Cycle 10 Abstract catalog (based on Phase I submissions)

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Proposal Category: GO
Scientific Category: Cosmology
ID: 9033
Title: Measuring the mass distribution in the most distant, very X-ray luminous galaxy cluster known
PI: Harald Ebeling
PI Institution: Institute for Astronomy

We propose to obtain a mosaic of deep HST/WFPC2 images to conduct a weak lensing analysis of the mass distribution in the massive, distant galaxy cluster ClJ1226.9+3332, recently discovered by us. At z=0.888 this exceptional system is more X-ray luminous and more distant than both MS1054.4-0321 and ClJ0152.7-1357, the previous record holders, thus providing yet greater leverage for cosmological studies of cluster evolution. ClJ1226.9+3332 differs markedly from all other currently known distant clusters in that it exhibits little substructure and may even host a cooling flow, suggesting that it could be the first cluster to be discovered at high redshift that is virialized. We propose joint HST and Chandra observations to investigate the dynamical state of this extreme object. This project will 1) take advantage of HST's superb resolution at optical wavelengths to accurately map the mass distribution within 1.9 h^-1_ 50 Mpc via strong and weak gravitational lensing, and 2) use Chandra's unprecedented resolution in the X-ray waveband to obtain independent constraints on the gas and dark matter distribution in the cluster core, including the suspected cooling flow region. As a bonus, the proposed WFPC2 observations will allow us to test the results by van Dokkum et al. (1998, 1999) on the properties of cluster galaxies (specifically merger rate and morphologies) at z~ 0.8 from their HST study of MS1054.4-0321.

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Proposal Category: GO
Scientific Category: Stellar Populations
ID: 9034
Title: The Masses and Luminosities of Population II Stars
PI: Elliott Horch
PI Institution: Rochester Institute of Technology

Very little is currently known concerning the mass-luminosity relation (MLR) of Population II stars. However, with the advent of the Hipparcos Catalogue, improved distances to many spectroscopic binaries known to be Pop II systems are now available. After surveying the literature and making reasonable estimates of the secondary masses, we find 13 systems whose minimum separation should be larger than the resolution limit of FGS1. Because of the expected magnitude differences and separations, it is not possible to resolve the systems from the ground. We therefore propose FGS observations of the sample. In combination with the known spectroscopic orbits and Hipparcos distances, these observations will yield up to 26 precise stellar mass determinations of metal-poor stars, if all systems are resolved and the relative orbits are determined. A combination of FGS data and ground-based observations will lead to component luminosities and effective temperatures. This program will allow for a significantly better understanding of the Pop II main sequence, which in turn will lead to better ages and distances of the galactic globular clusters, and a Pop II MLR will be constructed for the first time.

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Proposal Category: GO
Scientific Category: Solar System
ID: 9035
Title: Spatially Resolved Spectroscopy of Uranus and Neptune
PI: Erich Karkoschka
PI Institution: University of Arizona

We propose to use STIS to obtain data cubes for Uranus (Cycle 10) and Neptune (Cycle 11). The spectrum between 290 and 1020 nm is sampled at 2000 wavelengths. The north-south position on the planetary disk is sampled along the slit every 0.05". The east-west position is sampled by successive exposures every 0.05" (longward of 520 nm wavelength) and 0.3" (shortward of 520 nm). Such data have never been obtained. Only HST, with STIS, has the capability to record spatial variations of narrow methane and hydrogen absorption and Raman scattering features. We have obtained such data for Saturn by ground-based observations which permitted a comprehensive understanding of the vertical haze and cloud structure as a function of latitude. Similar improvements are expected from the proposed data for Uranus and Neptune. HST has revealed exciting images of Uranus and Neptune while

their quantitative analysis has been slow due to limitations in available filters. Our short, spatially-resolved spectroscopic program will reveal accurate spectral shapes across each WFPC2 filter which then will greatly improve the reliability of interpretations based on hundreds of past anf future WFPC2 images. Similarly, WFPC2 images of Titan required the addition of STIS spectra before the latest improvements in our understanding of its atmosphere were possible.

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Proposal Category: GO
Scientific Category: Galaxies
ID: 9036
Title: An Ultraviolet Spectroscopic Survey of Star-Forming Galaxies in the Local Universe
PI: Claus Leitherer
PI Institution: Space Telescope Science Institute

We propose a comprehensive STIS ultraviolet spectroscopic survey of star-forming galaxies in the local universe. The sample covers a broad range of morphologies, chemical composition, and luminosity. The observations will provide spectral coverage between 1200 and 3100 Angstrom, at a resolution of 100 to 200 kms and S/N of about 30. The data set will allow us to document and quantify the effects of massive stars on the interstellar medium and to infer implications for the evolution of the host galaxies. Specific issues to be addressed are: (i) the relation of interstellar-line profiles to gravity and macroturbulence, and indications for large-scale outflows of the cool gas; (ii) the search for systematic trends of interstellar-line strengths with metallicity, with the goal of calibrating a new metallicity indicator; (iii) the properties of the low- and high-ionization absorption lines of the interstellar medium and their relation to the X-ray emitting gas; (iv) the properties of dust obscuration in star-forming galaxies and its consequences for deriving star-formation rates; (v) studying the star-formation histories and relating the stellar properties to those of the interstellar medium. This data set, while fundamental in its own right, will also be significant as a template for the restframe-ultraviolet of high-z galaxies. We will entirely waive our proprietary rights to give the community immediate access to the data.

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Proposal Category: GO

Scientific Category: Cool Stars
ID: 9037
Title: Imaging the Dust Disk around Epsilon Eridani
PI: Mario Livio
PI Institution: Space Telescope Science Institute

Epsilon Eridani is the closest star to the Sun, around which a planet has been discovered. An asymmetric dust disk around the star has been detected in sub-millimeter observations. The clumps in the disk have been interpreted as resulting from resonant interaction, and the pattern has been predicted to revolve around star at a rate of ~0.7^degrees per year. We propose first epoch observations of the dust disk with STIS, to be followed up in subsequent cycles. These observations will not only reveal what may be the first extra-solar `Kuiper belt', but will also provide a crucial step in the development of observational techniques that can determine the presence and properties of planets, from the visible morphology of the disks around the parent stars.

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Proposal Category: GO
Scientific Category: Hot Stars
ID: 9038
Title: The Evolution of Cataclysmic Variable Stars
PI: Thomas Marsh
PI Institution: Department of Physics and Astronomy, Southampton University

We have discovered that EM Cygni, one of the most well-known cataclysmic variable stars (CVs), is very likely in a triple system with a spatially-unresolved K dwarf. EM Cyg has well measured masses, and the white dwarf's mass of 1.1, M_ shows that it must have come from an AGB star. This, together with considerations of binary evolution, can be used to predict a lower limit to the present-day separation of EM Cyg and the K dwarf of > 18, AU. Ground-based imaging only puts an upper limit on the angular separation of 0.2'', equivalent to < 60, AU at the 300, pc distance of EM Cyg; this does not seriously test the evolutionary prediction. With HST and FGS1R on the other hand, we can resolve a separation 6, AU, providing a direct test of the evolutionary path that leads to CVs, as well as to the Super-Soft X-ray sources widely believed to be the progenitors of Type Ia supernovae.

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Proposal Category: GO
Scientific Category: Galaxies
ID: 9039
Title: Getting to the Core of The Matter: The Inner Region of M15
PI: Bernard McNamara
PI Institution: New Mexico State University

We propose to measure the velocity dispersion profile within 15 arcseconds of the core of M15 to determine whether the mass distribution in this region is best fit by the presence of a Black Hole or by a more extended distribution of mass. We will test three models of the core region, that is possesses (1) a massive Black Hole, (2) a more extended distribution of neutron stars, or (3) is in the process of core collapse. Our observational data will consist of PC WFPC2 images. Using prior images in the HST archive and newly obtained images, we will compute the core velocity dispersion using proper motions. The expected accuracy of these motions is entirely adequate to test the models mentioned above.

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Proposal Category: GO
Scientific Category: Quasar Absorption Lines and IGM
ID: 9040
Title: Baryons in intermediate redshift (z > 1) OVI absorbers
PI: Dieter Reimers
PI Institution: Hamburger Sternwarte

We propose to search for intervening OVI absorption systems in two further extremely UV bright intermediate redshift QSOs (HS 0747 + 4259, z = 1.9, V = 15.6; HS 0818+2554, z = 1.5, V = 15.4) using the STIS E230M Echelle mode. The scientific aim is to measure the baryonic fraction in the warm-hot intergalactic medium at redshifts 1 <=q z <=q 1.8. Present existing data on HE 0515-4414 taken also with STIS E230M seem to indicate that the baryonic fraction at z = 1.5 is lower by a factor of ~ 15 than the high value found by Tripp et al. (2000) for z < 0.3. Our results need to be confirmed by more lines of sight, and we plan to test hierarchical structure formation models which predict a rapid evolution between z = 1.5 and z = 0.

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Proposal Category: GO

Scientific Category: Hot Stars
ID: 9041
Title: Direct imaging of the progenitors of massive, core-collapse supernovae
PI: Stephen Smartt
PI Institution: Institute of Astronomy

Recent surveys of starforming galaxies in the nearby Universe are discovering significant numbers of supernovae which have massive star progenitors (Types II, Ib and Ic). The extensive HST archive and high-resolution ground-based images of galaxies within ~20 Mpc enables us to resolve and quantify their individual bright stellar content. As massive, evolved stars are the most luminous single objects in a galaxy, the progenitors of core-collapse supernovae should be directly detectable on pre-explosion images. The site of the Type II supernova 1999gi (in NGC3184, ~8 Mpc distant) has been imaged in two colours by HST prior to explosion - it is a young star-forming region, with a resolved, massive stellar population. We request a post-explosion exposure to allow identification of the progenitor star, and its colours. We have deep, high-quality ground-based archive exposures of the pre-explosion region of 1999em (Type II in NGC1673, also at ~8 Mpc distant). We believe we have identified the progenitor as a mid-late G-type supergiant from its VRI colours, however a high-resolution HST image will indicate if this star really is coincident with the SN position at a more secure level. We are assimilating a database of all suitable exposures of nearby galaxies to allow similar future discoveries, and request similar follow-up exposures (as a TOO) if suitable pre-explosion material exists.

