mars.

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Proposal Category: GO
Scientific Category: SS
ID: 8659
Title: High Resolution Spectrum of the Venus Lyman-Alpha Line

Profile
PI: William Colwell
PI Institution: Southwest Research Institute

We propose to record a single high spectral resolution observation of the Venus Ly-alpha\ line, while HST is within Earth shadow and Venus is at 47.1^degrees solar elongation, with a supporting observation of the Ly-alpha\ geocorona outside the exclusion zone (50^degrees). This Ly-alpha\ line profile will be compared with emergent line profiles from Venus thermosphere radiative transfer models to assess the energetics and contributions from supra-thermal sources of hydrogen, a long-standing issue in Venus aeronomy. This information will enhance understanding of the pathways of hydrogen escape from Venus and constrain models of Venus climate evolution. The line profile will be used to assess the abundance of deuterium in the Venus atmosphere, a quantity with great importance to atmospheric evolution models. The HST STIS instrument is the only instrument capable of making these far UV observations with sufficient spectral resolution to address the details of hydrogen energetics in the Venus thermosphere and exosphere. HST previously observed Venus with Esposito as PI (P4518 and P5783).

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Proposal Category: GO
Scientific Category: SS
ID: 8660
Title: Saturn's Rings and Small Moons
PI: Richard French
PI Institution: Wellesley College

We propose to continue our long-term survey of Saturn's rings, using the unique capabilities of the WFPC2, to obtain a coherent set of high resolution, multi-color images of the Saturnian ring system over the full range of ring tilt and phase angles accessible from the Earth over the course of 1/4 Saturn year (7 Earth years). Our Cycle 6 (program 6806) and long-term Cycle 7 (7427) and Cycle 8 (8398) observations explored the rings from their nearly edge-on aspect, just after the most recent ring plane crossings, to their current moderate inclination. Here, we propose to complete our survey during the next three Saturn oppositions (Cycles 9--11), as the rings gradually approach their most open configuration, shortly before the arrival of the Cassini spacecraft at Saturn. Our key goals are to investigate the composition, structure, and

particle properties of the rings from variations of ring brightness and color with radius, tilt and phase angle, to measure the azimuthal asymmetry of the A ring and the temporal variability of the clumpy F ring, to follow the enigmatic behavior of the renegade satellites Prometheus and Pandora, and to observe the co-orbital satellites Janus and Epimetheus as they exchange orbits in February 2002.

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Proposal Category: GO
Scientific Category: SS
ID: 8661
Title: UV Spectroscopy of the Giant Planet Atmospheres with STIS
PI: Roger Yelle
PI Institution: Northern Arizona University

We propose STIS observations of the atmospheres of Jupiter, Saturn, Uranus, and Neptune in the ~1600-3100 Angstrom\ spectral region. Analysis of these observations will be used to determine the abundance and altitude profiles of gaseous absorbers and aerosols from the millibar region to hundreds of millibars. We will also determine the H_2 ortho/para ratio. Atmospheric properties will be derived through comparison of the observations to synthetic spectra based on model atmospheres and state-of-the-art radiative transfer calculations, that include raman scattering in a rigorous manner. Results from this analysis will be used to investigate photochemical processes in the giant planet atmospheres and to constrain the state of the interiors and the transport rate between the deep interior and visible atmosphere.

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Proposal Category: SNAP
Scientific Category: ISM
ID: 8662
Title: A SNAPSHOT Survey of the Hot Interstellar Medium
PI: James Lauroesch
PI Institution: Northwestern University

We propose to obtain SNAPSHOT STIS echelle observations of key tracers of hot interstellar gas (ionC4, ionN5, and ionSi4) for selected FUSE Team ionO6 survey targets with known UV fluxes. By taking advantage of the SNAPSHOT observing mode we will efficiently obtain a large number of spectra suitable for the study of the highly ionized hot component of the interstellar medium

(ISM). Our goals are to explore the physical conditions in and distribution of such gas, as well as to explore the nature of the interfaces between the hot ISM and the other interstellar gas phases. Using inter--comparisons of the various ionic ratios for ionC4, ionN5, ionO6, and ionSi4, we will be able to discriminate between the various models for the production of the highly ionized gas in the Galactic ISM. The survey will also enable detailed studies of regions already known to contain hot gas through X-ray emission measurements (e.g., SNRs and radio loops). Currently there are only 14 stars in the FUSE Team ionO6 survey that have planned or archived HST exposures that cover the lines of ionC4, ionN5, and ionSi4. We estimate that the proposed SNAPSHOT observations should more than triple the size of the sample for which all of the important hot gas tracers are available, enabling us to derive a truly global view of the hot ISM.

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Proposal Category: SNAP
Scientific Category: ISM
ID: 8663
Title: Survey of SMC Planetary Nebulae: Nebular and Stellar Evolution in a Low-Metallicity Environment
PI: Letizia Stanghellini
PI Institution: Space Telescope Science Institute

A survey of SMC planetary nebulae (PNe) is proposed to study the co-evolution of the nebulae and their central stars, in an environment that is chemically very metal poor. We will obtain STIS imaging and medium-resolution slitless spectroscopy which will yield line fluxes and nebular morphologies in important emission lines, plus magnitudes of the central stars. From these data we will gather a harvest of information: the nebular size, morphology, ionization structure, density, and mass; and the central star temperature, luminosity, and mass. We will test the correlation found in the Galaxy of nebular bipolarity with large progenitor star mass and with chemical enrichment of the outer envelope during the prior AGB phase. These relationships between PN and central star evolution will be pursued in the SMC with a sample free of distance uncertainties and selection biases, and in a metal-poor chemical environment that stands in sharp contrast to the Galaxy and the LMC. The importance of this program is two-fold: We will determine the late evolutionary paths of the most common stars in a galaxy that, in its chemical content, mimics a young galaxy; and we will produce a sample of

extragalactic PN images and spectra that will far exceed in number the galactic PNe already observed with HST, providing an homogeneous database for testing the evolutionary implications of metallicity variations in stellar evolution.

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Proposal Category: SNAP
Scientific Category: SP
ID: 8664
Title: Structural Measurement of Globular Clusters in M31 and NGC 5128: Stalking the Fundamental Plane
PI: William E. Harris
PI Institution: McMaster University

Globular clusters have amazingly simple structures that are well approximated by isotropic, single-mass King (1966) models. All structural properties of a King-model cluster follow from specifying its total luminosity L, central concentration c, mass-to-light ratio M/L, and binding energy E_b. However, in this four-dimensional space, real Galactic globulars inhabit only a remarkably narrow region referred to as the fundamental plane (FP). Recently McLaughlin (1999) has shown that clusters are confined to the FP through two extremely well defined empirical relations, M/L=const and E_b~ L^2.1, leaving only the two remaining parameters c and L to govern their scatter on the plane. These results strongly constrain the cluster formation process; in particular, the detailed nature of the E_b(L) correlation suggests that the star formation efficiency in protoglobulars increased systematically with their mass. We propose to use the STIS/CCD camera in SNAPSHOT mode to image a wide selection of individual globular clusters in two other large galaxies (M31 and NGC 5128) for measurement of their structural parameters (r_c, Mu_0, c). We will use these to compute their binding energies and define the FP in these two galaxies. Comparison with the Milky Way will then give us powerful new information on just how ``universal'' the cluster formation process was in the early protogalaxies.

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Proposal Category: GO
Scientific Category: AGN
ID: 8665
Title: The Starburst - AGN Connection: The Nature of the UV-bright Core in NGC 4303

PI: Luis Colina
PI Institution: Instituto de Fisica de Cantabria

NGC 4303 is to date the best example of the claimed starburst - AGN connection in active galaxies. HST images of NGC 4303 have unveiled the existence of a nuclear mini-bar (250 pc in size), centered on the unresolved (size <= 8 pc) UV-bright core, itself connected with a star-forming mini-spiral (radius ~ 250 pc). The spiral consist of compact clusters (size <= 15 pc) of young stars (5-25 Myrs). The UV-bright core is classified as a Seyfert 2 AGN but its UV luminosity and optical properties are also compatible with the existence of a young (~ 4 Myr) massive (~ 10^5 M_\odot) cluster of stars. We propose to obtain STIS UV spectra of the unresolved core and the brightest knots in the star-forming mini-spiral of NGC 4303. The spectra will be combined with multifrequency data and evolutionary spectral synthesis models to: (1) pin down the nature of the UV-bright core, i.e. AGN versus young massive stellar cluster, (2) quantify the AGN and starburst energy contribution, (3) determine the age and mass of the star-forming knots, and (4) establish an evolutionary sequence of events within the bar - starburst - AGN scenario. The detection of signatures of massive stars in the spectrum of the core of NGC 4303, would demonstrate for the first time ever that a compact (<= 8 pc) massive stellar cluster is located at the core of a Seyfert 2 galaxy and is, perhaps, its dominant energy source.

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Proposal Category: GO
Scientific Category: AGN
ID: 8666
Title: Outflows from the Disk Fueling the Massive Black Hole in M87
PI: Holland Ford
PI Institution: Space Telescope Science Institute

The disk in M87 is a prototype for gas orbiting a massive central object. Although the disk is rotating, its morphology and kinematics are far from simple. A deep Halpha+N II HST image shows a trailing, three arm spiral superposed on the underlying disk, and an extended system of filaments. The NW filaments appear to connect directly to the disk. Ground-based and HST observations suggest that some of the filaments originate in a bi-directional wind emanating from the disk. Such a wind can carry away angular momentum,

enabling gas to flow through the resolved disk into the accretion disk around the black hole. We propose high spatial resolution STIS spectroscopy aimed at achieving the following scientific goals: 1) Determine if winds are carrying angular momentum away from the disk, thereby enabling inflow and fueling of the massive black hole, 2) Estimation of the rate of mass loss and angular momentum loss from the disk, and 3) Use changes in the velocities and line strengths at the positions of the spiral-like features in the disk to determine if these are shocks where gas is flowing through a density wave. Because small, 100-parsec scale gaseous disks like the one in M87 are common in the centers of active galaxies, demonstration that a wind is removing angular momentum from the M87 disk will have far reaching consequences.

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Proposal Category: GO
Scientific Category: GAL
ID: 8667
Title: Nuclear Stellar Disks in Early Galaxies: Black Hole Masses and Disk/Bar/Bulge Evolution
PI: Walter Jaffe
PI Institution: Leiden Observatory

In an unbiased sample of nearby E/S0 galaxies we discovered 6 new stellar nuclear disks, in addition to 3 discovered in earlier work. These disks are ideal tools for measuring central black hole masses, and the one earlier case studied spectroscopically, NGC 4342, showed an unusually high M_bh/M_bulge ratio. Another, NGC 4570, shows a series of rings of anomalous color and morphology which seem to be a fossils of an episode of mass accretion, bar formation, dynamical resonances, and bar dissolution into a bulge. We propose STIS spectroscopy and WFPC/2 imaging of an additional 4 of these galaxies to: (1) test whether the unusual M_bh/M_bulge ratio is typical of these nuclear disk galaxies and (2) search for additional ring/bar structures will help determine the source of the accreted material and the time sequence of the disk/bar/bulge/Black Hole fueling connection.

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Proposal Category: GO
Scientific Category: GAL
ID: 8668
Title: Spectroscopy of candidate, very massive, intermediate age globular clusters in ESO 338-IG04

PI: Goeran Oestlin
PI Institution: Institut d'Astrophysique de Paris

The blue compact starbursting galaxy ESO 338-IG04 has been found to be very rich in globular clusters (GCs) of varying age, from a few Myr to 10 Gyr. Among low mass galaxies, it appears to be an extraordinary efficient GC factory, and its GC richness is fully comparable to those of giant ellipticals. An important GC formation event occured some 2.5 Gyrs ago. In this age category we find cluster no. \#34, an unusually massive cluster with \cal M > 10^7 \cal M_\odot. Here, we propose to observe this cluster, and two other intermediate age massive GC candidates. The aim is to derive ages, metallicities and internal extinction, in a self consistent way. This will provide a test on the origin and chemical evolution of the host galaxy, and a possibilty to assess the reliability of photometrically derived ages and masses for young GC candidates in general. The latter point is important, because GCs, beeing fossil starbursts, may be used to probe the starburst history of galaxies in the universe. Also, beeing true single stellar populations, massive (where number of stars are large and statisical fluctuations small) GCs provide important tests for stellar evolution models.

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Proposal Category: GO
Scientific Category: GAL
ID: 8669
Title: Merger-driven evolution of galactic nuclei: observations of the Toomre sequence
PI: Roeland P. van der Marel
PI Institution: Space Telescope Science Institute

Galaxy mergers are believed responsible for triggering starburst and AGN activity in galaxies, and even perhaps transforming spiral galaxies into ellipticals. Ground-based observations and numerical simulations have shed light on these issues, but have not been able to adequately resolve the nuclei of merging galaxies. However, it is these nuclei where most of the important physical processes operate, and where a direct study of the stellar and gaseous components yields crucial insight on any picture of merger-driven galaxy evolution. We propose here to use HST to study the structural, star-forming, and kinematic properties of the galactic nuclei in the `Toomre Sequence' of merging galaxies, at unprecedented spatial resolution. Broad-band

WFPC2 images with F555W and F814W will be used in concert with narrow-band HAlpha+NII images to study the connection between nuclear morphology and the structure of the ionized gas. The two-dimensional velocity field of the nuclear gas will be probed via medium resolution STIS G750M observations, while lower resolution G430L spectroscopy will study the young and old stellar populations in the merging nuclei. Our study will provide the first comprehensive view of the physical conditions in strongly interacting and merging galactic nuclei, and, in concert with our dynamical modeling, will place strong constraints on theories of merger-driven activity and evolution in galaxies.

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Proposal Category: GO
Scientific Category: ISM
ID: 8670
Title: The Role of Polycyclic Aromatic Hydrocarbons in Ultraviolet Extinction
PI: Geoffrey C. Clayton
PI Institution: Louisiana State University

We propose to use the STIS on HST to search for structure in the ultraviolet interstellar extinction curve, with particular emphasis on a search for absorption features produced by polycyclic aromatic hydrocarbons (PAHs). The existence of these molecules in the interstellar medium has been postulated to explain the infrared emission features seen in the 3-13 Mum spectra of numerous sources. However, these features have stubbornly resisted satisfactory identification. We propose to obtain high S/N UV spectra of stars which are significantly more reddened than those observed in previous studies. These data, which can now be obtained through the high sensitivity of STIS and HST, will allow us to estimate the abundances of PAHs in the ISM, to make identifications of individual PAH molecules and to put strong limits on the role of PAHs in UV extinction. The observational program will be guided by our ongoing laboratory studies of neutral and ionized PAHs at the low temperatures characteristic of the interstellar environment. PAHs are of importance because of their ubiquity and high abundance inferred from the infrared data and also because they may link the molecular and dust phases of the interstellar medium. A search for ultraviolet absorptions due to PAHs could be a definitive test of this hypothesis and, if successful, can identify the particular PAH species present; this is not possible from infrared data

alone.

Proposal Category: GO
Scientific Category: ISM
ID: 8671
Title: STIS Observations of a Magellanic Cloud Nova in Outburst
PI: S. N. Shore
PI Institution: Indiana University South Bend

We propose target-of-opportunity observations of a classical nova in the Magellanic Clouds in the early stages of its outburst. Nova outbursts are thermonuclear runaways triggered by accretion onto a white dwarf within a close binary system. As such, nova systems are a possible evolutionary stage on the way to a final accretion-induced collapse and a Type Ia supernova explosion. The study of how the accreted mass is mixed, the nuclear processing that occurs during the outburst, the energetics of the explosion, and the determination of ejecta masses constrain models for SNe Ia progenitors. The ultraviolet (UV) spectrum provides fundamental and unique information on the expanding nova ejecta. We propose to obtain spectrophotometric and line-profile information at sufficient resolution with STIS to determine the abundances and mass of the ejecta as a function of position in the nebula and, thereby, obtain a comprehensive picture of the energetics of the outburst, which can be compared to multidimensional hydrodynamic studies of nova explosions. Because novae are hot and have lines from chemical elements that are only detectable in the UV, the STIS UV capability is crucial for an analysis of nova ejecta. The nova will also provide a background source for study of the Galactic and MC interstellar media along the line of sight to the outburst.

Proposal Category: GO
Scientific Category: QAL
ID: 8672
Title: Establishing the Gaseous Phases of Galaxies Following the Epoch of Star Formation
PI: Chris Churchill
PI Institution: The Pennsylvania State University

We propose an ambitious program designed to: (1) establish if high ionization,

metal--rich halos/coronae were in place as early as z~ 1, which would imply that extended, early--epoch, galactic halos result from reprocessed galactic gas and that the kinematics are mechanically driven; (2) obtain the first comparison of the relative kinematics of low and high ionization species in z ~ 1 galaxies, covering a wide range of N(\HI) environments and Mg II kinematic spreads up to ~ 400 kms; (3) discriminate between single--phase and multi--phase ionization, and therefore spatial, absorbing structures (eg.\ Mg II clouds embedded in diffuse high ionization halos); and (4) place constraints on the gas--phase metallicites in early--epoch galaxies. We propose to obtain STIS R=30,000 (Delta v = 10 kms) spectra of five bright quasars, for which the FOS/ HST data are fully analyzed. Our observational goal is to resolve the absorption profiles of several low, intermediate, and high ionization species, including OVI,OI,NV,NIII,CIV,CIII,CII,[S II]V, [S II]II, and [S II]I, in 18 Mg II absorption systems covering 0.5 <= z <= 1.3. We incorporate our high signal--to--noise HIRES/Keck (Delta v=6.6 kms) profiles of MgII,\MgI, and Fe II of the low ionization absorbing gas, and our database of the absorbing galaxy luminosities, colors, and impact parameters.