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Proposal Category: SNAP
Scientific Category: Hot Stars
ID: 9042
Title: An archive to detect the progenitors of massive, core-collapse supernovae
PI: Stephen Smartt
PI Institution: Institute of Astronomy

Recent surveys of starforming galaxies in the nearby Universe are discovering significant numbers of supernovae which have massive star progenitors (Types II, Ib and Ic). The already extensive HST archive and high-resolution ground-

based images of galaxies within ~20 Mpc enables us to resolve and quantify their individual bright stellar content. As massive, evolved stars are the most luminous single objects in a galaxy, the progenitors of core-collapse supernovae should be directly detectable on pre-explosion images. We have detected one Type II progenitor this year, and have proposed a short, companion WFPC2 proposal to confirm this candidate and identify a second. This SNAP proposal aims to increase the amount of WFPC2 multi-colour, pre-explosion imaging data of spirals and high star-formation rate galaxies in the nearby Universe to ~300 galaxies. By doing so we estimate that we may detect 2-3 massive core-collapse progenitors per year. Once we have this high-quality archive in place, we will run the detection program for about 5 years, which will produce a study of the colours of ~10-15 progenitors, revolutionising the present knowledge in the field.

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Proposal Category: GO
Scientific Category: Cosmology
ID: 9043
Title: Cepheid Distances to Early-type Galaxies
PI: John Tonry
PI Institution: Institute for Astronomy

-.07in The HST Key Project on the Extragalactic Distance Scale and the HST project on the ``Calibration of Nearby Type Ia Supernovae'' have greatly improved our knowledge of the Hubble Constant by providing a solid zero point for the Tully-Fisher (TF) relation and Type Ia Supernovae (SNIa). However, severe inconsistencies remain for distance estimators to early-type galaxies such as surface brightness fluctuations (SBF), the planetary nebula luminosity function (PNLF), the fundamental plane (FP), and the globular cluster luminosity function (GCLF). As a result, the distance to the Virgo cluster core remains uncertain by as much as 20 determination is directly affected by a lingering 0.1 mag (5 uncertainty in the photometric calibration of the WFPC2. Resolving these issues is essential not only to firm up the extragalactic distance scale, but also to understand the mass and velocity structure of the local universe. SBF in particular is emerging as the method of choice for mapping local velocity fields to 10,000 kms because it offers an order of magnitude less Malmquist bias than TF, and SNIa are too rare to study large scale flows effectively. This project will tighten the photometric calibration of the WFPC2, and provide a solid Cepheid calibration

for SBF and PNLF.

Proposal Category: GO
Scientific Category: Stellar Populations
ID: 9044
Title: The Stellar Population of UGCA 292, An Extreme Low Metallicity Galaxy
PI: Liese van Zee
PI Institution: Herzberg Institute of Astrophysics

As the third lowest metallicity galaxy known, UGCA 292 provides a unique opportunity to investigate the evolutionary status of extremely metal--poor, gas--rich, star--forming galaxies. UGCA 292 is sufficiently nearby (3.1 Mpc), that it is possible to resolve the stellar population with HST. The proposed observations will enable us to investigate the stellar population of this relatively unevolved galaxy to determine if the low metallicity and high gas mass fraction are indicative of a newly formed galaxy. The detection of an intermediate age stellar population in UGCA 292 will definitively prove that it is possible to have galaxies which are gas--rich and metal--poor, yet have extended star formation histories. Alternatively, the lack of an intermediate age stellar population in UGCA 292 will support the hypothesis that there is no single epoch of galaxy formation, and that some low mass galaxies have delayed formation for almost a Hubble time.

Proposal Category: GO
Scientific Category: AGN/Quasars
ID: 9045
Title: The Relationship Between Radio Luminosity and Radio-Loud AGN Host Galaxy Properties
PI: Chris Willott
PI Institution: University of Oxford

We propose a large program aimed at determining the relationship between the properties of the host galaxies of radio-loud AGN and their radio luminosities. Previous studies in this area with the HST have concentrated on the 3C sample which shows a tight correlation between luminosity and redshift, such that evolutionary effects cannot be distinguished from those depending upon radio luminosity. Our sample of 46 radio galaxies at z ~ 0.5 comes from

four complete, low-frequency-selected samples of radio sources with differing flux limits. Thus the total sample spans an unprecedented three orders of magnitude in radio luminosity at a fixed redshift interval. These observations will probe the relationship between the radio sources, their host galaxies and supermassive black holes. With 2D-modelling of the radio galaxies we will derive morphologies and scalelengths to determine if all radio-loud AGN reside in giant ellipticals and follow the Kormendy relation exhibited by low-redshift, radio-quiet ellipticals.

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Proposal Category: GO
Scientific Category: Galaxies
ID: 9046
Title: Black Holes and Bars: A Recipe for Making Bulges?
PI: Martin Bureau
PI Institution: Sterrewacht Leiden

We propose to obtain WFPC2 multi-color images and STIS emission line spectroscopy of the nuclear regions of 6 edge-on barred spiral galaxies spanning a range of bulge morphologies and bar strengths. Our goal is to quantify the amount of vertical heating in the nuclei, and to test whether or not bars are indeed destroyed and create a bulge if enough mass is accumulated in their centers. Edge-on galaxies provide a unique tool to study the structure and dynamics of barred disks rapidly and extensively, and we have already obtained extensive ground-based data for all our targets. The high spatial resolution of HST is crucial for our project as the efficiency of bar-driven processes is determined by the galaxies' nuclear properties. Our images will yield the nuclear cusp slope and will allow us to determine the conditions under which bars can survive. Color information is required to correct for internal dust extinction, identify population gradients, and evaluate the rate at which disk stars migrate into bulges. STIS will be used to probe the kinematics of the nuclear gas disks and to weigh any unresolved massive point mass (black hole), providing a direct test of bar dissolution scenarios. We will use line-ratio diagnostics to study the physical conditions of the nuclear gas and determine the importance of bar-induced shocks and nuclear spirals for inflow.

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Proposal Category: GO
Scientific Category: Cool Stars

ID: 9047
Title: The densely spotted photospheres of active cool stars
PI: Andrew Cameron
PI Institution: University of St Andrews

Rapidly rotating main-sequence stars are so heavily mottled by starspots that rotational modulation of their light may amount to 0.1 magnitude or more. Over the last decade or so, the spatial distributions of the largest starspot groups have been mapped on many active stars using Doppler imaging methods applied to ground-based echelle spectroscopy. In rapidly rotating young main-sequence stars with ages comparable to the Pleiades, Doppler images seldom show more than 10 methods such as TiO band-strength analysis and broad-band optical and near-IR photometry, however, indicate that 20 active stars' surfaces are occupied by spots. The discrepancy can be resolved by requiring the brighter regions of an active stellar surface to be packed with a high density of dark spots, too small to be resolved in Doppler images. Here we propose to measure the packing fraction and size distribution of small starspots on the inner face of the G2/3V primary of the eclipsing binary SV Cam (= HD 44982). We will observe three primary eclipses at the exquisite photometric precision (1.3* 10^-4 mag RMS with time resolution 50s) attainable by using STIS as a bright-star photometer. Starspots with radii as small as 15000 km will be detected as marginally-resolved, 5Sigma fluctuations in the eclipse profile as the dark K5 secondary scans across the disk of the primary.

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Proposal Category: GO
Scientific Category: Cool Stars
ID: 9048
Title: Boron Constraints on Slow Mixing in Low Mass Stars
PI: Constantine Deliyannis
PI Institution: Indiana University, Department of Astronomy

The atomic and nuclear characteristics of the light elements Li, Be and B make their photospheric abundances ideal tracers of internal physical processes in stars. Both Li and Be have been heavily utilized to this end since their diminished abundances are a direct result of the extent of internal slow mixing between surface and interior layers, as we have shown with our ground-based data. Boron provides a fresh and special probe because it survives to greater depths inside stars than does Li or Be, and can thus uniquely reveal

the depth of mixing. We propose to observe B in stars with very large depletions of Li and Be, i.e. stars which have been the most seriously affected by mixing. Previously, we have found one star in which B might be slightly depleted; new observations are needed to establish whether or not B depletion really occurs in stars, and if yes, how much. Our published detailed stellar models agree remarkably well with the correlated depletion of Li and Be. Similar models imply that the Big Bang ^7Li abundance has been depleted, up to 0.3dex according to ^6Li data. However, such models do not deplete B. It is thus imperative (for improved knowledge of both, stellar interiors and cosmology) to establish whether low mass stars deplete B, and thus the degree to which such models are or are not realistic. In low mass dwarfs, B can only be observed from space, using HST/STIS.