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Proposal Category: GO
Scientific Category: QAL
ID: 8673
Title: The Properties of Ly-Alpha Absorbers at Redshifts Between 0.9<z<1.5
PI: Buell Jannuzi
PI Institution: National Optical Astronomy Observatories

We propose to use STIS to obtain new Echelle resolution (10 km s^-1) spectra of three bright quasars which, when combined with archived and scheduled observations, will be used to characterize the properties of Ly-Alpha absorbers in the redshift range 0.9<z<1.6. A well measured sample of approximately 300 Ly-Alpha absorbers, comparable in size to some of the samples being used successfully to characterize the properties of absorbers at higher redshifts, is the immediate objective of this program. The physical characteristics of the final sample will be compared to the expected properties derived from analysis of the ever increasing number of simulations of the IGM and Ly-Alpha absorbers at z~1 (e.g., Zhang et al. 1997; Dave et al. 1998; Riediger et al. 1998; and Theuns et al. 1998). While the simulations have all managed to reproduce the general observed properties of z~3

absorbers, they make different predictions for these properties at z~1. These differences arise because the expansion history of the universe and the rate of structure formation depend on the values of Omega and Lambda, and both affect the evolution of statistical properties of the absorbers. More broadly, comparison between the properties at z~1 and those at higher redshifts can test whether structure in the Ly-Alpha forest is evolving in the manner predicted by gravitational instability theories.

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Proposal Category: GO
Scientific Category: SF
ID: 8674
Title: STIS coronographic imaging of old PMS stars
PI: Anne-Marie Lagrange
PI Institution: Laboratoire d'Astrophysique de Grenoble

In the past decade, \cs (CS) disks of short lived dust and gas have been evidenced around \ms (MS) stars (e.g. \bp). The dust and gas are probably due to planetesimal collisions and/or comet evaporation. These so called ``second generation disks'' are then believed to trace the history of planetary systems formation, in a stage where planetesimals are numerous and planets may be already formed, i.e. an evolved stage compared to the disks around young stars such as Classical T Tauri stars, but yet prior to mostly dust free planetary systems such as those revealed by radial velocity searches., We recently began to investigate the missing link between MS and young stars CS environments by searching for second generation disks of dust or gas around the few known old +/-s stars and by modeling their CS environments. Our HST/NICMOS images revealed a disk around HD141569 (10 Myrs), and possibly also (but still to be confirmed) around HD100546 and HD135344. , We propose here to use the unprecedent detection capabilities of STIS/CORON to get high signal-to-noise (SN) images of HD141569 and HD135344. This will allow to study in much more detail the HD141569 disk, to confirm or infirm the other disk, and to perform fine modeling of the CS dust. This is a key step in the study of the complete evolution of (proto)planetary systems, from the PMS to the MS stages.

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Proposal Category: GO
Scientific Category: SP
ID: 8675
Title: The Massive Star Content of NGC 6822

PI: Luciana Bianchi
PI Institution: The Johns Hopkins University

We propose to characterize the young, coeval stellar population discovered with WFPC2 multiband imaging in a NGC6822 star forming region, with follow-up spectroscopy of the massive star candidates. Photometry alone is not sensitive to accurate measurements of temperature and extinction for stars hotter than B2. Blue spectra will provide spectral type classification, and measurements of the stellar temperature, which will allow us to construct meaningful H-R diagrams. UV spectra will provide critical measurements of ionizing luminosities, wind velocity and mass loss. STIS configurations allow a most effective observing strategy: we will take UV spectra in slitless mode, and the optical spectra with the STIS long slit in the G430L range, which will also provide spatially resolved information on the surrounding parent nebula. The UV plus optical spectra will yield a quantitative determination of all stellar parameters, and of the extinction properties, in this extremely metal -poor HII region. This study will provide a step forward in understanding how massive star formation (initial mass function, radiative and dynamical balance) and evolution depend on metallicity and other environmental factors. Resolved studies of local starbursts provide a key to interpret active star-forming distant galaxies. We also request WFPC2 parallel imaging to continue our stellar population study.

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Proposal Category: GO
Scientific Category: SP
ID: 8676
Title: Halo Microlens Source Systems and their Backgrounds and Reddening
PI: Kem Cook
PI Institution: Lawrence Livermore National Laboratory

The MACHO project is about to release 5.7 years of LMC data revealing ~ 20 candidate microlensing events, and suggesting the existence of dark objects in the Galactic halo. We propose to obtain medium-deep broadband images of 8 of the new candidate source stars. This will allow us to determine a) which star was actually lensed, b) the amount of crowding in our ground-based frames, c) if the stars are normal in the CMD, and d) if they lie preferentially at the back of the LMC. This provides a clear test for microlensing by halo objects.

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Proposal Category: GO
Scientific Category: SP
ID: 8677
Title: Extragalactic Novae: the Maximum Magnitude - Rate of Decline Relation in NGC 4472
PI: Laura Ferrarese
PI Institution: California Institute of Technology

The two goals of this proposal are: (1) to provide the first homogeneous observational constraints on theoretical models for novae outbursts; and (2) to assess the reliability of novae as standard candles. We propose to accomplish these goals by using WFPC2 to collect well sampled light curves for 20-50 novae in the supergiant elliptical galaxy NGC 4472, the brightest galaxy within 30 Mpc. Both the length of the observing window and the temporal sampling of the observations are specifically designed to ensure that the novae peak magnitudes and decline rates are measured accurately. These data will be used to construct the first `Maximum Magnitude versus Rate of Decline' (MMRD) relation for a galaxy beyond the Local Group. This relation is not only a potentially powerful standard candle, but its shape and dispersion are directly linked to physical parameters which govern the physics of novae outbursts such as the white dwarf mass, temperature and mass accretion rate. At present, it is impossible to investigate the universality of the MMRD relation since there exist no more than 30 extra-galactic novae with well sampled light curves (most in M31 and the LMC). Our short survey will therefore double the sample of novae light curves accumulated during the past century, and will provide the first strong observational constraints on theoretical models of novae production and outburst.
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Proposal Category: GO
Scientific Category: SP
ID: 8678
Title: Galaxy Mass and the Fate of the ISM in Candidate Proto-Spheroidals at z~0.2-0.4
PI: Rafael Guzman
PI Institution: Yale University

We propose to obtain STIS long-slit spectra for a sample of 5 faint blue

compact galaxies (BCGs) at z ~ 0.2 to 0.4. Despite being very luminous (M_B~-20), BCGs have velocity widths Sigma <~ 60 kms, and half-light radii r_e <~ 0.5'' (or R_e <~ 3Kpc). The small sizes and velocity widths suggest that BCGs are low-mass stellar systems (Mla10^10M_\odot), while their very blue colors, strong emission lines and low M/L-ratios indicate that they are undergoing a major starburst. If the star-forming process halts after the current burst, galaxy evolution models predict that BCGs will fade by ~3-4 magnitudes after a few Gyrs to reach the low luminosities and surface brightnesses characteristic of spheroidal galaxies. Thus we may be witnessing, in-situ, the last major episode of star formation in today's dwarf, low surface brightness galaxies such as NGC 205. Spatially-resolved spectroscopy will allow us to perform unique tests of this evolutionary scenario by providing: i) measurements of rotational velocities --rather than Sigma-- to determine whether BCGs are indeed low-mass stellar systems; and ii) evidence for any substructure in the line emitting region associated to SN-driven galactic winds. This information will shed light on the ultimate fate of the ISM in BCGs, and thus on whether it is reasonable to expect that no further star formation episodes will occur after the current burst.

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Proposal Category: GO
Scientific Category: SP
ID: 8679
Title: Constraining the Age of the Oldest Stars from the White Dwarf Cooling Sequence in M4
PI: Harvey Richer
PI Institution: University of British Columbia

We propose to search for the oldest and hence coolest white dwarfs (WDs) in M4, the nearest Galactic globular cluster to the Sun. New models for cooling hydrogen white dwarfs predict that their colors should become bluer, rather than redder, with increasing age. Our goal is to test these models and at the same time constrain the age of M4. This would be the first test of globular cluster ages ever done that would not depend on the timescale to exhaust the hydrogen core of a main sequence star. New revised distance moduli and stellar evolution models now support an age of 11.5+/- 1.5 Gyr for the globular clusters. If we can reach V=30, we can solidly measure the turnover in the M4 WD luminosity function for an age of 12 Gyr, and we will get meaningful constraints on larger ages. The images will be taken in a single field of the

cluster using the WFPC2 and the F606W and F814W filters. If we are successful in reaching the termination point of the WD cooling sequence in this cluster we will be able to derive an accurate estimate for the age of the cluster and, with only a mild extrapolation, for the Universe itself. Further, if it is indeed correct that the lensing objects in the various microlensing experiments in the direction of the Magellanic Clouds are old WDs, then these data will also prove to be critical in guiding the extensive searches that are now being carried out to find local examples of these MACHOs.

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Proposal Category: GO
Scientific Category: SS
ID: 8680
Title: The Asymmetric Atmosphere of Uranus
PI: Heidi Hammel
PI Institution: Space Science Institute

We propose to image Uranus as the planet plunges toward equinox in 2007. Recent HST images during this unique epoch (6818: Hammel, Lockwood, and Rages; 7429: Tomasko and Karkoschka; 7885: Hammel, Karkoschka, and Marley) have revealed: (i) strongly wavelength-dependent latitudinal structure, (ii) the presence of numerous visible-wavelength cloud features in the northern hemisphere, (iii) zonal winds which may deviate from the smooth profile implied by the Voyager observations in 1986, and, (iv) in the near-IR, discrete features northward of +25degrees\ that have the highest contrast ever seen for a Uranian cloud (Karkoschka 1998, Science 393, 765-767; Hammel Etal 1999, submitted to Icarus). Specific scientific issues we will address with new observations are: whether the northern features are indicative of intrinsic change or result simply from a change of viewing angle; the shape and stability of the zonal wind profile; and the source of the as-yet unexplained variations of the atmospheric reflectivity. When possible, observations will be coordinated with ground-based imaging, spectroscopy, and photometry. This period approaching equinox is the first opportunity (in the era of modern instrumentation) to examine the far regions of the northern hemisphere on Uranus.

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Proposal Category: SNAP
Scientific Category: AGN
ID: 8681

Title: A Snapshot Survey of Variability of Narrow and Broad Associated Absorption Lines in Quasars
PI: Jane Charlton
PI Institution: The Pennsylvania State University

Variability in the strength of absorption lines in quasar spectra is definitive proof that we are observing material that is physically associated with the quasars. We propose to conduct a STIS snapshot survey to provide second epoch observations of 37 quasars with narrow associated (Delta v<5000 kms) or broad absorption lines (NALs and BALs), previously observed with the FOS. At high redshift several intrinsic NALs and about two thirds of BALs are known to vary, often in accord with continuum variability. The timescales decrease with increasing quasar luminosity. The low-redshift sample of quasars in the FOS archive includes a larger fraction of nearby low-luminosity quasars. Thus it may show more extreme variability in intrinsic absorption lines than the high redshift sample. The present study will provide: (1) an estimate of the fraction of quasars that have intrinsic NALs, (2) a lower limit on the fraction of intrinsic NALs and of BALs that are variable and (3) an indication of the relationships between continuum, emission line, and absorption line variability in various chemical species. More importantly, this snapshot survey will produce a database of variable low-z NALs and BALs for studies at higher temporal and spectral resolution. Well resolved time variability and partial coverage analysis of multiple chemical transitions in these quasars may well provide the most detailed views yet of outflows from the central engines.

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Proposal Category: SNAP
Scientific Category: COS
ID: 8682
Title: A snapshot study of 0<z<1 sub-mJy starburst galaxies
PI: Stephen Serjeant
PI Institution: Astrophysics Group, Imperial College

The observational constraints on the cosmic star formation history is currently among the most active fields in observational cosmology. The most widely used tracer of the comoving volume-averaged star formation rate (SFR) is the UV luminosity density, which early results found to peak at z~1-2. The apparent identification of the primary epoch of metal production and star

formation in the Universe led to intense theoretical and observational interest. Nevertheless, and remarkably for such a fundamental observation, little is known about the history of star formation in the Universe beyond its global average. Also, obscuration corrections are critical, and the UV luminosity is highly sensitive to these dust corrections. The most ideal obscuration-independent starburst selection is the decimetric radio flux, which measures both obscured and unobscured star formation. Here we propose to extend our cycle 8 program of WFPC2 F814W snapshots of sub-mJy starbursts, selected at low radio frequency to avoid AGN and provide a robust SFR conversion. We will greatly extend our luminosity and redshift range, to determine the evolving morphologies and effects of obscuration in the galaxies which dominate the cosmic SFR at 0<z<1. Our higher-z targets are also very likely high-z counterparts of local IR-luminous / ultraluminous galaxies.

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Proposal Category: SNAP
Scientific Category: GAL
ID: 8683
Title: Imaging of brightest cluster galaxies: the high end of the black hole mass distribution
PI: Roeland van der Marel
PI Institution: Space Telescope Science Institute

Kinematic black hole (BH) detections in galaxies indicate that the mass \Mbh correlates with both optical luminosity L and radio power P. However, these quantities are themselves not tightly correlated, suggesting the existence of a multi-variate relation between \Mbh, L and P. To study this relation we propose a WFPC2 I-band snapshot survey of brightest cluster galaxies (BCGs). BCGs have a nearly universal optical luminosity, but their radio power varies by >10^4. We will infer the nuclear surface brightness profiles and central cusp slopes, which yield photometric BH mass determinations using Young's adiabatic BH growth models. Such determinations agree well with kinematical measurements (van der Marel 1999), so this provides an efficient method to study a large sample without time-consuming spectroscopy. We focus on the galaxies in the volume limited sample (z <= 0.05) that we have studied from the ground at optical (Lauer & Postman) and radio (Owen, O'Dea) wavelengths. We will use the HST data to estimate the scatter in cusp slope and \Mbh at fixed optical luminosity, and its correlation with radio power. The images will also provide an important database for studying the relation between

satellite accretion, multiple nuclei and the brightness profiles of BCGs. The dataset will be generally useful for studies of many kinds, and for maximum benefit to the community we give up all proprietary rights.

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Proposal Category: GO
Scientific Category: AGN
ID: 8684
Title: Emission Lines from Photoionized Accretion Disks and Winds in AGNs
PI: Michael Eracleous
PI Institution: The Pennsylvania State University

A fundamental gap that remains in our knowledge of AGNs is the origin and dynamics of the gas that produces their broad optical and ultraviolet emission lines. In most other accreting systems, emission lines are demonstrably linked either to the accretion disk or to an accretion-disk wind; these are both leading hypotheses for the origin of emission lines in AGNs as well. We can test both of these models by exploiting the extreme properties of the so-called ``double-peaked emitters.'' These very broad double-peaked emission lines have proven to be uniquely capable of testing dynamical models, and as a result several theories are no longer considered likely. The two major theories that are the subject of this proposal require HST for their evaluation because they make contrasting predictions about the differences between the Balmer-line and UV resonance-line profiles. In fact, there is good evidence that both photoionized disk atmospheres and radiatively driven winds contribute to observed emission lines in varying degrees. We have preliminary evidence that points toward luminosity as the primary factor which controls the relative importance of disk and wind. By observing a set of four more double-peaked emitters covering a wide range of luminosity, we will test the hypothesis that photoionized disk atmospheres dominate line production at low luminosity and winds dominate at high luminosity.

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Proposal Category: GO
Scientific Category: GAL
ID: 8685
Title: Isolated compact stellar systems in the Fornax Cluster
PI: Michael Drinkwater
PI Institution: University of Melbourne

We have discovered a new population of compact objects in the centre of the Fornax Cluster. These objects have spectra typical of old stellar systems, but are unresolved in ground-based imaging. They are all at least 10 times more luminous than any Galactic globular clusters, but fainter than any known compact dwarf galaxies. They may be a new class of intermediate object, neither globular clusters nor dwarf galaxies but something in between. We request HST imaging of a sample of these objects to measure their light profiles and determine their structure. We need the high resolution imaging of HST to measure the radii of these objects which we will combine with ground-based spectroscopy to determine their mass-to-light ratios. This will allow us to compare them to known compact objects such as globular clusters and the nuclei of dE galaxies to establish if they do indeed represent a new class of hitherto unknown stellar system.