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Proposal Category: GO
Scientific Category: Cool Stars
ID: 9049
Title: Boron in G64-12: Higher Big Bang Lithium or Signature of the Nu-Process?
PI: Constantine Deliyannis
PI Institution: Indiana University, Department of Astronomy

The extremely metal-poor (Fe/H ~ -3.3) star G64-12 shows a remarkable lithium (Li) abundance that is about 2 times larger than those seen in other warm metal-poor stars, from which the Big Bang Li abundance is inferred. This star's enhanced Li has resulted from either a) Galactic Li enrichment from a lower Big Bang value, or b) stellar depletion from a higher Big Bang value, with significant cosmological implications. We argue against two of the three prominent mechanisms of Galactic Li enrichment, leaving the theoretical Nu-process in Type II supernovae as the sole viable mechanism. This mechanism's crisp signature is the concomitant production of copious amounts of boron (B); if the Nu-process enriched the material out which G64-12 formed with the extra Li observed today, then this star should also exhibit a large detectable B overabundance. B in G64-12 can only be observed from space, using HST/STIS. If this star's STIS-based B abundance lies above the established B-Fe trend, this would be the first observational evidence for the Nu-process. But if its B abundance lies near the B-Fe trend, this would provide direct evidence that G64-12 is an elusive fossil of a Big Bang Li abundance about 0.3 dex above currently favored values, providing consistency in standard Big

Bang Nucleosynthesis between Li and D (but not ^4He). EITHER RESULT would be of fundamental importance to Astronomy.

Proposal Category: GO
Scientific Category: ISM and Circumstellar Matter
ID: 9050
Title: Outflow Collimation in Bipolar Symbiotic Nebulae
PI: Bruce Balick
PI Institution: University of Washington

Flow collimation in evolved stars is neither expected nor understood. Classical theories of stellar evolution do not predict and cannot explain this bipolarity. More exotic concepts (binary interactions, spun-up atmospheres, poloidal or toroidal magnetized winds) have been proposed, but observations are yet to verify or falsify any of their predictions. We propose to probe the near-nuclear morphology and kinematics of four bright, low-extinction targets whose large-scale structure is highly bipolar. Our goal is to provide a detailed description of the circumnuclear outflows, to uncover the physical structure and nature of the collimator, and to evaluate the speculative collimation mechanisms. The bright nucleus has hampered efforts to explore the nebular collimators that lie close to the star, so we'll use STIS to disperse the nuclear light and, thus, to avoid its glare. A secondary goal is to obtain second-epoch WFPC2 images of all targets. The outflow speeds predict readily measurable proper motions of >~2 PC pix in 3 yr at distances of 0.5--1 kpc.

Proposal Category: GO
Scientific Category: Quasar Absorption Lines and IGM
ID: 9051
Title: Identifying Damped Lyman-alpha Galaxies at z~1
PI: Robert Becker
PI Institution: University of California, Davis

Damped Lyman-alpha absorption systems contain the bulk of the neutral gas in the Universe in the redshift range z = 0.5 - 5 yet the nature of the galaxies responsible for the absorption is not well understood. Only recently have we found more than a handful of damped absorbers at redshifts z < 1.5. Using the FIRST Bright Quasar Survey (FBQS), with over a 1000 quasars, we have

undertaken a survey to build a complete picture of the nature of the galaxies responsible for damped Lyman-alpha absorption systems at z~1 and to double the sample size at this redshift. The FBQS provides the first large, well defined, unbiased sample to use in these studies. STIS spectroscopy of candidate damped absorption systems at z < 1.7 is required to accurately measure their HI column densities and confirm which are damped. A complementary ground-based imaging and spectroscopic program is underway at Keck Observatory to identify and characterize the galaxies associated with the absorption systems.

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Proposal Category: GO
Scientific Category: Solar System
ID: 9052
Title: A Global Search for Alteration Minerals on Mars
PI: James Bell
PI Institution: Cornell University

-0.5cm We propose to perform high spatial resolution and moderate spectral resolution 3000 Angstrom to 5700 Angstrom STIS long-slit imaging spectroscopy of Mars, to search for and globally map the presence of iron-bearing minerals that are diagnostic of specific climatic conditions. STIS measurements would be obtained by push-broom scanning the 0.2 " slit across the planet during four separate visits spaced ~90degrees apart in Martian longitude. These hyperspectral STIS image cubes will be complemented by near-simultaneous WFPC2 UV-VIS imaging that will allow us to quantify the effects of water ice clouds or other aerosols on our STIS spectra. These STIS data will provide the ability to detect and map small abundances (~1 jarosite K,Na,H_3OFe_3(SO_4)_2(OH)_6, goethite (AlphaFeOOH), hematite (alphaFe_2O_3), and other ferric and ferrous phases. These minerals are formed under specific environmental conditions, and some are potential sinks for Martian atmospheric volatiles. Our search will be conducted at a spatial scale comparable to existing spacecraft orbital spectroscopy data (~15-20 km/pixel) and in a wavelength region not sampled by existing or planned Mars spacecraft instrumentation. These observations also provide complementary measurements in support of current and future NASA Mars exploration missions. We require these observations to be scheduled near opposition (June-July 2001) in order to maximize spatial resolution.

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Proposal Category: GO

Scientific Category: Stellar Populations
ID: 9053
Title: The Late Evolution of Low-Mass Stars: a Deep UV Color-Magnitude Diagram of M32
PI: Thomas M. Brown
PI Institution: Goddard Space Flight Center

We propose to construct a deep far-UV color-magnitude diagram (CMD) of the hot stellar population in the center of M32 (NGC221). Our previous Cycle 7 near-UV STIS observations of the M32 core resolved ~8000 stars in a single bandpass. While these observations provided no color information, they nonetheless showed conclusively that hot (T_{eff} > 8500 K) horizontal branch (HB) stars exist in M32. Moreover, the near-UV luminosity function showed a surprising lack of post-asymptotic giant branch (post-AGB) stars, indicating that they evolve much more rapidly than expected from canonical theory. Obtaining color information is the vital next step to extending this analysis. A CMD for a statistically large sample of evolved stars in M32 will provide fundamental information on post-red giant branch evolution that is not obtainable from Galactic globular clusters (because of too few stars) or from the Galactic field (because distance uncertainties dominate the errors). We aim to address the following questions: 1) Do hot HB stars have high helium abundance, as predicted by some models of elliptical galaxy chemical evolution? 2) How does the rate of post-AGB evolution differ from theoretical expectations, and what does this tell us about mass-loss on the AGB? 3) What is the mass and temperature distribution on the HB of M32? 4) What are the relative lifetimes of the HB and post-HB phases?

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Proposal Category: GO
Scientific Category: Galaxies
ID: 9054
Title: Star Formation Triggers and Chemical Reprocessing in I Zw 18
PI: Thomas M. Brown
PI Institution: Goddard Space Flight Center

I Zw 18 is a blue compact galaxy (BCD) with the smallest known abundance of heavy elements yet observed. Although it is currently undergoing an intense period of star formation, debate continues to focus on the presence of any

older generations of stars in this system. If its star formation history is truly restricted to the last ~50 Myr, the existence of I Zw 18 demonstrates that the formation of galaxies can be delayed until the present epoch. This galaxy may represent a local template for the young galaxies that will be observed with NGST at high redshift, and as such it is essential that we understand its evolutionary status. Narrow-band imaging and spectroscopy have focused on the ionized gas in this galaxy. Broad-band imaging has resolved the brighter stellar populations, but due to the uncertain distance of I Zw 18 and its high level of crowding, interpretation of this imaging has been disputed. We propose a spatially resolved far-UV spectroscopic map of this critically important galaxy. Our data will investigate how star formation propagates across a starbursting galaxy, determine if heavy elements have been incorporated into the young hot stars or instead have been blown out of the galaxy, extend our understanding of mass loss and stellar winds to very low metallicity, and create a template for metal-poor starbursts observed at high redshift.

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Proposal Category: GO
Scientific Category: Star Formation
ID: 9055
Title: Direct Detection of an Extrasolar Planet in Reflected Light
PI: David Charbonneau
PI Institution: Harvard-Smithsonian Center for Astrophysics

HD 209458 b is the first extrasolar planet known to transit the disk of its parent star. Precise measurement of both the photometric transit curve and the radial velocity orbit has allowed for an accurate estimation of the mass, radius, average density and surface gravity. We propose to detect directly the gas giant planet orbiting HD 209458 in reflected light by observing the secondary eclipse, i.e. when the planet is occulted by the star. We will use STIS to disperse the stellar flux over a large number of detector pixels. The photometric signal is produced by summing the counts over a desired band. For each of six bands spanning the UV to the near-IR, we will obtain sufficient precision either to detect the planet, or to limit its geometric albedo in each band to less than 0.2. Combining data at all wavelengths, our detection threshold for the average geometric albedo will be 0.08. These data span the wavelengths over which the majority of the stellar flux is emitted. Thus we

will quantify the net energy deposited into the planet, the key remaining unknown in comparing the measured planetary radius to theoretical models of its structure and evolutionary history. Furthermore, the measured wavelength-dependent albedo will provide stringent constraints on the numerous atmospheric models for these objects. We should be able to identify the dominant scattering sources, such as Rayleigh scattering and atmospheric silicates.

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Proposal Category: GO
Scientific Category: Solar System
ID: 9056
Title: Spectroscopic Imaging of the Atmosphere of Callisto
PI: Paul D. Feldman
PI Institution: The Johns Hopkins University

We propose to obtain long-slit imaging ultraviolet spectra of Callisto, using STIS with the G140L grating, to study the interaction of the Jovian plasma environment with the tenuous carbon dioxide atmosphere of this icy satellite. This spectral range is rich in emissions of CO, ionC1, ionC2, and ionO1 characteristic of CO_2 atmospheres. Recent Galileo measurements of atmospheric CO_2 infrared limb emission and the plasma density and magnetic field in the vicinity of Callisto suggest that Callisto should show emission brightness comparable to Europa and Ganymede, both of which have been successfully imaged in ultraviolet ionO1 emission by STIS.