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Proposal Category: GO
Scientific Category: GAL
ID: 8686
Title: LINERs in Early-type Galaxies: Ionized by the UV-upturn Population ?
PI: Paul Goudfrooij
PI Institution: Space Telescope Science Institute

Our recent ground-based imaging and spectroscopic surveys have revealed the presence of extended ionized gas with LINER spectra in a large fraction (60--70\ galaxies. In order to provide clues to the nature of this gas, we propose to obtain deep STIS far-UV images of a suitable sample of 8 nearby ellipticals and E/S0s to test in detail whether the ``UV upturn'' population in early-type galaxies (AGB-manque stars and post-AGB stars) is a viable source of ionization for the observed ionized gas in ``normal'', radio-quiet E and E/S0 galaxies. STIS is the first and only instrument able to provide data to study the radial distribution of the UV-bright population, as its influence is expected to show up only in the central few hundred parsec. The observed radial (far-UV - optical) color gradients will be compared to detailed spectrophotometric synthesis models to deduce the number of ionizing photons and their spectral energy distribution, from which we will deduce the expected emission-line spectra and H-alpha\ luminosities as a function of radius. We also request narrow-band WFPC2 images for 5 galaxies in our sample to derive

the central radial surface brightness profile of the H-alpha+N II\ emission
which can be directly compared to the model prediction. The other 3 galaxies
have such WFPC2 data already available in the archive.
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Proposal Category: GO
Scientific Category: GAL
ID: 8687
Title: Elliptical Galaxies With Nuclear Disks of Stars: Black
                     Hole Search and Stellar Populations
PI: John Kormendy
PI Institution: University of Hawaii

def\ts def\mbhM_o We propose STIS spectroscopy of the galaxies NGC 3706 (E3)
and NGC 4486A (E2) to search for supermassive black holes (BHs). NGC 3706
contains a bright, edge-on nuclear disk of stars. Therefore we can measure
the BH mass \mbh\ as easily as in a galaxy with a gas disk but without
uncertainty about whether the motions are affected by non-gravitational
forces. NGC 4486A, like NGC 4486B, is a dwarf elliptical companion of NGC
4486 (M\ts87) with signs of an unusually massive BH. Keck spectroscopy shows
that its velocity dispersion Sigma ~eq 160 km s^-1 is abnormally high for a
dwarf galaxy of absolute magnitude M_B ~eq -17.5. We want to know whether it
is an exception to the correlation of \mbh\ with bulge luminosity. We propose
low-resolution Mg I b spectroscopy of the above galaxies and NGC 5845 to
compare the stellar populations in their nuclear disks with those of their
bulge components. Many ellipticals contain dust disks or stellar disks. NGC
4486A and NGC 5845 are ``Rosetta stone'' objects that contain both. They can
provide direct evidence that gas disks grow stellar disks near the centers of
early-type galaxies and thereby secularly increase the cuspiness of the mass
distribution. The timescale of this process is unknown. Our spectra would
tell us the relative ages of the stellar disks and bulges in two ellipticals
that are caught in the act and in one with a remarkably prominent and fully
formed stellar disk.
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Proposal Category: GO
Scientific Category: GAL
ID: 8688
Title: Gamma-ray bursts: discovering the progenitors and
                     understanding the explosion

PI: S. R. Kulkarni
PI Institution: California Institute of Technology

Gamma-ray burst astronomy, one of the most active and exciting frontiers in astrophysics, is now entering a critical stage -- with dramatic leaps in our understanding of these events, as well as new discoveries imminent. In the upcoming year, improvements in triggering and positioning accuracy provided by the SAX and HETE-2 gamma-ray satellites will allow entirely new classes of events to be studied. Given the recent progress in this field, we are now in a position to design precision, broadband measurements that can provide quantitative information on the as-yet unknown energy sources, the explosion geometry, and the surrounding medium. In particular, the growing evidence of an intimate connection between SNe and GRBs can be definitively tested. We propose a set of HST TOO and standard observations, synergistic with ground-based radio, IR and optical observations, as well as CXO measurements, designed to answer the outstanding and fundamental questions in GRB astronomy. We believe this program will dramatically alter our understanding of these events, and will become a significant part of the scientific legacy of

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Proposal Category: GO
Scientific Category: GAL
ID: 8689
Title: UV extinction in Dusty Ellipticals
PI: James Rhoads
PI Institution: Kitt Peak National Observatory

We propose UV spectroscopy of bright inner parts of two dusty elliptical galaxies to study their ultraviolet extinction, in particular the 2175 Angstrom bump. These galaxies are selected from a sample of dusty ellipticals having very different, and in some cases highly chromatic extinction law in the visible (Goudfrooij et al. 1994). A chromatic extinction law requires either a deficiency of carbonaceous grains or a smaller typical grain size relative to Milky Way dust. The strength of the 2175 Angstrom\ feature, which is due to carbon grains, is the best way to distinguish between these two possibilities. A smaller typical grain size can come about due to grain erosion by x-ray gas, or due to lack of grain growth in dense molecular clouds. A deficiency of carbonaceous grains could come about due to chemical sputtering by hydrogen or due to reduced production of carbonaceous grains by

aging stellar populations. These observations will distinguish between different physical explanations for anomalous optical extinction properties, and will thereby constrain the evolutionary history and physical conditions in the interstellar media of elliptical galaxies.

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Proposal Category: GO
Scientific Category: GAL
ID: 8690
Title: The Central Region of NGC4696: Manifestation of the Physics of Mergers?
PI: William Sparks
PI Institution: Space Telescope Science Institute

Massive, dominant ellipticals with attendant emission-line gas, dust and hot, heavy X--ray emitting coronae lie at the very centers of galaxy clusters. The physics of these complex, high pressure regions remains controversial: Are cooling flows responsible? Do mergers dominate, with massive accretion events triggering an array of phenomena? Is the AGN crucial? A major impetus to understanding the physics of these regions will come with Chandra. NGC4696 in the Centaurus galaxy cluster is archetypal. WFPC2 images have shown a dramatic bifurcation between gas and dust. The nucleus itself is seen to be a compact triple, with two blue components straddling a third red one. We propose to obtain STIS long-slit spectra (\romannumeral1) along a line-emission filament and (\romannumeral2) along a dust filament: are we witnessing physical separation of gas and dust, as in comet ion/dust tails, due to late stage merger physics; or are very high velocities, due to powerful AGN influences, shifting emission lines out of filters? Is the HAlpha+NII filament a shock, responsible for the known off-center X--ray peak? (\romannumeral3) A third spectrum will be across the compact 0.26'' triple nucleus: is it a multiple nucleus confirming the merger scenario; or a disk around a black-hole, allowing mass determination; or the first double optical synchrotron jet; or a gravitational lens? A wealth of vital physical and kinematical data will result from these carefully selected spectra.

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Proposal Category: GO
Scientific Category: HS
ID: 8691
Title: Calibrating the Cosmic Meter Stick: The Distance to the

LMC Using Eclipsing Binaries
PI: Edward Guinan
PI Institution: Villanova University

The LMC distance is crucial for the calibration of the Cosmic Distance Scale. However, there is considerable disagreement about this fundamental measurement, with discrepancies among different methods of ~ 10\ immune from zero-point uncertainties plaguing less direct methods, we recently determined an accurate distance (m-M = 18.30 +/- 0.07 mag.) to the LMC eclipsing binary (EB) HV2274. This distance was derived from ground-based light curves, HST/FOS spectrophotometry, and GHRS radial velocity data. We propose HST/STIS observations of three additional LMC EBs, carefully chosen from the large MACHO and EROS surveys, to determine more accurately the LMC distance. These detached, uncomplicated EBs, in the Bar or 30 Dor region, minimize corrections to the LMC centroid. HST/STIS low-dispersion spectrophometry (115 - 580 nm) will be used to determine T_eff and E(B-V). STIS/G140M observations yield accurate radial velocities of these double-line systems which, when combined with the light curves and temperatures, yield the stellar radii and luminosities, and distances. These data form the core of this program to determine the LMC distance, thereby firmly establishing the length of the Cosmic Meter Stick to better than 2\

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Proposal Category: GO
Scientific Category: ISM
ID: 8692
Title: Search for an Optical Counterpart to the Central X-ray Point Source in Cas A
PI: Robert Fesen
PI Institution: Dartmouth College

First-light Chandra X-ray Observatory images have uncovered a central point-like source in Cas A, the Galaxy's youngest known supernova remnant (SN 1680). The object lies within 5'' of the remnant's estimated expansion center and is presumably either the remnant's neutron star or black hole. Preliminary analysis of the source's ACIS spectrum indicates Si (and possibly S) emission, not unlike that seen in the remnant's ejecta, suggesting possibly an accretion disk of fall-back SN debris. If this spectral analysis holds up, there is then a good chance of detecting an optical emission line counterpart. We propose

to obtain deep `white light' STIS images of the Cas A center during five LOW background orbits to search for an optical candidate down to ~ 29.5 mag. Complementary WFPC2 images of Cas A which are sensitive to ejecta line emission and already scheduled as part of a Cycle 8 program will be combined to yield spectral information on all but the faintest sources. These data will constrain the point source's nature through limits on its X-ray/optical flux ratio, color properties, and the presence of any extended emission structure. If a sufficiently bright optical source is found coincident with the X-ray position, five additional orbits (TOO) are requested for low-dispersion STIS spectra to search for optical line emission.

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Proposal Category: GO
Scientific Category: ISM
ID: 8693
Title: Interstellar Boron & Oxygen Abundances in the Cep OB2 Association: Probing Neutrino Nucleosynthesis
PI: Verne V. Smith
PI Institution: University of Texas El Paso

A specific nuclear process associated with core-collapse supernovae involves the inelastic scattering of neutrinos (produced as a result of the core collapse) off of abundant nuclei in the outer layers of the dying star. Two relatively low-abundance elements, boron and fluorine, have been suggested to owe some uncertain fraction of their cosmic abundances to this process. In the case of boron, the dominant isotope is ^11B, and neutrinos interacting with ^12C can lead to its synthesis. Fluorine-19 is the only stable F isotope and it can be produced by neutrino scattering removing a proton from ^20Ne. Competing processes can also synthesyze these elements: cosmic-ray spallation reactions for B and shell He-burning in AGB stars for F. In order to gauge the importance of neutrino nucleosynthesis in the chemical evolution of the Galaxy, we will use HST with STIS to determine interstellar B and O abundances in the gas associated with the Cep OB2 association (using the B II 1362Angstrom\ and O I 1356Angstrom\ lines). These results will be combined with observations of interstellar F I along the same lines-of-sight obtained with FUSE (fluorine can only be compared directly to boron using interstellar lines and interstellar F is only observable with FUSE). The derived F/O and F/B ratios in Cep OB2 will allow us to determine the relative importance of neutrino nucleosynthesis to the origins of B and F.

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Proposal Category: GO
Scientific Category: ISM
ID: 8694
Title: Probing the Galactic Halo and Beyond with Young Supernovae
PI: George Sonneborn
PI Institution: NASA's Goddard Space Flight Center

We propose a Target of Opportunity program to obtain STIS echelle spectra of a bright new supernova (V<= 14) to characterize the ionization state, gas-phase abundances, depletion on dust grains, metallicity, and gas kinematics in the Galactic halo, the ISM and halo of the SN's host galaxy, and, if the properties of the sightline are favorable, in the intervening intergalactic medium. The principal spectral region for this study is the far ultraviolet (\wl <1700Angstrom), which provides a comprehensive set of lines to study the hot, warm, and cool phases of the ISM. New core-collapse supernovae, with their strong, nearly featureless UV continua, provide outstanding opportunities to obtain high-quality absorption line spectra of the gas on the line of sight to the SN, but only if the observations are executed within ~1 week of outburst. Our team has the experience and extensive ground-based support to promptly assess the suitability of each newly-discovered supernova for this program and to quickly provide all the necessary data to rapidly execute the observations. This proposal is a continuation of our Cycle 8 TOO program, for which we await a suitable target.
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Proposal Category: GO
Scientific Category: QAL
ID: 8695
Title: The Nature and Distribution of O VI Absorbers in the Vicinity of Galaxies
PI: Todd Tripp
PI Institution: Princeton University Observatory

Hydrodynamic cosmological simulations predict that at z ~ 0, up to 50\ of the baryons are in a shock-heated gaseous phase at 10^5 -- 10^7 \ ^degreesK. Such gas may be easiest to detect via O VI absorption lines in the spectrum of a background QSO. We have recently discovered several low redshift O VI

absorption line systems in the vicinity of groups of galaxies. In some cases these absorbers are highly ionized, and the O VI lines can be quite weak. In one case, low and intermediate ionization stages are detected, as well as O VI, with complex velocity structure. Here we propose to study PG1259+593 (z_Q = 0.472) with the STIS E140M echelle mode to substantially improve the statistical base of observed O VI absorbers (including weak lines) for comparison with the cosmological models and to constrain the physical conditions and abundances in these systems and their relationships with galaxies. We will also obtain follow-up observations of PG0953+415. With these observations we will (1) measure the number of O VI absorbers per unit redshift (dN/dz) with a limiting equivalent width of W_Lambda ~25 mAngstrom , (2) examine whether the O VI absorption arises in photoionized, collisionally ionized, or multiphase gas, (3) estimate the absorber metallicities, and (4) study the dependence of the absorber properties on the proximity of luminous galaxies. These observations will be useful for testing predictions from the cosmological models.

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Proposal Category: GO
Scientific Category: SP
ID: 8696
Title: Disentangling the Bulge and NGC 6528 - a proper motion study
PI: Sofia Feltzing
PI Institution: Lund Observatory

We propose to obtain second epoch WFPC2 observations of the Galactic globular cluster NGC 6528. These will be used to obtain proper motions of the cluster relative to the background bulge field and thus provide, for the first time, a colour-magnitude diagram of NGC 6528 free from background stars. NGC 6528 is perhaps the most metal-rich globular cluster known and as such serves as an invaluable template for calibrating and understanding metal-rich stellar populations in extra-galactic bulges and disks, as well as serving as a template in studies of our own Galactic Bulge. Observations of this cluster are, however, severely hampered by it being superimposed on and physically close to the Galactic Bulge itself, resulting in a colour-magnitude diagram made up of Bulge and cluster stars. Thus the images currently available in the HST-archive are of limited, if any, use as a template for metal-rich stellar populations. Proper-motion studies of globular clusters, eg. NGC 6379, have

proved extremely efficient in cleaning the CMD from field stars.

Proposal Category: GO
Scientific Category: SP
ID: 8697
Title: Stellar Populations in the Disk-Halo Interface of NGC 55
PI: Annette Ferguson
PI Institution: Institute of Astronomy

The disk-halo interface is where the global effects of stellar feedback on the ISM are expected to be most pronounced. Our deep ground-based emission--line images of the nearby, edge--on SBm galaxy NGC 55 provide a particularly spectacular example of this phenomenon. In addition to numerous supergiant ionized filaments and shells, our images also reveal the surprising discovery of several candidate HII regions located at significant heights (1--2 kpc) above the disk plane. We have obtained high-resolution ground-based broad-band images for the brightest of these candidate HII regions, revealing several underlying blue continuum sources, supporting the idea that such regions might be the site of in situ star formation in the disk--halo interface. If recent star formation has occurred in these clumps, it would have extremely important implications for understanding the disk--halo connection in galaxies. Further, if this is not an isolated event, there should be a faint background thick disk/halo. We propose to obtain WFPC2 UVI images of these candidate HII regions to resolve the embedded stars that appear to be present, together with parallel STIS observations to investigate a possible background thick-disk/halo stellar population, about which there is little information in very late-type disk systems, and which will place our targetted WFPC2 HII region

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Proposal Category: GO
Scientific Category: SP
ID: 8698
Title: Identification of the Galaxy's Missing Mass
PI: Jeremy Mould
PI Institution: Australian National University

The nature of dark matter is one of the key astrophysical questions of the day. The existence of dark matter and its dynamical dominance in the outer

parts of our Galaxy and spiral galaxies with flat rotation curves is well established. The MACHO project has identified ~half of the Milky Way's dark matter with stellar objects of ~0.5 M_\odot, probably white dwarfs. But the location of the microlensing in the halo is disputed. Ibata et al (astroph-9908270) have detected two candidate halo white dwarfs of L/L_\odot ~ 10^-5 in the Hubble Deep Field with 25 +/- 5 mas/year proper motions. They argue that this could be the missing mass. We propose to make second epoch observations of 20 WFPC2 fields in the Groth parallel program. If Ibata et al are correct, we expect to see five times the number of white dwarfs, at half the distance, with twice the proper motions, and ~three times the time baseline. The angular shift of these objects will be ~300 mas, readily detected with WFPC2. In addition, the detected objects will be bright enough for low dispersion spectroscopy with large telescopes. If we confirm the Ibata et al result, quantitative constraints will be put on the fraction of the Galaxy's missing mass in this new stellar population.