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Proposal Category: SNAP
Scientific Category: AGN/Quasars
ID: 9057
Title: Host Galaxies of Obscured QSOs Identified by 2MASS
PI: Dean C. Hines
PI Institution: The University of Arizona

We propose a WFPC2 snapshot survey of red QSOs discovered in The Two Micron All Sky Survey (2MASS) to investigate the detailed properties of their host galaxies. This large, possibly dominant, population of QSOs in the local universe has been previously overlooked because reddening by (intrinsic) obscuration along our line of sight causes their colors to be too red for identification by traditional ``UV-excess'' techniques. Their near-IR colors

are similar to PG-type (UV-excess) QSOs, but it is far from certain whether they are indeed from the same parent population or represent a completely new class of QSO. Hints from our polarimetry survey suggest that they may simply be highly inclined PG-type QSOs. Alternatively, they may represent objects with high dust cover from an interaction similar to that seen in the Ultra- and Hyperluminous Infrared Galaxies (ULIRGs & HIGs). Regardless, the strong attenuation of the nuclear UV/optical light affords us with the unique opportunity to investigate the optical properties of QSO host galaxies without the pitfalls encountered while observing QSOs whose blinding nuclear emission often completely overwhelms the host galaxy, even in HST images. The snapshot images will form a comprehensive census, and strong legacy database, of the 2MASS QSO host galaxies that can be compared directly with previous HST imaging studies of PG-type QSOs, ULIRGs and HIGs.

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Proposal Category: GO
Scientific Category: Stellar Populations
ID: 9058
Title: Trigonometric Parallax of the Globular Cluster 47 Tucanae
PI: Ivan King
PI Institution: University of California, Berkeley

Using high-precision astrometric techniques that we have developed and demonstrated, we propose to measure the trigonometric parallax of 47 Tuc, which is about one quarter milliarcsec, to an accuracy of 10 repeating a field that was observed in 1995, we will measure the secular motion of the cluster stars with respect to the SMC background with sufficient accuracy that the parallax can be measured directly from the displacements within Cycle 10. Constraints of orientation, and the shape of the WFPC2 footprint, require that we take images at 3-month intervals, rotating 90 degrees each time. This project will have an important impact on the globular-cluster distance scale, and through it on the distance scale and age of the Universe. By doing so it will demonstrate the astrometric power of HST par excellence.

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Proposal Category: GO
Scientific Category: Solar System
ID: 9059
Title: UV/Visible Spectroscopy of Asteroid 762 Pulcova and its Newly-discovered Moon

PI: William Merline
PI Institution: Southwest Research Institute

We propose to acquire separate, comparative, and simultaneous spectra of asteroid 762 Pulcova and its satellite. We will compare our results with those we obtain in an identical program approved in Cycle 9 for 45 Eugenia and its moon. We discovered both of these moons using ground-based adaptive optics --- Eugenia in 1998, but Pulcova only in the last year. We can now compare two systems that both have primaries of the relatively uncommon F-like spectral class. We will use the high-spatial-resolution and UV-capabilities of STIS to obtain medium-resolution spectra over the range 2900--10300 Angstrom, using only two grating settings, on a single HST orbit. We will determine whether the surface compositions are similar or different in the parent-satellite pair and test hypotheses concerning satellite production mechanisms. Our fits to the orbits yield a surprisingly low density for Eugenia of 1.2 g cm^-3, but that of Pulcova is 50 F-type spectra are similar to the common C-types, but differ 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 (~ 9000 Angstrom) are diagnostic of the specific differences between F-, C-, and (Bus') X-class. HST is required 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: SNAP
Scientific Category: Solar System
ID: 9060
Title: Photometry of a Statistically Significant Sample of Kuiper Belt Objects
PI: Keith Noll
PI Institution: Space Telescope Science Institute

accelerating, the physical study of this new region of the solar system has been retarded by a lack of basic astrophysical data. Photometric observations of the majority of the more than 330 known KBOs and Centaurs are rudimentary and incomplete. The multicolor photometry that exists for a small subset of ~30 KBOs often shows significant discrepancies between observations by different observers. The intrinsic faintness of KBOs puts them at the practical limits of ground-based systems. We propose to propel the physical

study of KBOs forward by performing accurate photometry at V, R, and I on a sample of up to 150 KBOs. Our sample is made up of objects that will be observed at thermal infrared wavelengths by SIRTF and will be used with those data to derive the first accurate diameters and albedos for a large sample of KBOs.

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Proposal Category: GO
Scientific Category: Stellar Populations
ID: 9061
Title: A Census of Planets in the Globular Cluster M22 and the Galactic Bulge
PI: Kailash C. Sahu
PI Institution: Space Telescope Science Institute

We propose a program of intensive monitoring of the globular cluster M22 and its background Galactic bulge field, using both WFPC2 and simultaneous parallel STIS imaging. In an earlier pilot program to look for microlensing events due to M22, we detected one long-duration event (lens mass of 0.25 M_solar), and 11 candidate short-duration (<0.4 days) events corresponding to lens masses of <0.25 Mjup. This suggests the startling possibility that a non-negligible fraction of the cluster mass resides in free-floating, sub-Jupiter mass objects. However, each of the 11 events was seen only as a single brightening, due to the wide spacing of the observations. In order to follow up on this potentially important discovery, we propose to observe two fields in the core of M22 continuously with WFPC2 over a 7-day interval (92 orbits), followed by an additional 31 orbits spaced out over the ensuing 13 days. Based on the pilot study, we expect to detect 10--25 short-duration microlensing events, which will be well sampled and will yield lens masses. We will simultaneously observe a bulge field with STIS imaging, in order to detect planetary transits. Depending on the frequency of planets and its metallicity dependence, we should detect 3--15 planetary transits among the bulge stars. Byproducts will be a search for planets around the M22 stars, and a census of variable stars and binaries in both the cluster and the bulge.

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Proposal Category: GO

Scientific Category: Solar System
ID: 9062
Title: Observations of Comet Borrelly to Support the New Millennium/DS1 Flyby Occurring 23 September 2001
PI: Alan Stern
PI Institution: Southwest Research Institute

The New Millenium Program (NMP) Deep Space 1 asteroid-comet flyby mission is now en route to comet 19P/Borrelly for a late September 2001 flyby. DS1 carries particle and field instruments, a monochrome imager, and an IR imaging spectrometer; its UV spectrometer is inoperable. On behalf of the DS1 Science Team, we request STIS imagery and spectroscopy of comet Borrelly at the time of the DS1 encounter in order to provide both support science and context for the flyby datasets; the proposed Borrelly observations will also reveal important new information relating to the intriguing carbon-depletion in this bright, well-known comet with an origin in the Kuiper Belt.

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Proposal Category: GO
Scientific Category: Hot Stars
ID: 9063
Title: Optical Counterparts of Isolated Neutron Stars
PI: Marten van Kerkwijk
PI Institution: Utrecht University

There has been gradual recognition of neutron stars as laboratories to test our understanding of both quantum chromodynamics (QCD) and quantum electrodynamics (QED). Specifically, the measurement of radii of neutron stars can test QCD at high density. This is being realized through intensive X-ray observations of bright nearby neutron stars. However, the natures of these important sources are not clear and to this end we propose a simple proper motion program as a means to obtain their ages and potential association with star-forming regions. One of the sources is RX J0720.4-3125 which has been argued to be an old magnetar --- a highly magnetized neutron star --- and thanks to its high count rate is already a choice object for X-ray missions. Magnetars, with their extreme magnetic field strengths, are excellent laboratories for testing out some expectation of QED. We show how UV observations can be combined with optical and X-ray observations to demonstrate the magnetar nature of the source. The other sources are the

brightest of the nearby neutron stars that currently lack optical identifications. For these we will first detect them and then perform accurate astrometry so that future observations will yield birth locations.

Proposal Category: GO
Scientific Category: Star Formation
ID: 9064
Title: HI Detection of an Extra-Solar Planetary Atmosphere
PI: Alfred Vidal-Madjar
PI Institution: Institut d'Astrophysique de Paris, CNRS

The extra-solar planet discovered around HD 209458 is the unique one also detected through occultation. During its transit, we will obtain spectra of the HI and DI Lyman-Alpha line at 1215Angstrom . The extremely extended planetary exosphere is expected to produce an absorption line against the stellar chromospheric Lyman-Alpha emission. Because hydrogen is the most abundant element and its scale height in the exosphere is the largest (H is the lightest element), hydrogen is certainly the best suited species to be detected in an extra-solar planetary atmosphere. From a detection we will better understand the status of such peculiar planetary atmospheres while a non detection should underline possible important missing links in our present views on such subjects. Reference spectra obtained in quadrature position of the planet will give as a by-product the possible detection of extra-solar planetary Lyman-Alpha aurorae. All collected spectra will also allow to evaluate the interstellar D/H ratio on this line of sight.

Proposal Category: GO
Scientific Category: ISM and Circumstellar Matter
ID: 9065
Title: Variable Interstellar Absorption toward HD 219188 --- Probing the Structure of an Interstellar Cloud
PI: Daniel Welty
PI Institution: University of Chicago

Within the last 10 years, strong, narrow Na I absorption has appeared at v_SUN ~ -38 km s^-1 toward the halo star HD 219188; that absorption has continued to strengthen, by a factor 2--3, over the past three years. The line of sight appears to be moving into/through a relatively cold, quiescent intermediate

velocity (IV) cloud, due to the 13 mas/year proper motion of HD 219188. We propose to monitor the continuing changes in the IV absorption toward HD 219188 over the next three years with STIS echelle spectra --- making use of the rich diagnostics provided by the UV lines of various neutral and singly ionized species to determine abundances/depletions and physical conditions (temperature, density, ionization) as functions of depth within the cloud. In addition to providing a unique view of the detailed structure of an interstellar cloud, these data will yield constraints on grain scattering parameters (from the variation of ionization with depth) and on any dependence of depletion on local density.