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Proposal Category: GO
Scientific Category: SS
ID: 8699
Title: The Origin of Short-Period Comets
PI: Philippe LAMY
PI Institution: Laboratoire d'Astronomie Spatiale

Following our recent success in detecting and characterizing eight cometary nuclei with the HST and our approved program to detect 14 nuclei currently underway in cycle 8, we propose a major program to determine the basic physical properties of a large fraction of the population of short-period comets. By acquiring statistically significant data, we can study the origin of this family of comets and test the hypothesis that they are collisional fragments from the Kuiper Belt Objects. Our technique takes advantage of the high resolution of the PC2 to clearly distinguish the nuclei from the surrounding comae provided they come within ~2.75 AU from Earth. Cycle 9 is exceptionally favorable as 14 short-period comets meet this criterion. By observing each nucleus eight different times, we will construct a light curve from which we can derive the shape and rotation period. Observations will be made through several filters (some combination of U,B,V,R,I depending on the brightness) to obtain unique color information. If appropriate, corrections will be applied to the measured sizes to remove the effect of erosion and

retrieve the ``original'' size distribution function. The results on the size, shape, rotation period, and color to be obtained during this survey will significantly contribute to the database of the physical properties of cometary nuclei, nearly doubling the amount of reliable information currently available.

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Proposal Category: SNAP
Scientific Category: AGN
ID: 8700
Title: A STIS Spectroscopic Snapshot Survey of 3CR Radio Galaxies : The Nature of the Unresolved Nuclei
PI: Andr'e R. Martel
PI Institution: The Johns Hopkins University

The 3CR Snapshot Survey, conducted with HST in Cycles 4-8 in broad-, LRF, and UV/MAMA filters, has revealed the existence of unresolved nuclei or spikes in 36 ellipticals ellipticals with z<0.25. These are found in both FR I and FR II radio types, over a wide range of radio luminosities and emission-line properties. In this project, we propose to perform STIS snapshot long-slit spectroscopy of these nuclei over 2900-10300 AA\ to classify them (QSO, NLRG, BLRG, BL Lac, \ldots) and establish their AGN characteristics down to the lowest nuclear luminosities, while still within powerful 3C radio galaxies. Our primary goals are : (1) to test unification schemes by identifying previously undetected signatures of low-level AGN/QSO activity in their spectra in the form of weak, broad emission lines, featureless continua, and UV excess, (2) to constrain the FR I/BL Lac connection by measuring the relative contribution of thermal (starburst), non-thermal (optical synchrotron), and line emission, and (3) to perform line and continuum diagnostics to determine the dominant ionization mechanisms in the circumnuclear regions (tenths of arcseconds) and the role of dust extinction in the NLRGs and BLRGs in the form of geometrically thick or thin tori and foreground dust.

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Proposal Category: SNAP
Scientific Category: CS
ID: 8701
Title: Multiplicity among Very-Low Mass Stars and Brown Dwarfs in Alpha Persei and the Pleiades

PI: Eduardo Martin
PI Institution: Caltech

Open clusters provide excellent hunting grounds for brown dwarf (BD) searches. The AlphaPer and Pleiades clusters are young (80--120 Myr), nearby (120--175 pc), and have low extinction. They are cosidered to be the best-suited places to study the Substellar Mass Function (SMF). A dozen of cool faint AlphaPer and Pleiades members have been confirmed as ``bona-fide'' BDs with the lithium test. By comparison with those, about 60 very good cluster BD candiates are currently known. The Pleiades SMF obtained using the most recent deep large CCD surveys indicates that BDs are quite numerous but do not make a significant contribution to the total cluster mass. One of the main uncertainties of the SMF is the effect of binary corrections. We propose a WFPC2 search for faint companions to very low-mass cluster stars and BDs. We will use any identified companions to provide empirical constraints on BD evolutionary models, to test our ideas about fragmentation in molecular clouds, and to correct the SMF. The sensitivity of WFPC2 shows that we can readily detect secondaries with masses of about 25 Jupiters orbiting at about 40 AU from our targets. Companions with masses of about 15 Jupiters can be detected at separations of 80 AU.

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Proposal Category: SNAP
Scientific Category: ISM
ID: 8702
Title: The Most Elusive Nuclei of LMC Planetary Nebulae
PI: Richard Shaw
PI Institution: Space Telescope Science Institute

We propose to carry out a SNAPSHOT survey of the faintest nuclei of planetary nebulae (PNe) in the LMC. This program will be a crucial follow-on to a Cycle 8 SNAPSHOT of LMC PNe; here we plan to observe the faintest or most obscured nuclei to determine their evolutionary state to an accuracy not possible in the Galaxy. These faintest central stars are predicted to be among the most massive nuclei, and owing to the typically advanced age of the surrounding nebulae, are the most sensitive discriminants for validating the post-AGB evolution timescales predicted by theory. The key to calibrating the evolutionary timescales is to relate them to the nebular dynamical (expansion) timescale. By studying the parallel evolution of nebula and star it will be

possible to gain a firm understanding of the complex interplay between the progenitor mass, and the post-AGB evolution of the nebula and the central star.

Proposal Category: GO
Scientific Category: AGN
ID: 8703
Title: A Spectacular Post-Starburst Quasar and the AGN--Starburst Connection
PI: Michael Brotherton
PI Institution: Lawrence Livermore National Laboratory

We propose broad-band imaging of the spectacular post-starburst quasar UN J1025-0040 (V=19, z=0.634). The optical spectrum is a chimera, dominated in the blue by light from a quasar, and dominated in the red by light from a 400-Myr-old starburst with a mass possibly as much as 10^11 M_SUN. The total energy budget of both sources appears similar, 10^11.6 L_SUN. The extended fuzz of the host galaxy is asymmetric toward a nearby companion (dominated by an 800-Myr-old starburst), signifiying some kind of interaction. The relationship between the starburst and the quasar is unclear. The resolution of the Hubble Space Telescope is required to determine if the starburst is located in a second nucleus of a merging system, a circumnuclear ring, or some more complex geometry. The extreme nature of this post-starburst quasar provides a unique test case to investigate the connection between galaxy interactions, starbursts, and AGN activity.

Proposal Category: GO
Scientific Category: COS
ID: 8704
Title: The Distance to the Type Ia SN 1999by in NGC 2841
PI: Peter Garnavich
PI Institution: University of Notre Dame

HST is unique in its powerful ability to directly calibrate type Ia supernova luminosities by observing Cepheid variables in their host galaxies. Still, only five SNIa with light curves obtained photoelectrically have had their hosts distances measured and most of these are slow-declining, over-luminous events. We propose to estimate the distance to SN 1999by, a sub-luminous type

Ia, by obtaining light curves of Cepheid variables we discover in NGC 2841. The Cepheid distance to SN 1999by combined with the previously measured SNIa will be used to calibrate all ~40 well-observed SN Ia events in the Hubble flow to estimate an unbiased Hubble constant. Because intrinsically faint SNIa are most often found in E/S0 galaxies, SN 1999by provides the only case where Cepheid calibration of a sub-luminous SNIa is possible.

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Proposal Category: GO
Scientific Category: COS
ID: 8705
Title: External Shear in the Time-Delay Lens RX J0911+05
PI: Jens Hjorth
PI Institution: University of Copenhagen

We propose to map the mass distribution in the vicinity of the multiple QSO system RX J0911+05 using weak gravitational lensing. This object has emerged as one of the most promising candidates for a cosmological determination of the Hubble constant using time delay measurements. There is evidence that a high-redshift group or cluster of galaxies (z=0.6--0.8) acts as the source of a very large external shear (Gamma > 0.15), affecting the lens potential. Deep WFPC2 images will allow us to directly measure this shear from the distortions of faint background galaxies. Such data are essential for producing a reliable mass model of the system which, in combination with the newly measured time delay, will provide the best constrained mass model for a multiple QSO, hence leading to an accurate cosmological estimate of the Hubble constant.

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Proposal Category: GO
Scientific Category: GAL
ID: 8706
Title: Phoenix: ``halo/disk'' structures in dwarf galaxies
PI: Antonio Aparicio
PI Institution: Instituto de Astrofi sica de Canarias

Hierarchical clustering scenarios for galaxy formation predict that dwarf galaxies are the first to be formed and that they are building blocks of larger galaxies. We propose here to measure the spatial structure and the stellar age and metallicity distribution of the Phoenix dwarf galaxy to give support or reject such scenarios. The kind of detailed study we propose can

only be carried on in nearby dwarfs and using the HST. We intend to obtain very deep V and I color-magnitude diagrams reaching the oldest MS turn-offs of a central and an outer field of Phoenix. Applying our techniques based on synthetic color-magnitude diagrams, we will determine the stellar population (age and metallicity distribution) gradients as a function of the galactocentric distance. Combined with our previous ground-based study of the galaxy, this will provide evidences of whether or not Phoenix has a real ``disk/halo'' structure and will allow to trace out the early phases of its evolution.

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Proposal Category: GO
Scientific Category: GAL
ID: 8707
Title: A Study of Star Formation in Galactic Resonance Rings
PI: Ronald Buta
PI Institution: University of Alabama

Rings of star formation are a common phenomenon of early-type spiral galaxies. Most rings form by gas cloud collisions near resonances, under the continuous action of gravity torques from a bar perturbation, while a small number form in response to a mild tidal interaction with a nearby companion. In either case, a resonance is a very special place in any galaxy where star formation can be enhanced and may proceed either as a starburst or continuously over a long time period. Resonance rings are natural dynamical laboratories for star cluster formation and evolution. We are proposing here to study star formation in two galaxies where we feel certain that the rings are resonance rings with a different origin. NGC 3081 has four excellent star-forming rings that are easily connected to bar-driven gas dynamics, while NGC 4622 is a nonbarred spiral where a strong inner ring is easily connected to a tidal interaction. We wish to isolate the young clusters in the rings of these two galaxies, measure their ages and luminosity functions, examine the properties of the background starlight, and use the information to trace the dynamics of these galaxies and understand the interplay between perturbations, gas dynamics, and star formation in normal galaxies.

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Proposal Category: GO
Scientific Category: GAL
ID: 8708

Title: NGC 625: An Intriguing Nearby Dwarf Starburst Galaxy
PI: Evan Skillman
PI Institution: University of Minnesota

NGC 625 is a dwarf irregular galaxy in the nearby Sculptor group which is experiencing a strong burst of star formation. Its close proximity and high galactic latitude make it a very desirable target to help us to understand the starburst phase of dwarf galaxies. WFPC2 observations are needed to combine with existing HI synthesis imaging, ground based optical imaging and spectroscopy, and x-ray imaging in order to construct a coherent model for this starburst. Specifically, we need high resolution optical imaging at V and I in order to reconstruct the recent star formation history. This will allow us to assess the impact of the burst on the HI and the development of the x-ray emission in a self-consistent way. Our ultimate goal is a better understanding of the average duration of bursts of star formation and the duty cycle for bursting star formation in dwarf galaxies through comparative studies of nearby systems.

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Proposal Category: GO
Scientific Category: HS
ID: 8709
Title: UV Light from Old Stellar Populations: A Census of UV Bright Stars in `Blue Tail' Globular Clusters
PI: Francesco R. Ferraro
PI Institution: Osservatorio Astronomico di Bologna

We propose observations of UV-bright stars in 7 Galactic Globular Clusters (GGCs). These will complement data obtained during Cycles 5 and 6. Our goals are multifold: (a) to observe the morphology in the faint blue tails (BTs) of GGC horizontal branches (HBs); (b) to explore the relationship between the HB mass distribution in BT clusters to the clusters' structural and dynamical properties; (c) to gain further samples of Blue Straggler Stars and the long-sought Cataclysmic Variables in GGC cores; and (d) to obtain relatively large samples of post main sequence stars. All the targets have a BT which reaches at least to or beyond the turnoff in V; the actual extent can only be determined from the uncrowded UV observations. Our observations will allow a number of studies which cannot be done using ground-based observations: (a) and (b) will indirectly probe the mass loss process close to the tip of the

red giant branch (RGB), which our data (from previous cycles) suggest to be often multimodal; (c) provides a complete survey of these peculiar UV stellar types, along with their radial distributions, will provide fundamental data for internal cluster dynamics. The observations will add to an archive of HST\ data on GGC's optimized for the study of hot stellar populations. This data set, beyond the study of GGCs, will be fundamental to the understanding of the origin of UV light from elliptical galaxies.

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Proposal Category: GO
Scientific Category: HS
ID: 8710
Title: Timing and proper motion measurement of the proposed optical counterpart of the nearby pulsar PSR1929+10.
PI: Roberto Mignani
PI Institution: ESA Space Telescope European Coordinating Facility

PSR1929+10 is an old (Tau ~ 10^6 yrs), nearby (~ 170 pc) isolated neutron star detected as an X-ray pulsar. A possible optical counterpart has been detected by the FOC but the identification still awaits confirmation. Optical observations of neutron stars include both young (~ 10^3-10^4 yrs) and middle -aged (~ 10^5 yrs) objects for which different emission models (e.g. magnetospheric and thermal) have been proposed. However, the general picture is far from being clear. A firm optical identification of PSR1929+10 would thus be crucial to understand the long term evolution of the optical luminosity of pulsars and to investigate possible turnovers in the emission physics. Here we propose to use the STIS NUV-MAMA detector to perform time-resolved imaging of the proposed counterpart with the double aim of (i) searching for periodicity at the radio period and (ii) measuring its expected displacement (~ 500 mas) along the known proper motion direction of the radio pulsar. A single MAMA observation would thus provide two independent and complementary proofs to secure the optical identification of PSR1929+10.

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Proposal Category: GO
Scientific Category: ISM
ID: 8711
Title: C/O abundance ratios across WCL planetary nebulae with strong PAH and crystalline silicate emission
PI: Orsola De Marco

PI Institution: Department of Physics and Astronomy - University College London

ISO has discovered cool O-rich crystalline silicate and water-ice emission in the far-IR spectra of several planetary nebulae (PNe) which show very strong hot PAH (polycyclic aromatic hydrocarbon, carbon-rich) emission bands in their near- and mid-IR spectra. All of these PNe are young and compact and of low-ionization, and have cool H-deficient Wolf-Rayet central stars. The correlation with carbon-rich WCL Wolf-Rayet central stars suggests that the phenomenon is associated with a recent transition from an O-rich to a C-rich phase by the evolving objects, following the exposure of 3rd dredge-up enriched material. For these nebulae, the gas-phase C/O ratios (two of the nebulae have the largest C/O ratios known) are strongly correlated with the PAH feature strength. The unexpected discovery of cool oxygen-rich particles around them suggests that strong C/O abundance gradients may be present in the nebulae. Long-slit spatially resolved STIS spectra will be acquired of three WCL PNe that simultaneously show PAH and silicate features, in order to test for C/O spatial variations within them that can diagnose the origin of the two contradictory chemistries. Only the HST can provide the required high angular resolution (0arcs1) across these compact (~ 2") nebulae for the crucial abundance-diagnostic lines of C ii 2326 Angstrom\ and O ii 2470 Angstrom .

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Proposal Category: GO
Scientific Category: ISM
ID: 8712
Title: The wind accretion wake in a detached binary system
PI: Thomas Dumm
PI Institution: Swiss Federal Institute of Technology

RW Hya (= HD 117970) is the only known detached binary system, where direct observational evidence for wind accretion onto a white dwarf is found. STIS UV observations will enable us to advance our knowledge in a field which has for long had to remain a theoretical subject. RW Hya is an eclipsing system containing a mass-losing M-giant and a hot white dwarf on circular orbits (370 days). Close to quadrature, Rayleigh attenuation of the white dwarf UV-continuum has revealed a strong temporary increase in the column density of neutral hydrogen in the line of sight. This behaviour is a forceful indication for an accretion wake trailing the white dwarf. With the proposed STIS/UV

observations of RW Hya, we can for the first time tomographically map the structure of an accretion wake. The shape of the accretion wake depends on the properties of the unperturbed M-giant wind as well as on hydrodynamical processes in the wake. We will therefore be able to study both, M-giant wind acceleration and dynamics of shocked ionized flows. The proposed set of spectra will thus yield stringent boundary conditions for refined hydrodynamical wind accretion simulations in detached binary systems.

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Proposal Category: GO
Scientific Category: ISM
ID: 8713
Title: The Photoevaporation of Protostellar Envelopes in the NGC 281 Young Stellar Cluster
PI: S. Thomas Megeath
PI Institution: Harvard Smithsonian Center for Astrophsycis

We propose HAlpha, SII, SIII and R--band WFPC2 imaging of the NGC 281 nebula. This region, which we have studied intensively at near--infrared and radio wavelengths, contains a rich cluster of young, low--mass stars emerging from an edge--on molecular gas/H, ii region interface. With the WFPC2 images, we plan to search for <= 2000 AU sized evaporating globules, or EGGs, similar to those detected in M16 by Hester et al. (1996). These globules are thought to be accreting envelopes surrounding young protostars. By comparing the proposed WFPC2 imaging with our existing near--infrared (NIR) data, we can estimate the fraction of stars which emerge from the molecular cloud enshrouded in EGGs. The goal is to determine whether most stars in the NGC 281 cluster emerge from the clouds still cloaked in their protostellar envelopes, or whether they disrupt their envelopes prior to emergence. From this analysis, we will ascertain whether photoevaporation by external OB stars plays a significant role in terminating protostellar accretion in young clusters.

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Proposal Category: GO
Scientific Category: ISM
ID: 8714
Title: The ^12C/^13C abundance ratio in NGC 3242
PI: Francesco Palla
PI Institution: Osservatorio Astrofisico di Arcetri

We propose to carry out high quality spectroscopic observations of ^12C and ^13C in the ionized gas of the planetary nebula (PN) NGC 3242 by using the C iii multiplet near <~m 1908 Angstrom. Our goal is to determine the ^12C/^13C ratio in this object, following the method successfully pionereed by Clegg et al. (1997). NGC 3242 is the only PN with a measured abundance of ^3He, an isotope of cosmological interest. The observed ^3He abundance is in agreement with the predictions of standard stellar evolution models for a ~ 1 M_\odot star. However, low-mass stars cannot produce ^3He at the level indicated by NGC 3242 and by standard models otherwise the resulting ^3He abundance in the Galaxy would be a factor ~ 20--100 higher than observed in the local ISM, in H ii regions, and in meteorites. The only solution to this problem appears to rely on a non-standard mixing process that preferentially destroys ^3He during the RGB/AGB phases. A consequence of such mixing mechanism is the reduction by a factor ~ 5 of the ^12C/^13C ratio in the stellar envelope. Thus, an independent measurement of the ^12C/^13C ratio, combined with the available information on the ^3He abundance, will make possible to perform a crucial test on theories of low-mass stellar nucleosynthesis. Only STIS on HST can perform the required UV observations of the C iii multiplet and measure the carbon isotopic ratio in this unique PN.

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Proposal Category: GO
Scientific Category: SF
ID: 8715
Title: A Young Globular Cluster Surrounded by Numerous Smaller Clusters and a Giant Bubble in NGC 6946
PI: S\oren Larsen
PI Institution: Copenhagen University Observatory

Ground-based images recently lead to the discovery of a young globular cluster in the nearby spiral galaxy NGC 6946. With an absolute visual magnitude of -13, this object can be compared to the young globular clusters discovered by the HST in large numbers in recent merger galaxies like e.g. the Antennae. However, NGC 6946 is more than a factor of 3 closer than even the most nearby young merger galaxy, so observations of the young globular here could offer much more detailed information about the structure and environment of such an object. The young globular is located within a bubble-like structure with a radius of about 300 pc, in which dozens of other young clusters are seen on

ground-based images. We have shown in a recent paper that the young globular could have formed by coalescence of many smaller clusters. Considering the youth of this region (15 Myr), and its relatively small distance, HST images are expected to provide detailed information about the formation and early evolution of globular clusters. This has important implications for understanding the physical conditions in the early Universe when most globular clusters and their host galaxies formed.

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Proposal Category: GO
Scientific Category: SF
ID: 8716
Title: Search for sub-stellar companions to young brown dwarfs in the Chamaeleon I dark cloud
PI: Ralph Neuhaeuser
PI Institution: MPI Extraterrestrische Physik

We have discovered 12 very low-mass dwarfs in the Chamaeleon I dark cloud, a site of on-going star formation, all showing HAlpha emission with spectral types from M6 to M8. We could obtain medium-resolution spectra for the eight brightest objects, detected the lithium absorption line, and found the radial velocity to be consistent with kinematic membership to the Cha I dark cloud. When placed on an H-R diagram and compared with theoretical evolutionary tracks and isochrones, we find a range of masses between ~ 0.04 and ~ 0.1 M_\odot and ages from ~ 1 to ~ 10 Myrs. Because the possibly unresolved systems are already sub-stellar or nearly sub-stellar, any companion would be clearly sub-stellar, too. We propose to use HST/WFPC2 to observe these young, very low-mass dwarfs in order to search for close, faint companions. At an age of a few Myrs, any sub-stellar companion (brown dwarf or giant planet) should still be relatively bright and self-luminous (powered by on-going accretion and/or contraction), making its detection much easier than around older stars in the solar neigborhood. With the exposure times proposed, we can detect companions down to ~ 5 M_jup at separations as close as ~ 0.3" from the targets. The detection of young, sub-stellar companions would have important implication on our understanding of the formation and frequency of planets and brown dwarfs.

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Proposal Category: GO
Scientific Category: SP

ID: 8717
Title: Observations of Stellar Systems in Seyfert's Sextet
PI: Sally Hunsberger
PI Institution: Lowell Observatory

We propose to obtain imaging in WFPC2 UBVI filters of the compact group of galaxies known as Seyfert's Sextet, near enough that super star clusters are detectable and luminosity profiles can be constructed for possible dwarf galaxy members, yet compact enough that the Sextet can be imaged in one pointing. Stages of Toomre's merger sequence, from initial encounter through interaction to final merger, occur simultaneously in the field-of-view. Our goal is to appraise the epochs of star formation associated with each of these stages in order to assess the role interactions and mergers play in the formation of stellar systems (e.g. globular clusters, dwarf galaxies) and in the evolution of galaxies within dense groups. Analysis of earlier HST observations (e.g. NGC 4038/9) has shown that stellar population ages can be determined by imaging in four filters. Single burst star formation systems, such as super star clusters, will be used to pinpoint eras of starburst. Stellar ages in tidal dwarfs, i.e., small galaxies forming in tidal tails, will indicate whether their stars were born in the sudden collapse of an HI cloud or whether they are clumps of stars torn from the ``parent'' galaxy. The formation epochs of stellar systems, along with their spatial distribution, and the detailed morphologies of the giant galaxies will constrain numerical simulations which attempt to model the Sextet's interaction history and/or the evolution of compact groups.

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Proposal Category: GO
Scientific Category: SP
ID: 8718
Title: Understanding the Anomalous Hot Stellar Population in Galactic Globular Clusters
PI: Giampaolo Piotto
PI Institution: Universita di Padova

We propose to image in mid- (F255W) and near-UV (F336W) the globular clusters NGC5986, NGC6273, NGC6388, and NGC6441. During our HST survey we found that these objects have a horizontal branch (HB) with an anomalously extended blue tail (EBT) and puzzling gaps along it. The survey F439W and F555W data

indicate that the EBTs of the proposed targets extend up to T_eff>=40000K, implying that the hottest HB stars have lost almost all their envelope. The EBTs represent the most extreme of the mixed bag of anomalies known as ``2^ ndparameter problem'', and likely hold the key for understanding the factors affecting the HB morphology. The UV data, coupled with the existing optical images, will allow us: 1) to isolate the HB stars from other evolutionary sequences, enabling the measurement of the fraction of cluster stars in the EBTs; 2) measure the main physical parameters (as mass and temperature) of the EBT stars; 3) locate the gaps on the EBTs and measure their statistical significance 4) to provide tests for the origin of the EBT stars. Also the blue stragglers (BS) are better isolated in UV, allowing us to check if there is any relation between the presence of EBTs and the fraction of BS. Understanding the structure of the EBT stars, and why they are found in some, but not all systems will help to understand the stellar population of distant galaxies, and in particular the intringuing UV-upturn phonomenon in ellipticals.

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Proposal Category: SNAP
Scientific Category: COS
ID: 8719
Title: A Continuation of a SNAPSHOT survey of X-ray selected central cluster galaxies
PI: Alastair Edge
PI Institution: University of Durham

Central cluster galaxies are the most massive stellar systems known and have been used as standard candles for many decades. Only recently have central cluster galaxies been recognised to exhibit a wide variety of small scale (<100 pc) features that can only be reliably detected with HST resolution. The most intriguing of these are dust lanes which have been detected in many central cluster galaxies. Dust is not expected to survive long in the hostile cluster environment unless shielded by the ISM of a disk galaxy or very dense clouds of cold gas. WFPC2 snapshot images of a representative subset of the central cluster galaxies from an X-ray selected cluster sample would provide important constraints on the formation and evolution of dust in cluster cores that cannot be obtained from ground-based observations. We were awarded 50 SNAPSHOTS in Cycle 8 for this program of which one has been made so far and another five are scheduled. We wish to continue this project into cycle 9 to

ensure that a sample of more than 50 are observed and cover a number of recently discovered systems. This project complements our extensive multi-frequency work on this sample that includes optical spectroscopy and photometry, VLA and X-ray images for the majority of our targets.

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Proposal Category: SNAP
Scientific Category: CS
ID: 8720
Title: Masses and Multiplicity of Nearby Free-floating Methane and L Dwarfs
PI: Wolfgang Brandner
PI Institution: University of Hawaii, Institute for Astronomy

Brown dwarfs never stabilize themselves on the hydrogen main sequence, so there is an ambiguity between the temperature or luminosity of a given object and its mass or age. In order to test the mass-luminosity relations from (still uncertain) evolutionary models, a direct dynamical determination of mass is required. As a first step towards a dynamical mass estimate for brown dwarfs, we have compiled a sample of 50 very-low-mass objects (M<=0.08M_\odot) in the solar neighborhood (distances 5 pc to 30 pc) with spectral types of L0 and later (including 7 dwarfs with Methane absorption bands in their atmospheres). Using WFPC2, we propose to observe these objects in two filter bands with the aim to identify close companions, measure their colors, and to obtain first epoch data of the newly discovered binaries. We show that the closest binary brown dwarfs we can resolve will have orbital periods between 3 and 10 yr. Hence, within a few years we should be able to very accurately pin down masses for brown dwarfs and to calibrate evolutionary tracks. Binary properties like multiplicity, distribution of binary separations and brightness ratios hold clues on the origin of free-floating brown dwarf binaries. Our program will be an important step towards a better understanding of the still elusive class of brown dwarfs.

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Proposal Category: SNAP
Scientific Category: GAL
ID: 8721
Title: A UV Imaging Survey of IR-Bright Star-Forming Galaxies
PI: Daniela Calzetti
PI Institution: Space Telescope Science Institute

We propose to carry out a UV(~1,600 Angstrom) snapshot imaging survey with STIS of all the actively star-forming galaxies detected by ISO at Lambda>170 Mum and closer than cz=9000 km/s. The sample covers a large region in the parameter's space of morphology, luminosity, metallicity, and star formation intensity. The multiwavelength (UV/far-IR) information will be exploited to address open issues on low- and high-redshift star formation and on the dust/star-formation interconnection. The ISO galaxies will be used as low-redshift benchmarks to explore the relationship between the Lyman-break galaxies at z~3 and the SCUBA sources. The conditions for the escape of UV light from a `dusty' galaxy will be investigated as a function of the sample parameters. UV-bright structures will be measured and used to quantify the fractions of nuclear and disk emission, the fraction of star formation in massive clusters and the properties of those star clusters, the structural properties of star forming bars, rings, and tidally-driven star formation in IR-bright galaxies. Given the breadth of scientific applications and the relevance of this unique dataset for upcoming instruments and missions, including mid/far-IR ones like SIRTF, we propose this project as a Service to the Community and will release immediately the UV images in the public domain.

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Proposal Category: SNAP
Scientific Category: HS
ID: 8722
Title: Is Cir X-1 associated with SNR G321.9-0.3?
PI: Roberto Mignani
PI Institution: ESA Space Telescope European Coordinating Facility

Cir X-1 is one of the most intriguing galactic X-ray sources. It is a ~ 16.6 d variable X/radio source, a type I X-ray burster and a QPO emitter, which, in spite of an ambiguous optical counterpart classification, identify it as an LMXB. The source is embedded in a radio nebula, with finer structures protruding towards the centre of the nearby SNR G321.9-0.3. This prompted the speculation about a connection between the two, with Cir X-1 being a runaway binary originated from the supernova explosion. In this case, a a significant proper motion would be expected for Cir X-1. Since this source has been already imaged by HST in 1992, one more WFPC2 image could allow to measure its proper motion in the expected direction. This, together with securing the association with the SNR, will constrain the

age of the neutron star in Cir X-1, crucial to trace its magnetic field evolution in an accretion regime and to provide observational inputs to theoretical models. ,bf This is a case where a single, very simple, and short observation can greatly contribute to solve an important astrophysical issue.

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Proposal Category: SNAP
Scientific Category: SP
ID: 8723
Title: A Snapshot Survey of Galactic Globular Clusters
PI: Giampaolo Piotto
PI Institution: Universita di Padova

HST observations of crowded centers of globular clusters (GCs) have produced intriguing discoveries of new phenomena, most of which are not understood theoretically. We propose here a continuation of two Cycle 7 and Cycle 8 snapshot proposals, to extend such work to a much larger portion of the Galactic GC system. Up to now <40\ the Cycle 7--8 targets have been observed, with results that have been so fruitful that we propose to complete the original target list, continuing to observe the centers in B and $V with WPFC2. We request a proprietary period of only 3 months. Our color-magnitude diagrams will include all stars down to ~ 1^ m below the main-sequence turnoff, allowing us to address many outstanding questions, such as: How does the frequency of confirmed or suspected stellar interaction products e.g., blue stragglers, horizontal branch (HB) tails depend upon the local stellar density and the cluster dynamical state? How common are the strange HB morphologies recently discovered by HST in several GCs, and are they confined to the central regions? How often do metal-rich GCs have a hot HB, and does it correlate with the cluster dynamics? We will also improve the core parameters for a number of GCs, and constrain their dynamical states. This survey will produce a fundamental data set of Galactic GCs, which will be useful for a large number of studies in the years to come, and be a part of the legacy of HST.

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Proposal Category: GO
Scientific Category: AGN
ID: 8724
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 revealed by indirect techniques such as reverberation mapping. An already approved CHANDRA Cycle 1 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: GAL
ID: 8725
Title: The Formation Epoch(s) of Globular Clusters Around Ellipticals from Ultraviolet Photometry
PI: Steve Zepf
PI Institution: Yale University

We propose to study the formation history of elliptical galaxies by obtaining far-UV photometry of their globular clusters. The far-UV photometry will be used in conjunction with existing optical data to constrain the ages of these clusters, and thus the formation epochs of their host galaxies. Optical data show that globular cluster systems of ellipticals often have bimodal metallicity distributions, indicating an episodic formation history. However, the ages of these formation epochs are uncertain. The age distribution is critical because it directly tests models of the formation of elliptical galaxies and their globular clusters. Specifically, merger models predict that the metal-rich clusters are formed in the merger that made the elliptical and are therefore younger than the metal-poor clusters that come from the halos of the progenitor spirals. Alternatively, if the observed bimodality comes from accreting metal-poor clusters onto an already formed elliptical, then the

metal-rich clusters will generally be older. Moreover, age-dating the major formation epochs of elliptical galaxies provides a critical link between the local fossil record and the formation history of ellipticals inferred from deep data. The far-UV to optical color provides this important age information because the stars that make up the horizontal branch are hotter in older stellar populations, with significant evolution for otherwise difficult ages of t > 8 Gyr.

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Proposal Category: GO
Scientific Category: ISM
ID: 8726
Title: Cometary Knots in Planetary Nebulae
PI: C.R. O'Dell
PI Institution: Rice University

Cometary Knots trap a significant fraction of all the ejected material in the closest of the Planetary Nebulae, NGC 7293. This means that these knots may transport material into free space in a highly preserved state, possibly as solid bodies, a consequence of some import to understanding the composition of the interstellar medium. Recent HST and VLT results indicate that the Cometary Knots are actually quite common among a sampling of nearby Planetary Nebulae, so that it is likely they are a natural part of the expulsion of material by intermediate mass stars. We propose second epoch observations of the Cometary Knots in NGC 7293 in order to get a better idea of just how these objects are formed by comparison of their spatial motions with that of the ambient gas. We also propose observations of four Planetary Nebulae that give indications of the presence of Cometary Knots at different phases of development. These observational data will be used to quantitatively assess the masses, ubiquity, and probable survival of Cometary Knots in the sample. Added to our knowledge of the Cometary Knots in NGC 7293, the set should be large enough to allow drawing general conclusions about their role in the Planetary Nebula phenomenon and the interstellar medium.

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Proposal Category: GO
Scientific Category: AGN
ID: 8727
Title: Ultra-High Resolution Studies of AGNs III: nuclear extent and the SIM astrometric grid

PI: Ethan Schreier
PI Institution: Space Telescope Science Institute

We successfully completed a pilot project using the original Fine Guidance Sensor astrometer (FGS3) to study optical extent of several AGN. We will extend this work using the significantly enhanced performance of the new FGS (FGS1R). We will re-observe two high S-N AGN from our earlier sample, probing the broad line region at 10mas resolution. In an important extension of the work, we will observe two classes of nearby AGN deemed suitable for the Space Interferometry Mission (SIM) extragalactic grid. Stable, point-like extragalactic sources are needed to provide a frame tie from the SIM galactic grid to a global astrometric reference frame (e.g. ICRF). Because of their relative brightness, nearby BL Lac & Seyfert 1 objects make up a large fraction of the flux-limited sample of grid objects. Based on our pilot and the improved FGS1R performance, we will probe angular sizes of 5-10 mas for these sources. Resolved structure at these scales would have profound implications for AGN models. If the nuclear emission remains point-like at the finer resolution possible with FGS1R, then more stringent limits to the size of the broad line region and and surrounding emission can be established. Our program thus has a unique complementarity: resolved structure will be of general scientific interest, while upper limits to structure will help produce a reliable input catalog for the SIM astrometric grid.