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Proposal Category: GO
Scientific Category: Cosmology
ID: 9066
Title: Closing in on the Hydrogen Reionization Edge of the Universe at z<7.2 with deep STIS/CCD Parallels
PI: Rogier Windhorst
PI Institution: Arizona State Univ., Physics & Astronomy

We propose 398 parallel orbits to constrain the Hydrogen reionization edge in emission that marks the transition from a neutral to a fully ionized IGM at a predicted redshifts z~5--10. The edge is due to a rapid change in recombination from the Hydrogen Lyman series at z~ (Baltz Etal 1998), which leaves a sharp signal in the recombination spectrum 3 dex below the Zodiacal background. Z is one of the most important remaining unknown quantities in cosmology. HST is unique in that it can constrain this signal with the STIS CCD plus long-slit, covering Lambda~ 5240 -- 10,270 Angstrom or z=3.3--7.5. In Cycle 8, we took 28 STIS parallel orbits with contemporaneous calibrations to reduce systematics, and set limits to the Hydrogen edge signal of 2* 10^-21 erg cm^2 s Hz sr at z cge 5. This 28 orbit data set has not yet pushed STIS to its absolute calibration limits. We therefore propose parallels in ~260 high and sim100 lower latitude fields (1--3 orbits each) to map any variation in the Zodiacal spectrum across the sky. The combined data will allow us to improve constraints to the Hydrogen reionization edge at 5 z. 7.5 by a factor of 4, within reach of theoretical predictions. We must develop this technique to learn how to optimally develop instruments for NGST to make this measurement with greater sensitivity and at higher redshifts (z=7.5--15).

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Proposal Category: SNAP
Scientific Category: Quasar Absorption Lines and IGM
ID: 9067
Title: UV Detectability of Bright Quasars in the Sloan Fields
PI: Wei Zheng
PI Institution: The Johns Hopkins University

He II LyAlpha absorption at 304(1+z) Angstrom is a far more sensitive tracer of the IGM than its H I counterpart. The recent detection of such absorption in a small handful of quasars, albeit with limited data quality and tiny sample size, demonstrates the great potential of such a probe. Unfortunately, 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 redward of the He II LyAlpha feature. In order to sample more than just a few clean lines of sight to high redshift, and with good quality spectra, it is necessary to find additional high-redshift, UV-bright quasars. The Sloan Digital Sky Survey, which has discovered more than 2600 quasars and will identify ~20 000 quasars per year, with provides a very substantial resource for new, bright, high-redshift quasars. In a continuation of our SNAPSHOT survey GO-8582, we propose to take MAMA spectra of approximately 30 such quasars in each of the next three cycles. The goal is to find additional rare z > 2.9 quasars having sufficient UV flux to allow detailed He II LyAlpha absorption follow-on spectroscopic studies (at good S/N and resolution) with STIS and COS in future HST cycles.
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Proposal Category: GO
Scientific Category: Galaxies
ID: 9068
Title: Accurate determination of the BH mass in early-type disk galaxies
PI: Francesco Bertola
PI Institution: Dipartimento di Astronomia, Universita di Padova

It is now commonly accepted that almost every galaxy should host in its center a supermassive black hole (BH). Supermassive BH's may have played a major role in galaxy evolution as the recently found correlation between the black-hole mass and the bulge stellar velocity dispersion seems to witness. However it

should be kept in mind that the current demography of supermassive BH's suffers of important biases, related to the limited sampling over the different basic properties of their host galaxies. In particular it is evident that the number of BH mass estimates in spiral galaxies is strongly underrepresented. Moreover up to now only two spiral galaxies have very accurate BH mass measurments. Therefore we propose new STIS spectroscopic observations to map the ionized gas velocity field of 3 early-type disk galaxies, for which we will be able to derive high precision BH mass measurements. Indeed the sample galaxies have been selected by means of ground-based high resolution spectroscopy among 37 observed objects, since we recognize in their central regions the clear presence of a circumnuclear Keplerian disk of ionized disk suitable for dynamical modelling.

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Proposal Category: GO
Scientific Category: AGN/Quasars
ID: 9069
Title: Proper Motions in Extragalactic Optical Jets
PI: John Biretta
PI Institution: Space Telescope Science Institute

The flow velocity of extragalactic jets is a crucial missing parameter in our understanding of these objects. We would like to build on our successful HST proper motion measurements in M87, and propose similar measurements in four other optical jets.

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Proposal Category: SNAP
Scientific Category: Galaxies
ID: 9070
Title: A Census of Nuclear Star Clusters in Late-Type Spiral Galaxies: II - Spectroscopy and Stellar Populations
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, but statistics for cluster frequency, size, and luminosity remain incomplete. To fill this gap, we are undertaking a Cycle 9 WFPC2 snapshot survey of a well-defined sample of late-type galaxies. However, imaging data alone cannot yield the age distribution

of the clusters, which is needed to clarify whether nuclear cluster formation is a one-time event or a recurrent process. This question is important because a central mass concentration is required for some models of bulge formation. In the few cases where cluster ages could be measured from ground-based spectra, they have been found to be rather young (<=q 10^7.5>yrs) and metal-rich. The question then is whether nuclear clusters indeed form recurrently, or whether ground-based observations are biased towards the brightest and hence youngest clusters. To address this issue, we propose to follow up our Cycle 9 program with a snapshot program of low-resolution STIS spectroscopy of the detected clusters. HST's spatial resolution is required to separate the cluster light from the underlying galaxy emission. We will use stellar population synthesis models to infer the age distribution of the clusters, and to constrain their star formation history. The combined Cycle 9 and 10 programs will provide the first systematic census of nuclear star clusters in any class of spirals.

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Proposal Category: GO
Scientific Category: Hot Stars
ID: 9071
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 7-9 program. Sakurai's Object (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 ``born-again'' hydrogen-deficient red giant in 1995-96, and currently it is undergoing episodes of atmospheric dust formation. If it follows the pattern that the similar object V605 Aql took early this century, it will soon begin evolving back to high temperature. During the subsequent few years, it will begin to (re)-ionize its large, faint, old planetary nebula as well as the new ejecta, and we should be able to witness the re-establishment and evolution of a fast stellar wind as the effective temperature increases. When the star does begin to heat up, we will initiate Target-of-Opportunity STIS observations to monitor the star's spectroscopic development in the UV at regular intervals, continuing over the next 3 Cycles. We will also use WFPC2 twice over the next

3 years to continue our monitoring of the expansion of the ejecta and to determine the star's proper motion. 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 back to the hot planetary-nebula-nucleus phase.

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Proposal Category: GO
Scientific Category: Hot Stars
ID: 9072
Title: Dynamical Masses of White Dwarfs from Resolved Sirius-Like Binaries
PI: Howard E. Bond
PI Institution: Space Telescope Science Institute

In Cycle 8 we initiated a WFPC2 snapshot survey for resolved, ``Sirius-like'' systems containing hot white-dwarf companions of cooler main-sequence stars. Out of 17 systems observed to date, 8 have been resolved with WFPC2 by using UV filters. Two of the resolved systems---56 Persei and ZetaCyg ni---have predicted or known orbital periods short enough that dynamical masses can be determined for the white dwarfs within reasonable times. These would thus add to the extremely small number of white dwarfs presently having accurately and directly measured masses. We propose to image them annually in the UV with WFPC2. In addition, we will observe ZetaCyg with FGS in order to measure the absolute motion of the optical component, needed for the mass solution. We also propose to observe Sirius itself with WFPC2 over the next 3 Cycles. The resulting astrometric data will not only greatly improve the precision of the binary orbit and the dynamical mass measurements for both the main-sequence and white-dwarf components, but will also test definitively for the claimed presence of a third body in this famous system.

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Proposal Category: GO
Scientific Category: Galaxies
ID: 9073
Title: Ultraluminous X-Ray Sources and Intermediate Mass Black Holes
PI: Joel Bregman
PI Institution: University of Michigan

Ultraluminous X-ray sources (ULX) are second only to AGNs in point-source luminosity yet they have no known optical counterparts. These extraordinary X-ray objects, which radiate at the Eddington luminosity of a 30-100 M _dot object, are non-nuclear sources in normal disk galaxies. One explanation is that they are binary systems where the accreting black hole has a mass of 30-100 M_dot , although this challenges stellar evolutionary models, which do not predict remnants larger than about 10 M _dot . Another possibility is that ULXs are intermediate mass black holes (10^3-10^4 M_dot), acting as micro-quasars in galaxy disks and representing the link between stellar black holes (4-10 M_dot) and supermassive black holes (10^6-10^10 M_dot). We can distinguish between the models by identifying the optical counterparts of ULXs and measuring their colors. This would be a fundamental step in gaining an understanding of these enigmatic and possibly new astronomical objects.

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Proposal Category: GO
Scientific Category: Galaxies
ID: 9074
Title: The Origin and Physics of Gamma-Ray Bursts
PI: Andrew Fruchter
PI Institution: Space Telescope Science Institute

The rapid and accurate localization of gamma-ray bursts (GRBs) promised by the launch of HETE-2 will revolutionize our ability to study these enigmatic but highly luminous objects. We propose a program of HST and Chandra observations to capitalize on this extraordinary opportunity. The association of GRBs to star-forming galaxies now appears strong, in part because of our successful HST-based observing programs. We propose new observations that will provide the most stringent tests yet performed of the hypothesis that GRBs are powered by the collapse of massive stars. We will use STIS CCD spectroscopy to detect broad atomic features of supernovae underlying GRB optical transients, at flux levels more than a factor of three fainter than SN 1998bw. We will use UV, optical, and X-ray spectroscopy to study the local ISM around the GRB, testing whether GRBs preferentially occur in molecular clouds. Our broadband late-time imaging will further test physical models of the relativistic blast wave that produces the bright GRB afterglow, and together with our early spectroscopy will provide unique insight into the relationship between the behavior of the afterglow and the environment of the burster.