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Proposal Category: GO
Scientific Category: CS
ID: 8728
Title: The Low-Mass Multiple System GL 831 (Wolf 922): Definitive Orbit and the Mass-Luminosity Relation
PI: Otto Franz
PI Institution: Lowell Observatory

GL 831 = Wolf 922 (V = 11.98, B-V = 1.67, PI = 0.1258 +/- 0.0023 arcsec) belongs to the select group of about one dozen nearby multiple sytems suitable for calibrating the empirical mass-luminosity relation for masses below 0.2 Msun\ (Henry et al. 1999), and has been observed 13 times with FGS3 through Cycle 7. However, a 1.93--yr orbital period, HST scheduling constraints, and a safe mode event conspired to yield repeated coverage of a 180--deg arc about apastron, while leaving unobserved the complementary arc containing periastron

(Figure 1). Consequently, the orbital period is accurate to 0.2\ major is known at best to 1.0\ these orbital elements yield masses with an accuracy well short of our goal of 5\ Cycle 9 provides the first and only opportunity in the next three years to complete the coverage by TRANS mode measures needed to yield a definitive orbit of GL 831 essential for accurate mass determination. We therefore request five orbits as indicated in Figure 1. New POS mode data, combined with those in hand, will yield the mass ratio and a parallax much more accurate than that currently available. Use of FGS1r should also clarify the location and nature of a fainter third component, possibly of 0.1 Msun, detected in two observations with the less capable FGS3.

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Proposal Category: GO
Scientific Category: CS
ID: 8729
Title: Speedy Gonzales Mass Determinations: Fast Orbiting Red Dwarf Systems
PI: Todd Henry
PI Institution: Johns Hopkins Universtiy

We propose to observe five fast-orbiting red dwarf systems in order to determine masses for objects near the end of the stellar main sequence. All five systems have periods of two years or less, hence the moniker ``Speedy Gonzales'' systems. In addition, all have parallaxes placing them within 10 parsecs, so high quality masses with errors less than 5\ for Cycle 9 is to get first points on the orbits for three systems (Gl 54, Gl 433, Gl 896) and to obtain final points for two systems (Gl 791.2 and GJ 2005). For the first three systems, we will use the data from Cycle 9 to evaluate the best observing strategies for future Cycles.

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Proposal Category: GO
Scientific Category: HS
ID: 8730
Title: The Masses of the O-type Binary 15 Monocerotis
PI: Douglas Gies
PI Institution: Georgia State University

The O-type star 15 Mon (HD 47839) was recently discovered to be an astrometric and spectroscopic binary with an orbital period of 25 years; it is the first

known O-star system to bridge the observational gap between the period regimes normally probed by these techniques. An analysis of both the radial velocity curve and astrometric orbit yields the masses of the components and distance to the system. Both radial velocity and astrometric measurements are scant at present, but the system is now close to periastron and continued spectroscopic and astrometric monitoring will lead to a definitive orbit and yield important information about the masses of O-type stars. FGS TRANS mode measurements of separation, position angle, and magnitude difference (begun in Cycle 5) are needed to bridge the gap between recent speckle observations and anticipated observations with CHARA Array optical interferometer. In addition, new field astrometry measurements (FGS POS mode) will provide the proper motion, parallax, and the binary motion around the center of mass. The POS data will provide an accurate estimate of the mass ratio and an improved estimate of distance, and taken together with the spectroscopic and astrometric orbital data, we should be able to obtain masses for both components accurate to a few percent.

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Proposal Category: SNAP
Scientific Category: SP
ID: 8731
Title: A High Angular Resolution Survey of the Most Massive Stars in the SMC
PI: Edmund Nelan
PI Institution: Space Telescope Science Institute

To better guarantee the reliability of cosmological calibrations based upon UV spectroscopy of objects in the SMC, we propose to use HST's Fine Guidance Sensor (FGS 1R) to conduct high angular resolution observations of some of the SMC's hottest and most luminous objects. Our plan calls for a comprehensive survey of nearly every spectral type in the upper portion of the HR diagram. Binary or multiple star systems will be detected down to an unprecedented 0arcs007 (460 A.U.), more than one order of magnitude better than possible with WFPC2. The targets we've selected include a representative list of normal Main Sequence O-stars and their evolved descendents, namely supergiants, hypergiants, LBVs, and WRs, many of which have been observed by HST's spectrometers for purposes of cosmological calibrations. The data from these observations will place much tighter limits on the binary status of these objects and fundamentally enhance our knowledge of the SMC's upper IMF and

upper stellar mass limit.

Proposal Category: AR
Scientific Category: SS
ID: 8732
Title: Understanding the Physical Structure of the Comet Shoemaker-Levy 9 Fragments
PI: Terrence Rettig
PI Institution: University of Notre Dame

Images of the fragmented comet Shoemaker--Levy 9 (SL9) as it approached Jupiter in 1994 provided a unique opportunity to (1) probe the comae, (2) understand the structure of the 20 cometary objects, and (3) provide limits on the Jovian impact parameters. The primary cometary questions were: how were the fragments formed and what was their central structure? There still remains a diversity of opinion regarding the structure of the 21 comet-like fragments as well as the specifics of the disruption event itself. We have shown from Monte Carlo modeling of surface brightness profiles that SL9 fragments had unusual dust size distributions and outflow velocities. Further work of a preliminary nature showed some of the central reflecting area excesses derived from surface brightness profile fitting (w/psf) appeared distributed rather than centrally concentrated as would be expected for comet-like objects, some central excesses were negative and also, the excesses could vary with time. With an improved coma subtraction technique we propose to model each coma surface brightness profile, extract central reflecting areas or central brightness excesses for the non-star-contaminated WFPC-2 SL9, to determine the behavior and characteristics of the central excesses as the fragments approached Jupiter. A second phase of the proposal will be to use numerical techniques (in conjunction with D. Richardson) to investigate the various fragment models. This is a difficult modeling process that will allow us to model the structure and physical characteristics of the fragments and thus constrain parameters for the Jovian impact events. The results will be used to constrain the structure of the central fragment cores of SL9 and how the observed dust comae were produced. The results will provide evidence to discriminate between the parent nucleus models (i.e., were the fragments solid objects or swarms of particles?) and provide better constraints on the atmospheric impact models. The physical characteristics of cometary nuclei are not well understood and the SL9 data provides an important opportunity to

constrain these parameters.

Proposal Category: AR
Scientific Category: ISM
ID: 8733
Title: Confirming the Interstellar Abundance of Oxygen
PI: Edward Fitzpatrick
PI Institution: Villanova University

The precise determination of interstellar column densities was a major scientific goal --- and a major success --- of the GHRS. Particularly important results have been obtained for the element oxygen in the diffuse ISM. High quality observations and careful analyses suggest that the total (gas + dust) abundance of oxygen is only 2/3 that found in the Sun. This result has been interpreted to indicate that the nearby ISM is generally underabundant in metals compared to the Sun. This has critical bearing on our view of chemical evolution in the nearby regions of the Galaxy, and also on the interpretation of other interstellar column density measurements and on the assumed composition of interstellar dust. As good as the oxygen results appear to be, they all depend on only one spectral feature, namely, O I Lambda1355.5977. The generally adopted f-value (i.e., the intrinsic transition probability) for this line is a theoretical estimate with a quoted uncertainty of 15\ weight of the oxygen results and interpretation rests on this single theoretical f-value. I propose to perform an independent empirical determination of the Lambda1355.5977 f-value using GHRS echelle observations along 6 sightlines. The results of this program will place the oxygen analyses on a much firmer footing. The success of this empirical approach has been demonstrated previously for the Mg II doublet at LambdaLambda1239, 1240.

Proposal Category: AR
Scientific Category: COS
ID: 8734
Title: Star Formation in E+A Galaxies in Distant Clusters
PI: James Rose
PI Institution: University of North Carolina

It is well-known that star formation occurs at a substantially higher level in

galaxies in distant rich clusters (z>0.3) than it does in their nearby cluster counterparts. A much-contested issue is what environmental effect leads to the termination of star formation between z=0.3 and the present epoch. For instance, there is considerable controversy regarding whether disk star formation in cluster spirals is simply truncated, perhaps by ram pressure stripping, or whether the gas is depleted by a major starburst. We propose to carry out surface photometry of 63 ``E+A'' galaxies in four distant clusters, and of a similar number of galaxies with ``normal'' spectra, using two-color WFPC2 imaging of these clusters. The goal is to see whether the E+A galaxies have bluer nuclei than the surrounding disk, which would indicate the presence of a recent starburst, as opposed to truncated star formation in the disk. We have already searched the HST archive of distant cluster images, and located two-color images of these 63 E+A galaxies. We now request funding to carry out the surface photometry and color maps, so that we can distinguish between the two hypotheses for the end of star formation in distant clusters.

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Proposal Category: AR
Scientific Category: SP
ID: 8735
Title: Dynamical Correlations for Globular Clusters in the Local Group Galaxies: Clues About Their Formation
PI: S. George Djorgovski
PI Institution: California Institute of Technology

We propose an archival study of globular clusters in the nearby galaxies M31, M33, NGC 205, and NGC 185. Our goal is to construct dynamical correlations for globular clusters in these diverse galaxies and to compare them mutually, as well as with the properties of the Milky Way globulars. These correlations probe directly the physics and formative processes of globulars, their homogeneity (or lack thereof), and can be also used as new distance indicator relations for their parent galaxies, providing an independent check of other distance scales. The high angular resolution of the HST images is emphessential for this project: they will be used to extract a uniform set of morphological and photometric parameters for these objects, which we will combine with high-S/N measurements of their velocity dispersions from the Keck telescope. We would use this data set of fundamental cluster parameters to perform a detailed dynamical modeling of these systems, including their (M/L) ratios. We would construct for the first time the Fundamental Plane

correlations for these globular cluster systems, and compare them among the target galaxies. Perhaps the most interesting is the correlation between the (M/L) ratios and cluster metallicities. This relation and its scatter probe directly the cluster IMFs, the dependence of cluster model isochrones on metallicity, and may even constrain a possible spread in the cluster ages.

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Proposal Category: AR
Scientific Category: SP
ID: 8736
Title: The Hydrogen-Burning Limit in the Globular Cluster NGC 6397 (AR part)
PI: Ivan King
PI Institution: University of California, Berkeley

We propose a major enhancement of an earlier study of the bottom of the main sequence of NGC 6397, the globular cluster with the smallest distance modulus. In earlier work the lowest part of the MS had been lost among the numerically dominant field stars; but accurate astrometry, over a baseline of a few years, now allows an excellent proper-motion separation of faint cluster stars from the field. The purified CMD follows the main sequence to its ``end" (i.e., the terminal plunge of the LF). Just as the MS CMD gives a mass--radius relation, we show in a new way how this LF can give a mass--luminosity relation; both of these offer unique checks on theory. Our single WFPC2 field, however, had only a small number of stars in this range, too few to set firm restraints on the theories. We propose now to increase the number of such stars by a large factor by (1) getting 2nd-epoch images for three more fields in the cluster and, (2) in an accompanying AR proposal, remeasuring our previous images, and others that exist, to the deeper limit that we know can be attained. The number and the magnitudes of these faintest stars will greatly strengthen the constraints that we place on structure and atmosphere theories of lower-main-sequence stars. In each field we will also measure the anisotropy of internal stellar motions, which is predicted to be large in a collapsed-core cluster such as this one. as this one.

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Proposal Category: AR
Scientific Category: SP
ID: 8737
Title: Geometric Distances of Globular Clusters (AR part)

PI: Ivan King
PI Institution: University of California, Berkeley

This is a proposal to establish a globular-cluster distance scale of unprecedented accuracy and reliability, with far-reaching impact on the distance and time scales of cosmology. Our method is to compare internal dispersions of proper motion with ground-based determinations of the dispersion of radial velocities. The prospect is a geometrically based distance scale with an accuracy of better than 2\ ability to make such measurements, and we are progressing with the conversion of them to a distance for the cluster. Our project has two parts: (1) Where possible, we use archival observations for both astrometric epochs (the 2 clusters in the present proposal). (2) The accompanying GO proposal covers 5 more clusters for which an archival first epoch exists but we lack second-epoch observations. With this proposal, the accompanying GO proposal, and other HST collaborations in which we are involved, we expect to determine accurate distances for 13 clusters, with a large range of metallicities and second-parameter characteristics. (Moreover, we intend to cover additional clusters in future ACS proposals.)

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Proposal Category: AR
Scientific Category: SP
ID: 8738
Title: Proper Motions in Well-Observed Fields in Omega Centauri
PI: Ivan King
PI Institution: University of California, Berkeley

The two calibration fields in Omega Cen have been observed repeatedly over the years, yet have never been exploited scientifically. These two fields are the main calibration field at 12'\ (5 r_c) and the ``dense'' calibration field at 4arcm6 (2 r_c). The main calibration field, in particular, has been imaged over 900 times, through a variety of filters. We propose to combine these many independent observations to obtain exquisite photometry (0.002 mag) and proper motions (0.07 mas/yr). Our scientific aims are threefold: (1) We will measure the anisotropy of the velocity distribution. This should be quite large for this unrelaxed cluster. We will do this as a function of mass, a dynamical distinction that has never been possible before. (2) We will compare the internal dispersions of proper motions in these fields with the central

velocity dispersion (as measured in another proposal). Both of these observations will lead to a new understanding of the dynamics of the cluster. (3) In the outer field, we will do high-precision photometry of stars along the main sequence. An earlier study (at 7') showed the main sequence to bifurcate into two sequences separated in color by 0.05 mags (0.5 dex in Fe/H). Having photometrically separated the stars into populations of different metallicity, we can examine the kinematics and spatial distributions as a function of metallicity.

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Proposal Category: AR
Scientific Category: SP
ID: 8739
Title: Absolute Proper Motion of the Fornax Dwarf Spheroidal
PI: Dana Dinescu
PI Institution: University of Virginia

We propose to measure the absolute proper motion of the Fornax dwarf spheriodal using HST archived images as second-epoch material, and a combination of Palomar 200-inch and Du Pont 100-inch photographic plates as a first and intermediate epoch respectively. This project is motivated by the large number of fields taken with WFPC2 between 1994 and 1999 in the area of the Fornax dwarf, primarily targeted at Fornax globular clusters. In addition to these data, the archive contains WFPC2 parallel data as well as a field with a QSO. For our first epoch we have the plate material that provides an excellent time baseline (up to 50 years) at a plate scale that allows high-precision astrometry for relatively crowded fields. We estimate to obtain a proper-motion error between 0.05 and 0.09 mas yr^-1, a value that depends primarily on the number of extragalactic objects found on all of the WFPC2 fields, at the limiting magnitude of the plate material (B ~ 22.5). This proper-motion accuracy will provide tangential velocities of uncertainties between 30 and 54 km s^-1, which will 1) obtain a dynamical estimate of the mass of the Galaxy as derived from one of the very distant satellites and, 2) allow the study of the orbital parameters of the Fornax dwarf and therefore test its kinematical association with the Fornax-Leo-Sculptor stream proposed by Lynden-Bell.

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Proposal Category: AR
Scientific Category: COS

ID: 8740
Title: Local Cosmology: The Nearby Flow Field and its Structure
PI: Marc Davis
PI Institution: University of California

Our current knowledge of the velocity field of galaxies in the local neighborhood (<= 500 km/sec) is surprisingly limited. Although tremendous progress has been made in recent years in mapping the large-scale gravitational field (out to scales of cz ~ 10,000 km/sec), the major impediment to constraining the local flow is the lack of a consistent set of distances to nearby galaxies. Locally the deviations from a pure Hubble flow have been predicted to be large and measurable, as much as 1 magnitude(

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Proposal Category: AR
Scientific Category: COS
ID: 8741
Title: Blending and the Extragalactic Distance Scale: Accurate DIRECT Distance to M33
PI: Dimitar Sasselov
PI Institution: Harvard-Center for Astrophysics

We propose to use the archival observations by the HST/WFPC2 in an important galaxy in the cosmological distance ladder, M33, to identify the variable stars we have already discovered from the ground. The new variables come from our project, called DIRECT, aiming to obtain the distances to M31 and M33 using detached eclipsing binaries and Cepheids. Combining photometry and spectroscopy for a selected subsample of binaries and Cepheids allows us to derive a direct distance of high accuracy, with no intermediate steps. We expect to identify 25--40\ HST/WFPC2 images, thus improving significantly their photometry by quantifying systematic effects due to crowding/blending. We are completing a similar study of M31 (Grant AR-08354.01-97A), which proves very exciting and successful. It also made us aware of the magnitude of the task, which requires us to spend an additional year on M33 (summer of 2000). This should aid in both the accuracy and precision of our direct distance determination to M31 and M33, which are stepping stones for most of our current efforts to understand the evolving universe at large scales. Thus we expect to help in decreasing the HST Key Project's overall uncertainty in deriving the Hubble constant, H_0, by a factor of 2 (or to about 5\

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Proposal Category: AR
Scientific Category: HS
ID: 8742
Title: The Millisecond Pulsars of 47 Tucanae: Mining the Unique Stellar Equivalent of the Hubble Deep Field
PI: Bruce Margon
PI Institution: University of Washington

Millisecond pulsars (MSPs) in binary systems hold the key to a number of important problems in astronomy, involving fields as disparate as stellar evolution, neutron star structure, relativity, and, for those located in globular clusters, stellar dynamics and cluster structure. Although about a dozen binary MSPs in the galactic disk now have optical counterparts, and are thus amenable to detailed study, there are no firm identifications in globular star clusters, where distances and reddening are accurately known, and the most interesting dynamical interactions can occur. The optimal cluster to amend this situation is 47 Tucanae, the cluster with the largest number of known MSPs, located nearby, and with minimal reddening. By good fortune, in Cycle 8 an extraordinarily long WFPC2 exposure -- 8 days -- was obtained for this cluster. Although the motivation for that work was very different than that discussed here, namely a search for planetary transits, this unique field is fully the stellar equivalent of the Hubble Deep Field. We propose here to use newly derived, highly precise radio positions for a large number of MSPs in 47 Tuc, together with precision astrometric and photometric tools we have developed in previous HST programs, to greatly increase the number of optically identified MSPs, and provide the first such identifications in globular clusters.
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Proposal Category: AR
Scientific Category: AGN
ID: 8743
Title: A Morphological and Multicolor HST Survey for Ultrafaint Quasars, Sampling A Broad Redshift Range
PI: Scott Anderson
PI Institution: University of Washington

Quasars representative of the populous faint end of the luminosity function

are frustratingly dim with m>24 at modest to high redshift; moreover groundbased surveys for such faint QSOs suffer severe morphological contamination by compact galaxies. In an initial survey begun several years ago, we demonstrated the power of combining multicolor photometry with the 0.1'' spatial resolution of HST to yield a morphological and multicolor survey for quasars to B <=sssim 24. Although limited to z<=sssim 2.1 and based on only 10 QSO candidates, our initial HST counts both confirmed the severe (>85\ surveys, while simultaneously showing remarkable agreement (albeit with large errors) with predictions of popular model luminosity functions. These tantalizing initial results presage the full potential of an HST-based survey possible now; in the interim many additional WFPC2 fields, observed with more optimal filter sets, have become available in the archive. Our proposed program will: (1) increase by 3--8*$ the sample-size of reliable ultrafaint quasar candidates; (2) broaden the redshift sensitivity to encompass even the highest-z QSOs; (3) increase the depth surveyed consistently by 3 magnitudes, extending the logN-logS curve from B~24.5 to B~27.5. This new HST quasar survey will yield strong constraints on model luminosity functions, even pending confirming spectroscopy.