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Proposal Category: GO
Scientific Category: Cosmology
ID: 9075
Title: Cosmological Parameters from Type Ia Supernovae at High Redshift
PI: Saul Perlmutter
PI Institution: Lawrence Berkeley Laboratory

In the remaining lifetime of the HST, we have the opportunity to obtain a Hubble diagram of Type Ia supernovae (SNe Ia) that will be of longlasting value as a record of the expansion history of the universe. This record based on SNe Ia used as calibrated standard candles directly constrains the cosmological parameters. Building on our earlier HST work that has yielded increasingly high redshifts and increasingly detailed SN Ia studies, we here propose to measure: one SN Ia at z~0.5, five at z~0.85, and two beyond z~1.0. Of these, one z~0.5 and one z~1.0 SN Ia will be observed spectroscopically with STIS. These data will provide powerful constraints on SN Ia evolution and abnormal dust within or between galaxies, and can reveal all but the most contrived evolutionary effects. Accurate measurement of these high redshift SNe, possible only with the HST, will dramatically shrink the major-axis of the error ellipse in the Omega_M---Lambda plane, decoupling the measurements of Omega_M and Omega_Lambda. This will provide the first check on the CMB measurements of a spatially flat universe, and unambiguously determine whether the universe contains vacuum energy. The Hubble diagram in this redshift range is the only currently feasible way to begin constraining the physics of the ``dark energy'' that is accelerating the universe's expansion.

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Proposal Category: GO
Scientific Category: Quasar Absorption Lines and IGM
ID: 9076
Title: The z = 0.93 DLA in the Gravitationally Lensed QSO HE 0512-3329: a Test of Dust Bias in DLA Samples
PI: Max Pettini
PI Institution: Institute of Astronomy

Gregg et al have recently discovered that the bright QSO HE 0512-3329 is gravitationally lensed into two closely separated images and that the lensing galaxy is in all probability a damped LyAlpha system at z_ abs = 0.9313. Here

we request two HST orbits to use STIS to record the profile of the LyAlpha absorption line with sufficient S/N to deduce the column density of H I. This observation will make it possible to measure, for the first time, the abundances of several elements---including Zn, Cr, Fe, Si, and Mn---close (2-3 kpc) to the nucleus of a galaxy at z ~eq 1. There is a suspicion that DLAs at such close impact parameters may be missing from current samples due to dust obscuration, but this obstacle is overcome in this case by the boost provided by gravitational lensing. Establishing whether the metallicity of the galaxy is close to solar, as expected, will provide the first indication of the importance of dust in biasing absorption studies of the universe at z <=q 1. In addition the resolved STIS spectra along the two sight-lines will probe the spatial structure of a DLA on small scales; no such measurement has been performed before.

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Proposal Category: SNAP
Scientific Category: ISM and Circumstellar Matter
ID: 9077
Title: Survey of the LMC Planetary Nebulae
PI: Richard Shaw
PI Institution: Space Telescope Science Institute

A SNAPSHOT survey of all known LMC planetary nebulae (PNe) is proposed to study the co-evolution of the nebulae and their central stars, and to probe the chemical enrichment history of the LMC. We will obtain STIS imaging and medium-resolution slit-less 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 AGB phase. These relationships between PN and central star evolution will be pursued in the LMC with a sample free of distance uncertainties and selection biases. The importance of this program is two-fold: We will determine the late evolutionary paths of the most common stars in a local group galaxy that, in its chemical content, stands in sharp contrast to the SMC, where a complimentary survey is already underway; and we will produce a flux-limited sample of extra-galactic PNe images and spectra that will far exceed in number

the galactic PNe already observed with HST, providing an homogeneous database for testing stellar evolution and the chemical history of the LMC.

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Proposal Category: GO
Scientific Category: Hot Stars
ID: 9078
Title: Flares, Magnetic Reconnections and Accretion Disk Viscosity
PI: William Welsh
PI Institution: San Diego State University

Accretion disks are invoked to explain a host of astrophysical phenomena, from protostellar objects to AGN. And yet the mechanism allowing accretion disks to operate are completely unknown. This proposal seeks to observe the ``smoking gun'' signature of magnetically--driven viscosity in accretion disks. Magnetically--induced viscosity is a plausible and generally accepted hypothesis (for esthetic reasons), but it is completely untested. Determining the cause of accretion disk viscosity is of major significance to all accretion--disk powered systems (e.g. CVs, X--ray binaries, AGN and protostellar disks). These data will also firmly establish the importance of magnetic fields in accretion disks. Because of its known flaring properites, we will observe the accretion disk in EM Cyg simulataneously with STIS/FUV and CHANDRA. The simultaneous X-rays are absolutely necessary for the unambiguous detection of accretion disk magnetic reconnection flares.

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Proposal Category: AR
Scientific Category: AGN/Quasars
ID: 9079
Title: AGN outflows: Ionization Equilibrium and Abundances in Seyfert UV absorbers
PI: Nahum Arav
PI Institution: UC Davis

We propose to reanalyze the intrinsic absorption data from nearby Seyfert 1 galaxies, which are indicative of outflows emanating from the AGN. The main goal is to improve our understanding of the ionization equilibrium and abundances (IEA) in these outflows. To do so we will use analysis methods we developed in studying high-z quasar outflows. The quality of the HST high

resolution spectroscopic data for Seyferts is very similar (both in S/N and resolution) to the Keck HIRES quasars' data we analyzed in our studies. Furthermore, our quasar outflows have similar widths and are detected in the same lines. We will concentrate on two main projects: a) Extracting more accurate column densities from the detected absorption lines. This step is a prerequisite for any attempt to determine the IEA in the flows. Currently the column densities are uncertain by a factor of a few due to insufficient treatment of partial covering factor effects. b) Extensive photoionization modeling. In addition to relying on better column density determination, we will improve upon the existing photoionization analysis by incorporating inferences from FUSE and X-ray data of these objects, using information from lower resolution HST data as well as upper limits for undetected ions in the high-resolution data and taking into account attenuation of the incident ionizing flux by flow components closer to the source.

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Proposal Category: GO
Scientific Category: ISM and Circumstellar Matter
ID: 9080
Title: Transition from Non-radiative to Radiative Shocks in the Cygnus Loop
PI: William P. Blair
PI Institution: The Johns Hopkins University

We request WFPC2 narrow band HAlpha and O III imaging of faint filaments in the northeastern Cygnus Loop that represent the location of the primary shock front as it first encounters the ISM. The primary character of these filaments is non-radiative, but certain filaments are poised at the onset of becoming radiative, providing a unique laboratory for testing shock model predictions of the development and evolution of astrophysical shock waves. We also request a STIS/MAMA far-UV spectrum cutting across one of the transition filaments that has a clean geometry (selected from the requested imagery) to study the physical scale over which the strong far-UV resonance lines of N V, C IV and He II ramp up in the post-shock flow. Reobservation of a set of HAlpha filaments first observed with HST/WFPC2 in 1997 will permit an accurate proper motion measurement which, in conjunction with existing ground-based measurements, will permit us to assess directly whether the filament has decelerated over the last 50 years.

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Proposal Category: GO
Scientific Category: Star Formation
ID: 9081
Title: Accretion in the planet-forming disks of the TW Hya association
PI: Nuria Calvet
PI Institution: Smithsonian Astrophysical Observatory

We propose to obtain STIS/MAMA high signal-to-noise, low resolution ultraviolet spectra of the only two stars in the ~ 10 Myr old TW Hya association that are still accreting to measure the mass accretion rate through their disks. With these measurements we will be able to assess the gas content in these disks which show clear signs that dust is rapidly evolving towards planetesimals and planets, and obtain crucial parameters to address the problems of planet migration and survival at 10 Myr, the time-scale for planet formation according to meteoritic and preliminary astronomical evidence.

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Proposal Category: GO
Scientific Category: ISM and Circumstellar Matter
ID: 9082
Title: Expansion distances to the symbiotic Miras He 2-104 and He 2-147
PI: Romano Corradi
PI Institution: Isaac Newton Group of Telescopes

We propose to measure the expansion parallax of the nebulae around the binary symbiotic Miras He 2-104 (the Southern Crab) and He 2-147 by means of high resolution WFPC2/F658N images to be taken at two different epochs. Given the large outward velocities of these nebulae inferred from ground-based spectroscopy, their apparent expansion can be measured by HST imaging over timescales of only 2-3 years. For He 2-104 we have already obtained ``Epoch 1'' HST images (cf. STScI-PRC-PR99-32). Combining the angular and radial velocity expansions will straightforwardly yield the distance to the proposed targets. Knowledge of the distance to these nebulae will provide a solid contribution to a variety of research fields such as (a) the energetics of nuclear burning in symbiotic binaries containing a Mira, (b) the pulsation mode of binary Miras, and (c) the viability of Mira symbiotics as supersoft X-

ray sources and potential progenitors of Type Ia supernovae. HST high resolution imaging of the nebulae combined with ground-based spectroscopy will also address the still debated issue of the formation of bipolar nebulae by collimated outflows from evolved stars.

Proposal Category: GO
Scientific Category: Hot Stars
ID: 9083
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. Despite a series of remarkable discoveries in previous HST data, the nature of the central object remains elusive. Fortunately, recent developments offer, for the first time, an approach that can settle a number of long-standing questions which have been obstacles to understanding this unique object. A 5.5-year spectroscopic and X-ray cycle is now well established. STIS provides the most promising and very likely the only way to test whether Eta Car is a 5.5-year binary system. If it is, STIS gives by far the best constraints on the companion star, orbit, etc., needed to assess mechanisms for past outbursts and ejecta. If binary models don't work, then the 5.5-yr effect is probably a thermal cycle which gives novel information about the star's structure. In addition to the periodicity, the unprecedented brightening found with STIS in 1999 has continued at a diminished rate and merits followup observations. We sense that these recently discovered effects offer a likely breakthrough if Eta Car can be observed repeatedly with STIS through the current 5.5-year period, 1998.0--2003.5. During HST Cycle 10 the pace is expected to increase as this object enters the phase preceding its next major ``event.''

Proposal Category: GO
Scientific Category: Hot Stars
ID: 9084
Title: Physical Parameters of the Erupting Luminous Blue Variable NGC 2363-V1
PI: Laurent Drissen
PI Institution: Universite Laval

In 1996, we reported the discovery of a bright variable star in the giant extragalactic H , ii region NGC 2363. Subsequent photometry and high quality HST/STIS spectroscopy of this star, NGC 2363-V1, revealed that we are witnessing a significant event in the evolution of a massive star, namely a major eruption of a Luminous Blue Variable (LBV). A quantitative analysis of the STIS datasets gathered in 1997 and 1999 allowed us to determine the luminosity, mass loss rate, wind terminal velocity, surface temperature and even Fe content of this erupting LBV. Because such events are rare, continuous monitoring of the physical parameters of NGC 2363-V1 over the course of its present eruption will provide an invaluable set of constraints for theoretical models. We therefore propose to obtain high quality STIS spectra of this star once a year for the next three observing Cycles.

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Proposal Category: GO
Scientific Category: AGN/Quasars
ID: 9085
Title: Measuring the masses of high-z quasar host galaxies
PI: James Dunlop
PI Institution: University of Edinburgh

In recent years HST has played a major role in establishing the close link between black-hole mass and spheroid mass in both quiescent and active galaxies in the local universe. Consequently black-hole and spheroid formation/growth are now viewed as intimately related processes, and establishing the mass of quasar host galaxies as a function of redshift is now seen as a key measurement in observational cosmology (eg Kauffmann & Haehnelt 2000). From our Cycle 7 NICMOS program we have derived the best estimate to date of the mass evolution of the hosts of both radio-quiet and radio-loud quasars out to z ~eq 2. Under the assumption of passive stellar-population evolution our results are consistent with the black-hole/spheroid population being unchanged out to z ~eq 2. However, the crucial assumption of passive evolution needs to be tested, because discovery of any substantial star-formation activity would yield a reduction in luminosity-estimated host masses at z ~eq 1 - 2, potentially bringing our results into line with the order-of-magnitude mass reduction predicted by the hierarchical models of Kauffmann & Haenhelt (2000). We thus propose WFPC2 imaging of our luminosity-matched quasar sub-samples at z ~eq 1 and z ~eq 2 which, when coupled with our NICMOS

data, will yield the first reliable rest-frame U-V colours for high-z quasar hosts, and hence the first unbiased measurement of host-galaxy masses out to z ~eq 2.

Proposal Category: GO
Scientific Category: Galaxies
ID: 9086
Title: Investigating the Formation History of Spiral Galaxy Halos
PI: Henry Ferguson
PI Institution: Space Telescope Science Institute

We propose to constrain the origin of spiral galaxy halos by studying stellar populations near the tip of the red giant branch. This will be the first systematic study of this population in external galaxies and will quadruple the sample of normal spiral galaxies for which the halo metallicity distribution function is measured. This larger sample will permit us to study the relationship between the bulge, disk, and halo components and between halos and globular systems. Such correlations will in turn provide indications as to whether the halo, bulge, and globular cluster systems built up nearly simultaneously in the early universe or were accreted over time through different kinds of merging events.

Proposal Category: GO
Scientific Category: Galaxies
ID: 9087
Title: Black Hole X-ray Transients and X-ray Binaries in M31
PI: Michael Garcia
PI Institution: Smithsonian Astrophysical Observatory

As part of the Chandra Guaranteed Time Observations (GTO) program, we are searching M31 for x-ray transients. A complimentary GO program to study supersoft x-ray sources in M31 has recently been approved, and it will significantly expand our ability to find x-ray transients in M31. The x-ray properties of these transient sources (spectra, variability) allow us to determine whether the accreting object is a black hole or a neutron star. We propose HST observations of these x-ray transients to determine the nature of the mass-losing star. Massive stars will show little (<2 mag) change in their

UV luminosities during outbursts, while low-mass stars will show large (>5 mag) changes in their UV luminosities. By determining the nature of the primary (accreting) and secondary stars in these x-ray transients, we will have the first dataset that will allow the evolution of black hole and neutron star binaries to be studied in an external galaxy. As >70 transients in the Milky Way (MW) contain black hole primaries, we expect that a major result will be an understanding of the formation of stellar mass black holes in another galaxy. Recent HST/DD observations of one M31 x-ray transient demonstrate that these observations are entirely feasible.

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Proposal Category: SNAP
Scientific Category: Galaxies
ID: 9088
Title: A Next Generation Spectral Library of Stars
PI: Michael Gregg
PI Institution: University of California, Davis

We propose to use the low dispersion UV and optical gratings of STIS to produce a ``Next Generation'' Spectral Library of 600 stars for use in modeling the integrated light of galaxies and clusters. The library will be roughly equally divided among four metallicities, very low (Fe/H < -1.5), low (-1.5 < Fe/H < -0.5), near-solar (-0.5 < Fe/H < 0.1), and super-solar (Fe/H > 0.1), well-sampling the entire HR-diagram in each bin. Such a library will surpass all extant compilations and have lasting archival value, well into the Next Generation Space Telescope era. Because of the universal utility and community-broad nature of this venture, we waive the entire proprietary period.

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Proposal Category: GO
Scientific Category: Cool Stars
ID: 9089
Title: FGS Parallaxes of Cataclysmic Variables: Understanding Their Peculiar Secondary Stars
PI: Thomas Harrison
PI Institution: New Mexico State University

We have recently completed an HST FGS program that measured high-precision (+/- 0.5 mas) parallaxes for three dwarf novae. The true distances for all

three objects turned out to be substantially larger than predicted. The results for SS Cyg alone, will challenge existing models to explain its large accretion luminosity. As part of that program we obtained infrared spectra to examine the spectral types of the secondary stars. The combination of the parallaxes, the spectra, and existing optical/IR photometry has revealed that the secondary stars of cataclysmic variables (CVs) are peculiar, and are clearly affected by close-binary star evolution. We propose a program to measure precise parallaxes for three additional CVs (WZ Sge, RU Peg, and YZ Cnc), whose orbital periods span a much larger range than explored in our previous program. This will allow us to examine how the accretion luminosity and secondary star change with orbital period. To do this will require 18 total HST orbits over two separate cycles. Twelve orbits in Cycle 10 (four per object), and six orbits in Cycle 11 (two per object). Only the FGS on HST is capable of providing timely, high-precision parallaxes on CVs of particular astrophysical interest.

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Proposal Category: GO
Scientific Category: Cool Stars
ID: 9090
Title: Transition Region Emission in Very Low Mass Stars
PI: Suzanne Hawley
PI Institution: University of Washington

The origin of the magnetic heating which produces hot outer atmospheres in late-type stars is one of the most interesting, and elusive, problems in stellar astrophysics. Our poor understanding is due in part to the lack of data for a large and varied sample of stars, which are needed to provide the basis for a general theory. Observationally, our knowledge is particularly sparse for the very low mass stars. In fact, diametrically opposed conclusions have been reached in this field: the available data has been interpreted 1.) to indicate that magnetic heating of the hot transition region and corona becomes relatively more important in stars of later spectral type (lower mass) - the pre-1999 position; and 2.) to claim that the magnetic heating is insufficient to produce these regions at all, except during flares, in very low mass objects - the current widely held view. The manifestations of magnetic activity at the stellar/brown dwarf boundary have yet to be probed in transition region diagnostics; previous IUE and HST/GHRS observations were not sensitive enough to provide constraining data. Our proposed HST/STIS

observations of three very low mass stars will conclusively show if quiescent magnetic heating sufficient to produce a hot outer atmosphere still exists in these objects, or whether they are categorically different than higher mass M dwarfs.

Proposal Category: GO
Scientific Category: Star Formation
ID: 9091
Title: Evolution of Star Forming Environments in H II Regions
PI: Jeff Hester
PI Institution: Arizona State University

There are significant difficulties with the current understanding of the YSO disks and evaporative envelopes in the Orion nebula and how these objects fit into the broader picture of star formation. These are generally imagined to be a long-lived population, yet searches have turned up few such objects anywhere but Orion. Further, the observed masses of the disks in Orion combined with their observed evaporative mass loss rates imply ages for the objects of only a few * 10^4 years. Henney and O'Dell (1999) claim that no solution is possible unless submillimeter determinations of disk masses are off by a factor of 30. We suggest instead that these objects are only 10^4 years old, and that we are catching them as they are being uncovered by the advancing ionization front located only about 2 * 10^17 cm behind the Trapezium. When a YSO is uncovered by an advancing ionization front it will pass through two short-lived stages, first as an evaporating gaseous globule (EGG) such as those seen in M 16, then as an evaporating disk such as those seen in Orion. Such objects will live for only a few * 10^4 years, and should be found only in close proximity to molecular cloud walls. We propose to test this idea by looking for EGGs and silhouette disks in two young clusters and along one molecular cloud wall.