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Proposal Category: AR
Scientific Category: HS
ID: 8744
Title: Geminga's Parallax Revisited
PI: George Pavlov
PI Institution: The Pennsylvania State University

Measuring distances to neutron stars is extremely important to estimate their radii, with the aid of temperature determined from X-ray/UV observations. The first measurement of the distance to a neutron star, based on HST observations, has been recently reported by Caraveo et al. (1996), who measured the annual parallax of Geminga, a young, isolated pulsar, active from the radio to gamma-ray wavelengths. However, that result is based on only three WFPC2 observations of four now available, and it does not take into account additional information on the proper motion obtained in recent NICMOS observations. Moreover, the accuracy of the astrometric analysis can be improved significantly, making use of more reliable algorithms for centering point objects in the field and more recent procedures to correct the WFPC2 images for geometric distortion. We propose to use four WFPC2 archival

observations and one NICMOS observation to re-analyze both the proper motion and parallax of Geminga. The results will have important consequences for the physics of neutron star interiors, X-ray observations of atmospheres, the history of Geminga, and the origin of the Local Bubble.

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Proposal Category: AR
Scientific Category: SP
ID: 8745
Title: Chemistry of Messier 31
PI: Guy Worthey
PI Institution: Saint Ambrose University

Sampling local group spiral M31 from its nucleus to regions where its halo fades to nothing, stellar color-magnitude diagrams of the brighter giants will be used to construct histograms of (fraction of stars) as a function of (abundance) at each radial location. From these abundance distributions the following will be derived: (1) the overall radial abundance gradient in the disk and spheroid of M31 from stars, not nebulae, and (2) the simulated all-M31 ``closed box'' abundance distribution. These data will be far more complete and homogeneous than data available for the Milky Way. Chemical evolution models will be applied to the data. If the observed paucity of metal -poor stars in the outer disk of M31 continues to the M31 outskirts, it will be impossible to reconcile any constant-yield model with the M31 data, and, by inference, spirals in general.

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Proposal Category: AR
Scientific Category: COS
ID: 8746
Title: Constraints on the Flattening of Dark Matter Halos from Galaxy--Galaxy Lensing
PI: Tereasa Brainerd
PI Institution: Boston University

Deep archival imaging data will be used to investigate the degree to which the dark matter halos of field galaxies deviate from pure spherical symmetry. The technique that will be used is a measurement of the mean gravitational lensing shear induced by foreground galaxies in the images of background galaxies, a phenomenon known as galaxy--galaxy lensing. To date, all investigations of

galaxy--galaxy lensing have focused on a detection of the signal in via a circular average about the lens center and have implicitly assumed that galaxy halos are spherically symmetric. However, there is mounting observational evidence that dark matter halos may be substantially flattened, in which case their projected surface mass densities will deviate from circular symmetry. As a result, the gravitational lensing shear pattern that will be induced by these galaxies will not be circularly symmetric about the lens center. In this investigation the shear induced by galaxy--galaxy lensing will be computed along direction vectors defined by the major and minor axes of the images of the lenses, and the degree to which the shear pattern deviates from circular symmetry will be quantified. This will be used in conjunction with Monte Carlo simulations of galaxy--galaxy lensing by flattened halos in order to place constraints on the overall flattening of the dark matter halos of field galaxies.

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Proposal Category: AR
Scientific Category: COS
ID: 8747
Title: A Broken Rung on the Distance Scale Ladder? - The Case of NGC 4258
PI: Shoko Sakai
PI Institution: National Optical Astronomy Observatories

Recent determinations of the distance to a spiral galaxy NGC 4258 have sparked another controversy which could potentially have a significant impact on the entire extragalactic distance scale. A geometric distance from the observations of masers in this galaxy yields a distance of 7.2+/- 0.3Mpc (Herrnstein et al. 1999), while HST/WFPC2 Cepheid observations lead to a distance of 8.1 +/- 0.4 Mpc (Maoz et al. 1999); the two estimates are discrepant at the 2Sigma level. If the maser distance, which is independent of intermediate rungs in the distance scale ladder, is correct, then there appears to be a need to modify the Cepheid distance scale which has been serving as the foundation of the extragalactic distance scale. The goal of this Archival Proposal is to re--analyze the WFPC2 data obtained for the Cepheid study, and obtain a deep I--band luminosity function from a combined image, from which the distance will be estimated using the tip of the red giant branch (TRGB) method. The TRGB method is a Population II distance indicator, completely independent from the Cepheid distance scale, providing

an independent check on the distance to NGC 4258.

Proposal Category: AR
Scientific Category: AGN
ID: 8748
Title: Testing The AGN/QSO Accretion Disk Paradigm Using New Non-LTE Models
PI: Matthew Malkan
PI Institution: University of California Los Angeles

We propose to compare a large FOS database of observed quasar spectral energy distributions to new accretion disk models. We have constructed a large grid of non-LTE disk models for a wide range of black hole mass and mass accretion rate, viscosity parameter Alpha, and black hole spins. Our procedure calculates self-consistently the vertical structure of all disk annuli together with the radiation field, without any approximations imposed on the optical thickness of the disk, and without any ad hoc approximations of the radiation intensity. The total spectrum of a disk is computed by summing the spectra of the individual annuli, taking into account the general relativistic transfer function. The results, which include predictions of the polarization spectrum, differ substantially from previous less reliable models. The FOS database has sufficient size, spectral resolution, and S/N to allow us to account statistically for the important effects of intergalactic and interstellar absorption, as well as the range of expected accretion disk viewing angles in various AGN subtypes. Our aim is to make a definitive comparison between observations and accretion disk models.

Proposal Category: AR
Scientific Category: SP
ID: 8749
Title: Comparisons of Local Group Stellar Populations: Construction of a Public Database
PI: Jon Holtzman
PI Institution: New Mexico State University

We propose to construct a public database of stellar photometry of resolved stellar populations within Local Group galaxies. We will use this database to compare stellar population characteristics of different regions in the Local

Group differentially, avoiding some of the complications of comparisons with stellar evolution models, and to synthesize the results. In particular, we will address the following issues: beginitemize em What are the relative ages of the oldest populations in Milky Way neighbors? em To what degree is star formation is ``bursty'' in different Local Group galaxies? em Is there direct evidence for variations in the IMF in nearby galaxies? em What is the ``average cosmic star formation history" for dwarf galaxies in the Local Group? em What is the amount of mechanical and radiative energy input into the ISMs of different galaxies by massive stars? enditemize

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Proposal Category: AR
Scientific Category: GAL
ID: 8750
Title: The Fundamental Plane of Cluster Dwarf Ellipticals
PI: Rafael Guzman
PI Institution: Yale University

We propose to use archival WFPC2 images to measure the structural parameters (i.e., luminosity profile, half-light radius, surface brightness, and concentration indices) of dwarf ellipticals (dEs) in the Coma cluster. This proposal is part of a comprehensive program to study the scaling laws of cluster dEs. These empirical correlations provide key constrains to models of galaxy fomation and evolution. Compared to other studies of cluster dEs, this program is unique in that it includes measurements of the internal kinematics (i.e., velocity dispersions). Colors, magnitudes, redshifts, line strengths and velocity dispersions for ~80 dEs in the central 24'*18' region of Coma have already been measured from deep UBR images and multiobject spectroscopy using WIYN. In addition to these data, structural parameters are essential to explore fundamental plane-type correlations. Given the small size of faint dEs (~0.4'' at Coma), high spatial resolution images are required to measure their structural parameters. There are 61 archival WFPC2 pointings (mostly in F606W filter) which provide good signal-to-noise images of ~21 dEs in our sample. This combined WIYN/HST data set will allow the first determination of the fundamental plane of cluster dEs, and aims to be a milestone for testing current theories on the formation and evolution of dwarf galaxies in clusters.

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Proposal Category: AR
Scientific Category: SP

ID: 8751
Title: The Age of the Central 100 pc of the Galaxy
PI: R. Michael Rich
PI Institution: University of California at Los Angeles

We propose to compare the age of the Galactic nucleus population with metal rich globular clusters that are known to be ~ 12 Gyr old. The Galactic nucleus fields lie behind 10-30 magnitudes of visual extinction, but are now well imaged to the main sequence turnoff thanks to NICMOS. Preliminary reductions of fields some 10-20 arcmin from the Galactic Center clearly reveal a red clump population some 3.5 mag brighter than a clearly detected turnoff. These reductions suggest that the nucleus, even within 20 pc, is dominated by an old stellar population. We propose to produce color-magnitude diagrams and luminosity functions for archival NICMOS images of fields lying 20 arcmin, 1^degrees, 2^degrees, and 3^degrees from the Galactic Center, and to compare these to the old Galactic globular cluster NGC 6553. The luminosity functions of the bulge field population and the globular cluster can be directly compared, independent of distance modulus and reddening, by forcing both to agree at the maximum of the red clump. This method can give very precise relative ages of different bulge fields, relative to the oldest stars in the Galactic halo.

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Proposal Category: AR
Scientific Category: COS
ID: 8752
Title: The calibration of the distance scale using Cepheid Period Luminosity relations at maximum light
PI: Shashi Kanbur
PI Institution: Department of Physics and Astronomy, University of Massachusetts

This proposal aims to use existing HST Cepheid data to formulate Cepheid Period Luminosity (PL) relations at maximum light and so recalibrate the extra-galactic distance scale and estimate Hubble's constant. PL relations at maximum light are distinct from those at mean light because the physical conditions in the Cepheid envelope at maximum light are very different to conditions at all other pulsation phases. In particular, at maximum light the photospheric temperature is 6200K+/- 200K, independent of period. Current

uncertainties on the distance scale amount to about 0.15 mags or about a seven percent error in distance. Hence the results of our proposal will be a check on the existing Cepheid distance scale. Further the use of such maximum light PL relations may increase the accuracy of the distance scale because the different envelope conditions at maximum light imply a smaller dispersion at given period than mean light relations, a flat slope to the period color relation at maximum light and a way to check reddening determinations. We will also use the HST Cepheid data to make a detailed comparison of light curves with their local counterparts to test if they are indeed from the same population.

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Proposal Category: AR
Scientific Category: SS
ID: 8753
Title: Probing the Surface Composition of Europa through Atmospheric Spectroscopy
PI: Michael Brown
PI Institution: Caltech

We propose to analyze previously obtained spectra of the vicinity of Europa to search for magnesium in the satellite's atmosphere. Analysis of Galileo NIMS spectra has led to the suggestion that magnesium is abundant on parts of the satellite as a hydrated evaporite salt. This interpretation has been controversial, however, as similar spectra could be produced by mostly pure water ice under special conditions. In addition, the specific presence of magnesium is uncertain, as many hydrated salts produce a similar spectrum. Any salts present on the surface of Europa will be sputtered in the atmosphere where they are potentially detectable remotely. Our previous groundbased observations have detected potassium and sodium in the atmosphere of Europa, which are other possible components of salts on the surface. Detection of magnesium would be a strong confirmation of the magnesium salt interpretation of the NIMS data and would help to quantify the trace element composition of the surface and possibly any subsurface liquid on the satellite.

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Proposal Category: AR
Scientific Category: HS
ID: 8754
Title: Probing the Nature of Supernovae through Archival Images

of their Environments
PI: Alex Filippenko
PI Institution: University of California at Berkeley

The locations of supernovae (SNe) in the local stellar and gaseous environment in galaxies, as measured in high spatial resolution WFPC2 images, contain important clues to their progenitor stars. They provide accurate determinations of any association of SNe with H II regions or star clusters. In cases where multi-filter observations are available, we can determine the local stellar environment and search for possible attenuation of the SN by dust in the host galaxy. By checking the fields for background sources, we can correct the existing SN light curves and luminosities if necessary. When a SN has been observed incidentally, information can be gained on its optical and UV emission. Deep HST images can be used to find light echoes of SNe, as well as recover SNe interacting with circumstellar material at very late times. A direct search for the progenitor stars of SNe can be made in pre-existing HST images of their locations. In Cycle 9 we plan to extend our very successful work from previous cycles. A major improvement is that accurate ground-based coordinates are now available for numerous SNe. There are images of many host galaxies in the large and ever-growing HST archive.

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Proposal Category: AR
Scientific Category: GAL
ID: 8755
Title: The Radii and Destruction Timescales of Globular Clusters in NGC 3610
PI: Steve Zepf
PI Institution: Yale University

The luminosity function of well-studied old globular cluster systems is log-normal, while that of candidate young globular cluster systems is a power-law. If some of the young clusters are to be identified as globular clusters, the luminosity function must evolve to become log-normal. Several recent theoretical calculations find that dynamical evolution naturally changes a power-law mass and luminosity function into a log-normal one through the preferential destruction of low-mass clusters. However, there is no observational evidence for evolution of cluster luminosity functions. We propose to use archival WFPC2 images of NGC 3610 to study the luminosity

function of its globular cluster system, which has been recognized as having a significant intermediate age component. We will test whether the cluster luminosity function in NGC 3610 is intermediate between M87 (a quiescent elliptical) and NGC 3256 (an ongoing merger) as expected from dynamical models. Moreover, we will determine the radii of the NGC 3610 globular clusters using King model fits, applying techniques we have developed in our study of other cluster systems. The radii determined this way will provide much better input into the models of dynamical destruction of globular clusters, and therefore into model predictions for the location of a turnover in the globular cluster luminosity in the intermediate aged NGC 3610 system.

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Proposal Category: AR
Scientific Category: GAL
ID: 8756
Title: A Search for Extremely Red Objects Using Archival WFPC2 Images
PI: Lin Yan
PI Institution: The Observatories of Carnegie Institute of Washington

To date HST/WFPC2 has imaged over 450 fields at intermediate and high galactic latitudes to a depth of I_c ~ 26 mag (3Sigma in an 1Box^'' aperture) in the F814W filter. We propose an archival research program using these deep images in combination with ground-based K-band observations, to search for extremely red objects (EROs) with I_c - K > 5 and K < 19.0. We will survey roughly 1700 square arcminutes and expect to detect 68 bright EROs. The HST archive offers us two unique advantages to carry out an efficient survey: it provides a wealth of deep I-band images otherwise difficult to obtain from the ground, and the high resolution images will enable us to study in detail the distribution of ERO morphological types as a function of color. With the advent of large format near-IR detectors, imaging bright EROs in K-band over a large area is becoming efficient. In two years, this survey will produce the largest sample of bright EROs, useful for follow-up studies to determine the nature of EROs. Our ultimate goals are to 1). measure the percentages of old elliptical and dusty starburst galaxies among the overall ERO population, setting strong constraints on theories of the formation and evolution of massive galaxies; 2). determine how significant the starburst EROs contribute to the global star formation rate; and 3). determine the relationship between EROs and the local ultra-luminous IRAS galaxies.

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Proposal Category: AR
Scientific Category: HS
ID: 8757
Title: Systematic Serendipitous Discovery of Cataclysmic Variables and Other Odd Stars in Globular Clusters
PI: Eric Deutsch
PI Institution: University of Washington

Despite indications that classical cataclysmic variable (CV) stars are rare in globular clusters in general, and in the cluster NGC 6624 in particular, we have serendipitously discovered such a star ~6'' from the cluster center. An HST STIS spectrum of the m~22 object, which fell accidentally in the slit during an unrelated program, shows strong, broad emission lines typical of numerous field CVs, and the inferred optical and UV luminosity are also similar. That we have detected such an object in an observation that includes just a few percent of the central area of the cluster may indicate that cluster CVs are more common than previously thought. Here we propose a very simple archival program to examine all public STIS near- and far-UV spectra in globular clusters for similar objects, as well as other unusual hot stars.
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Proposal Category: AR
Scientific Category: GAL
ID: 8758
Title: Morphology of Butcher-Oemler Galaxies
PI: James Schombert
PI Institution: University of Oregon

This archival proposal is to analyze WFPC2 and NICMOS images of distant clusters, which have complimentary ground-based narrow band photometry, to investigate the Butcher-Oemler effect. Our narrow band work has isolated a population of faint starburst galaxies in Butcher-Oemler clusters which may provide insight into the debate between the galaxy harassment models and gas supply proposals for the star formation behavior behind the Butcher-Oemler effect. The primary goal of this project is to determine the basic morphological and structural properties (scale lengths, surface brightness, bulge-to-disk luminosities) of the blue population in clusters and, in particular, to determine what kind of galaxy is involved in ordinary star

formation versus a starburst phenomenon as assigned by narrow band colors. A newly discovered low luminosity starburst population will be studied to test whether they are future dwarf galaxies.

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Proposal Category: AR
Scientific Category: GAL
ID: 8759
Title: Kinematics of nuclear stellar disks around massive central black holes
PI: Monica Valluri
PI Institution: Univerisity of Chicago

HST imaging has revealed the presence of nuclear stellar disks at the centers of several early-type galaxies. Simultaneously, spectroscopic studies of galactic nuclei have yielded dynamical evidence for supermassive black holes with masses of 10^6 - 10^9Msun in about a dozen galaxies. Not an insignifcant fraction of the quiescent black holes appear to be associated with comparably-massive (~10^8Msun) stellar disks. The kinematics of these disks provide the most direct route to determining the masses of the black holes. They may also provide vital clues to the formation of black holes and establish a more tangible link to the quasar epoch: nuclear stellar disks may be remnants of more massive gas disks that fuelled the black holes in quasars. We propose to use archival STIS data obtained for the study of ``demographics of nuclear black holes'' to carry out a search and analysis of nuclear stellar disks in 7 galaxies. This study will allow us to determine the dynamical masses and other properties of disks (where present) and will also help to put tighter constraints on the masses of central black holes.

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Proposal Category: AR
Scientific Category: SS
ID: 8760
Title: The Dynamics of Dark Spots on Neptune
PI: Lawrence Sromovsky
PI Institution: University of Wisconsin-Madison

HST and groundbased observations of Neptune since 1991 provide potentially strong constraints on the behavior of Neptune's Northern Great Dark Spot (NGDS), first discovered in October 1994 HST images (Hammel et al., Science

268, 1995). Unlike the 1989 Great Dark Spot revealed by Voyager, which moved continuously equatorward and dissipated unseen during 1990, the NGDS seems to have remained at ~ 35degrees N from 1994 through at least 1996, suggesting that its zonal drift rate may be relatively constant and that its position may be highly predictable. An empirical model of its motion can be constrained by analysis of HST archive images in combination with existing groundbased images that are sensitive to the bright companion clouds of the NGDS. By combining sporadic groundbased observations of the companion clouds during 1993, 1994, 1996, 1997, and 1998, with HST observations of both the NGDS and its bright companion in 1994, 1995, and 1996, and HST observations of only bright companions in 1991, 1997, and 1998, we propose to determine spectral and other signatures for the companion clouds, the evolution of their characteristics, and whether or not the NGDS is a single circulation feature that has been present during this entire period. We expect to provide new constraints on NGDS dynamics and companion lifetimes and a prediction equation for NGDS future positions.

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Proposal Category: AR
Scientific Category: SS
ID: 8761
Title: Inclined Features in Saturn's Rings
PI: Amanda Bosh
PI Institution: Lowell Observatory

The occultation of GSC529-01240 observed in 1995 with the FOS on HST (GO-5824, Bosh PI) was the most sensitive occultation to date for inclinations in Saturn's rings. The F ring has been determined to be inclined using these data, and this has been independently verified with WFPC2 imaging of the F ring entering eclipse (possible only for an inclined F ring). Additional ring features in this data set exhibit signs of possible inclination (high radial residuals in just the 1995 data set). We propose to investigate these ring features for inclinations using the same method as was applied to the F ring. The improved kinematic models that will result from these analyses will lead to better understanding of narrow ringlet confinement. The determination of Saturn's gravitational harmonics and thus its interior structure will also be improved due to better ringlet models, as several ringlets are now used as significant constraints to these parameters.

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Proposal Category: AR
Scientific Category: COS
ID: 8762
Title: The Fundamental Plane of Cluster Ellipticals at z = 0.18: Establishing the Local Baseline
PI: S. George Djorgovski
PI Institution: California Institute of Technology

The process of assembling of galaxies into rich clusters may leave distinctive signatures in the stellar populations and morphological mix that depend on position in the cluster, and evolve with redshift. We propose to study the properties of galaxies in the core and halo of the galaxy cluster A1689 at z = 0.18 using a combination of HST optical, emphmosaic imaging (archival), ground -based optical and IR imaging (already obtained), and Keck medium resolution spectroscopy. This study will alleviate systematic uncertainties in the very local studies of the cluster galaxy population (in Coma) and form a bridge to the results from intermediate- to high-z systems. As a function of local galaxy density within each cluster, we will study the projections of the Fundamental Plane correlations (the optical-infrared color-magnitude relation and the radius-luminosity relation), the IR luminosity function, and the changing morphological mix. Keck spectroscopy will play a vital role in efficiently determining velocities and rotation curves for cluster members. The images will also be searched for extremely-red galaxies---which could represent high-redshift elliptical (z ~ 1) or star-forming (z > 4) galaxies lensed by the rich clusters. emphThis study is unique in that both the ground -based IR imaging and the HST optical imaging mosaic a wide-field, thereby allowing for the simultaneous study of galaxies in the core and the halo of the cluster.

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Proposal Category: AR
Scientific Category: AGN
ID: 8763
Title: The Cause of Narrow Absorption Lines Intrinsic to Quasi--Stellar Objects
PI: Jane C. Charlton
PI Institution: The Pennsylvania State University

We propose to investigate the archived FOS (R=1300) observations of quasars

for the purpose of understanding the origins of low redshift (z<1) associated (Delta v<5000 kms) CIV narrow absorption lines (NALs). Many of these NALs are intrinsic to the quasar and are likely to be related to outflow or inflow from the central engine. Therefore, their rate of incidence and its relationship to other quasar properties will constrain the geometry, ionization conditions, and kinematics of these flows. From studies of high redshift quasars, the existence of intrinsic NALs is likely to require some complex combination of QSO properties, and results from ground--based work in this area have left many questions as yet unanswered. Are NALS the result of orientation relative to the line of sight? Is it related to the relative (to Eddington) luminosity of the accretion disk? Only at low redshift, with data from the HST/FOS archive, can we study quasars with a range of luminosities, and accurately determine their radio morphologies and X--ray properties. Employing radio and X--ray data (luminosity, spectral index, morphology) from both the literature and online catalogs (e.g. NVSS, RASS), we will perform multivariate and 2--sample statistical tests to determine the combination of QSO properties that give rise to the presence of NALs along the line--of--sight.

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Proposal Category: AR
Scientific Category: GAL
ID: 8764
Title: Archival Search for a White Dwarf Dark Matter Component via WFPC2 Proper Motion Measurements
PI: Arlin Crotts
PI Institution: Columbia University

We propose searching for proper motions of faint blue objects in a previously well sampled field. Such objects have been recently detected in the HDF and are suggested to be old halo white dwarfs (Ibata et al. 1999). If this identification is correct, and the implied density persists, a major portion of the dark matter in galactic halos will have been found. A dominant baryonic component in dark halos has dramatic consequences for fields spanning much of astronomy and astrophysics. Theories of structure and galactic formation would have to be revised, while our understanding of stellar birth would need to account to the drastically different IMF required to produce halo white dwarfs. In addition the baryon and metallicity budgets of the universe would be profoundly effected. With the addition of the previously analysed HDF, our selection of a field at high galactic latitude would also allow us to begin

examining the spatial distribution of the new population. A true halo population should be clearly distinguishable from a thick disk-type distribution via the directions and magnitudes of the proper motions as a function of (l,b). Since these objects are faint (V ~ 28.5) and require high precision astrometry only HST can study them. We choose the best archival field to evaluate this approach, with no additional cost in HST time.

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Proposal Category: AR
Scientific Category: GAL
ID: 8765
Title: An Archival Study of The Mid-UV Structure of Nearby Early -Type Galaxies
PI: Claudia-Angelica Chiarenza Burg
PI Institution: Arizona State University

Currently, very little is known about nearby galaxy morphology in the UV. The restframe wavelength of galaxies at z~1 observed by HST in the R band is 3000\A. Therefore, before we can fully understand the morphology of the many irregular galaxies that we see at high redshifts, we must first understand what nearby galaxies look like in the UV. Images below 3100\A cannot be obtained from ground-based telescopes due to the earth's atmospheric cutoff. We propose to use Archival WFPC2 images of nearby galaxies in F300W, plus ground-based UBVR, to study morphology as a function of wavelength. The 2930\A filter on HST extends from ~2500\A-3200\A (half power points), thus extending much further into the UV than ground-based U(360). This proposal will look at the predominantly early to mid-type galaxies found in the (F300W) Archive. We also propose to search the Archive F300W images taken in parallel mode for the few 'chance' nearby galaxies contained in them. Specifically, we will use the targeted and parallel F300W images in the Archive, along with our ground-based data to address the following issues: o morphology as a function of Hubble type and restframe wavelength for early and mid-type galaxies in the mid-UV o apply proper bandpass shifting effects to get more reliable distant galaxy classifications

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Proposal Category: AR
Scientific Category: COS
ID: 8766
Title: Color Gradients in Elliptical Galaxies at z = 0.5: , An

Indicator of Galaxy Formation Processes
PI: Michael Pahre
PI Institution: Smithsonian Astrophysical Observatory

We propose to make a direct comparison of the frequency and size of color gradients in cluster elliptical galaxies at z ~ 0 and z ~ 0.5 to constrain the relative roles of merging and monolithic collapse on the galaxy formation process. Color gradients are ubiquitous in elliptical galaxies in the local universe, and are the origin of 20-50\ Local studies of color (and line-strength) gradients could be explained by metallicity and/or age gradients in the underlying stellar populations, but offer few clues as to how they could have formed. HST observations at z ~ 0.5, however, can provide direct insight into the origin(s) of these population gradients: the gradients steepen with redshift if dissipationless merging dominates; flatten if dissipative, gas-rich merging dominates; or remain roughly constant if monolithic collapse (at early epochs) created the population gradients. In order to test these predictions, we will utilize both ground-based and HST data: ground-based observations in (U-V) at z~ 0 are a nearly exact match in color and physical resolution to HST archival observations in (555-814) of three clusters at z ~ 0.5. Color gradients are shown to be easily measured with HST at z ~ 0.5, but they have yet to be studied in a systematic manner. Funding is requested here primarily to support a Harvard undergraduate to reduce, analyze, and publish the results of the study.

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Proposal Category: AR
Scientific Category: COS
ID: 8767
Title: Evolution of 1200 Field E/S0 Galaxies to z = 1
PI: Myungshin Im
PI Institution: University of California Observatories/Lick Observatory

The evolution of field E/S0 galaxies, especially their number density, is in debate. Theoretical models based on hierarchical structure formation predict that a significant fraction of present day E/S0's are formed at z < 1 via merging. This is in sharp contrast to the so-called ``monolithic collapse'' model which predicts the coeval formation of E/S0's at high redshift (z >> 1). Current observational constraints on the evolution of field E/S0's are controversial, mainly because of the lack of a sample large enough to provide

statistically significant limits. From the HST Archive, we have identified 230 WFPC2 fields at high Galactic latitude which have V and I imaging of sufficient depth for morphological identification of E/S0's to I = 22. In these fields, we estimate that there will be ~ 1200-1400 normal, luminous, field E/S0's with I < 22, z < 1 and z_med ~ 0.5, enough to provide significant improvement in the number statistics over previous studies. This large sample of E/S0 galaxies will constrain : i) the number density evolution of field E/S0's at z < 1 to an accuracy of better than 10\ ii) the luminosity evolution of field E/S0's since z=1; and iii) the cosmological parameters. Knowing the number density should settle whether merging since z=1 can have been a major process in the formation of E/S0's.

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Proposal Category: GO
Scientific Category: GAL
ID: 8769
Title: The red giant stellar population in three nearby low-metallicity blue compact dwarf galaxies
PI: Trinh Xuan Thuan
PI Institution: Astronomy Department, University of Virginia

We wish to obtain deep V and I WFPC2 images of three nearby metal-deficient blue compact dwarf (BCD) galaxies I Zw 18 (Z_\odot/50), UGC 4483 (Z_\odot/23) and NGC 2366 \equiv Mrk 71 (Z_\odot/13). Our main goal is to detect the red giant stellar population in these resolved BCDs to study their evolutionary history and constrain their ages. Are they young or old? On the basis of chemical evolution arguments, we have argued that all galaxies with Z < Z_\odot/20 are young with ages < 100 Myr, while those with Z > Z_\odot/20 are older. The high spatial resolution of the WFPC2 will allow to detect stars ~ 3 mag fainter than the red giant tip in UGC 4483 and NGC 2366, both members of the M81 group at a distance of 3.44 Mpc, and determine stellar ages directly through color-magnitude diagrams. If our chemical evolution arguments are correct, then UGC 4483 should not possess a red giant population and not be older than ~ 100 Myr, while such a population should be present in NGC 2366. As for I Zw 18, we shall concentrate on its C component where crowding is less than in the main body. If I Zw 18 is at the commonly assumed distance of 10 Mpc, then we should be able to detect the brightest red giant stars if they are present. In that case, the age of I Zw 18 would be greater than ~ 1 Gyr. Conversely, if red giant stars are absent, then either I Zw 18 is young (<=

100 Myr) or it is further away (D > 15 Mpc) than commonly assumed.

Proposal Category: AR
Scientific Category: AGN
ID: 8768
Title: The Morphological Mix of Faint Radio Sources From Archival WFPC2 Images

PI: Ian Waddington
PI Institution: Arizona State University, Dept of Physics & Astronomy

We propose to investigate the optical morphologies of ~ 300 faint radio sources using archival HST\ images. Using the FIRST survey and several deep VLA fields, we will assemble a sample of radio sour ces spanning five orders of magnitude in radio flux from 10^-5 Jy to 1 Jy at 1.4 GHz, that have WFPC 2 F606W/F814W images available in the archive. We will then use this sample to achieve the followin g goals: hbox(square)uare Determine the radio source counts as a function of optical morphology a nd radio flux density, allowing us to differentiate the various galaxy types that make up the faint radio source population. hbox(square)uare Determine the fraction of faint radio sources that have no optical counterpart to I~eq 25--27. Such objects must either be heavily obscured by dust, or be at very high redshift, or be high-redshift dusty sources. We previously found several such objects in the HDF-N. hbox(square)uare Determine the extent to which weak radio galaxies have their optic al emission aligned with their radio axis, as is typical of powerful radio galaxies at z>~ 0.6. hb ox(square)uare Investigate the environments of faint radio sources. The radio emission from microja nsky sources is attributed to high star formation rates in these galaxies --- we will be able to det ermine what fraction of these starbursts are caused by interactions or mergers.

Proposal Category: GO
Scientific Category: CS
ID: 8770
Title: The Nucleosynthesis of Boron - Benchmarks for the Galactic Disk

PI: Ann M. Boesgaard
PI Institution: Institute for Astronomy, University of Hawaii

In spite of several HST cycles of boron abundance determinations, we do not know the true, ambient, present-day abundance of B. Only two stars (with undepleted Li and Be) have been observed to derive the Population I true B abundance. Past cycles have focused on (1) halo stars with low metallicity and (2) solar-type stars with Li and/or Be deficiencies. In this study we wish to determine stellar abundances of boron, measured from the B, i 2497Angstrom\ line from STIS echelle spectra, of main sequence F-G stars that have retained their full initial abundances of boron. Our target stars are those for which ground-based observations show that beryllium is undepleted. These new abundances will map evolution of the boron abundance in the Galactic disk in the metallicity range from one-third solar up to solar. Then the B, and previously determined Li and Be abundances, will be used to improve understanding of the nucleosynthesis of B. In particular, we will be able to assess the relative contributions from cosmic ray-induced spallation vs neutrino-induced spallation in Type II SN, that are predicted to synthesize B (as ^11B) but not Be. Since the former process is the only identified site of Be synthesis, the B/Be ratio can be used to resolve the contributions of neutrino and cosmic ray induced spallation.
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