Proposal Category: GO
Scientific Category: ISM and Circumstellar Matter
ID: 9092
Title: V605 Aql: Sakurai's older brother
PI: Kenneth Hinkle
PI Institution: NOAO

Post-AGB stars can undergo a final episode of helium shell burning after the star has ejected a planetary nebula and has started on the white dwarf track. Starting in 1996 Sakurai's star has been observed to undergo a final helium shell flash. The same series of events occurred in V605 Aql 91 years ago. These stars both ejected a shell of gas first seen as a pseudo-photosphere and then as a thick dust envelope. The shells are expanding at sim100 km s^-1 and in the case of V605 Aql the shell now appears about 1" across. We propose to image this shell with WFPC2. The shell contains ionized material as well as dust. By combining WFPC2 and Gemini high spatial resolution infrared images we will discriminate between bipolar and lumpy models of the circumstellar shell. Since the precursor to the final flash was a white dwarf, as opposed to an AGB star with a complex structure and complex circumstellar environment, the observations will provide a test of the origins of structure in circumstellar shells and planetary nebulae. Comparison with a decade old FOC image may yield the luminosity of V605 Aql.

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Proposal Category: GO
Scientific Category: Star Formation
ID: 9093
Title: Resolving Molecular Hydrogen Disks Around T Tauri Stars
PI: Christopher Johns--Krull
PI Institution: University of California

Molecular hydrogen is believed to be the dominant constituent of circumstellar disks at radii ~ 0.1 - 5 AU around young stars. Fluoresced UV lines pumped by Ly-Alpha are bright and offer a valuable probe of H_2 in disks around young stars, with the ultimate goal being the ability to study the structure and evolution of the planet forming regions around these stars. The limited H_2 data now available for T Tauri stars (TTS) are inadequate to isolate the location of molecular hydrogen emission, though the current data suggests emission from ~ 2 AU in the disk around DF Tau. We will use deep, high resolution (E140H) STIS-FUV spectra to resolve the distinctive spectral line signature of Keplerian rotation in disks around two nearly edge on TTS. These will be the first high resolution UV spectra of any TTS and will provide the radius in the disk at which molecular hydrogen can survive. This in turn indicates the inner boundary of the ``dead zone" in TTS accretion disks which is the likely location for the formation of planets.

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Proposal Category: GO
Scientific Category: Hot Stars
ID: 9094
Title: The Wind-Wind Interactions in HD 5980
PI: Gloria Koenigsberger
PI Institution: UNAM-Instituto de Astronomia

HD 5980 is the visually brightest object in the SMC. It contains a close eclipsing binary LBV+WR (=Star A+Star B), the only one known to exist, with the possible exception of Eta Carinae. The LBV underwent a great eruption in 1994, ejecting <10^-3 M_dot at velocities in the range of 200-800 km s^-1. After the eruption, its wind velocity has been steadily increasing, and producing a circumstellar (CSM) fast-wind/slow-wind interaction region, which has now become visible spectroscopically in the C IV and Si IV lines at an expansion velocity of -680 km s^-1. These narrow features varied over a 1 year timescale. It is likely that HD 5980 is forming an H II region analogous to the Homunculus in Eta Carinae. In addition, the wind-wind collision shocked region between the two stars currently (1999-2000) forms a shock cone that winds tightly around the WR star. The purpose of this proposal is to: a) Determine the LBV's wind velocity close to the time when it will be observed with XMM and CHANDRA; b) follow the changes in the high velocity CSM absorption features; and c) Constrain the radial velocity variability of the third component, Star C, in order to determine whether it is bound to the A+B pair. The three objectives can be achieved with just two visits, using STIS to obtain the FUV+NUV spectrum. HST is the only observatory capable of providing these data. A reduced 3 month proprietary period is proposed.

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Proposal Category: GO
Scientific Category: AGN/Quasars
ID: 9095
Title: Simultaneous HST, Chandra and FUSE Observations of Intrinsic Absorbers in AGN
PI: Gerard Kriss
PI Institution: Space Telescope Science Institute

Photoionized, warm absorbing gas is an important component of the nuclear structure of AGN. Approximately half of all low-z AGN show high-ionization UV absorption lines and X-ray warm absorbers, but the relationship of the UV-

absorbing gas to the even higher ionization X-ray absorbing material is not yet understood. Only a handful of high-spectral-resolution observations with HST, Chandra or FUSE currently exist (NGC 4151, NGC 3516, NGC 3783, NGC 5548, Mrk 509). These show a diversity of kinematic structure and ionization states in the absorbers. We propose to increase significantly the sample of low-redshift AGN studied at high spectral resolution in the UV and the X-ray by obtaining simultaneous HST, Chandra, and FUSE spectra of NGC 7469 and Mrk 279. Both are bright AGN with O vi absorption resolved in recent FUSE observations. The new simultaneous observations will resolve the kinematics and ionization state of both the UV and X-ray absorbers. This will permit a definitive assessment of their relationship and give clues to their location in the nuclear region. Using the variety of ionization states and the multiple absorbing components, we will also reconstruct the ionizing spectrum. Understanding the absorbing gas and its influence on the radiation escaping from AGN has important implications for the radiative input to the IGM and the origins of the X-ray background.

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Proposal Category: GO
Scientific Category: Stellar Populations
ID: 9096
Title: Objective-Prism Spectroscopy of Massive Young Clusters
PI: Jesus Maiz-Apellaniz
PI Institution: Space Telescope Science Institute

Most of the present knowledge of the UV spectral properties of massive young clusters (MYCs) is based on IUE data with marginal spatial resolution. We propose to greatly improve the spatial information by obtaining STIS NUV-MAMA objective-prism spectroscopy in the 1300-3600 Angstrom range of three nearby extragalactic regions with a total of ~ 10 MYCs. Slitless techniques are seldom attempted on crowded clusters due to the overlap among different sources. We plan to overcome that problem by observing with two different roll angles, using comparison UV and optical images from the HST archive, and developing automatic extraction techniques based on codes already written by some of the authors. Some of the issues that will be tackled include: (i) Is there an age difference between the core and the outer parts of the clusters? (ii) What is the importance of differential extinction in the estimation of the cluster age? (iii) Is the absence of the 2175 Angstrom bump in starbursts due to geometrical effects or is it an intrinsic property of the dust? (iv)

Are the properties of the dust homogeneous or do they vary with position? The STIS NUV prism is ideal for this type of study since it provides relatively higher spectral resolution for the features around 1500 Angstrom and lower resolution at longer wavelengths, where the sources are generally less intense and the background is higher.

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Proposal Category: GO
Scientific Category: Hot Stars
ID: 9097
Title: The Mass-Luminosity Relationship for High Mass Stars: Resolving the `Mass Discrepancy' with HST
PI: Philip Massey
PI Institution: Lowell Observatory

The mass-luminosity relation is well determined for intermediate-mass stars, and on-going HST observations are extending the relationship to stars of very low mass. Here we propose to obtain similar, fundamental data on the highest mass stars, where physical complications (mass-loss, mixing) make such studies a necessary check on the stellar models. Empirical checks are particularly important given the factor-of-two ``mass discrepancy" that exists in the masses inferred from stellar atmospheres, and those computed from stellar interiors. We have selected 7 nearby, early-type stars with established velocity variations characteristic of long-period binaries. We will attempt to resolve these systems using the FGS. The separations, combined with double-lined spectroscopic orbit solutions, will provide unambiguous mass determinations. Success for even one system will allow us to anchor the high-luminosity end of the mass-luminosity relationship, and resolve the mass discrepancy.

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Proposal Category: GO
Scientific Category: Hot Stars
ID: 9098
Title: The Spectrum and the Light Curve of the Nearest Millisecond Pulsar
PI: George Pavlov
PI Institution: Pennsylvania State University

PSR J0437--4715 is the nearest and the brightest millisecond (recycled)

pulsar, and the only one that has been well studied at X-ray/EUV energies, where it has a strong pulsed signal. It is the most promising candidate for detecting the first optical counterpart of a millisecond pulsar. The HST has the unique ability to detect the cyclotron spectral line in the far UV from this weakly magnetized neutron star and to measure directly, for the first time, the magnetic field of a rotation-powered pulsar. The cyclotron line would be recognized by its sharp pulse profile in the FUV MAMA detector. The spectral and timing analysis of the far-UV continuum will allow us to study synchrotron radiation from the pulsar magnetosphere and thermal radiation from the surface of the neutron star. The magnetospheric and thermal components will be distinguished by their different pulse shapes and spectral slopes.

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Proposal Category: GO
Scientific Category: Galaxies
ID: 9099
Title: High Spatial Resolution Spectroscopy of the Massive Globular Cluster G1
PI: R. Michael Rich
PI Institution: University of California at Los Angeles

We propose to obtain high spatial resolution, long-slit spectroscopy of the most luminous globular cluster in the Local Group, G1 in M31. The kinematic structure obtained with these data will provide a stringent test of whether a central black hole exists, thereby determining whether globular clusters share the same intimate connection that normal galaxies do with their black holes. The central surface brightness of the core of this cluster reaches 13.5 V mag arcsec^-2, and the core radius of the cluster is 0.9 pc; both these properties allow for detailed kinematic information using HST. If a black hole is present, and G1 falls on the black-hole mass/sigma correlation recently established for bulges and ellipticals, the mass should be 6*10^4M_dot, and the velocity dispersion should rise to 36 km s^-1. Detection of a black hole in G1 would extend the black-hole mass/sigma relationship to masses 100 times lower than the lowest mass nuclear black hole currently known, and establish a solid connection between the formation of galaxies and globular clusters. The data will also provide the basis for an excellent dynamical model of G1 and a study of stellar population gradients in this unique cluster. Parallel imaging with WFPC2 will produce a very deep color-magnitude diagram of the M31 halo field stars adjacent to G1. Short

exposures of the M31 halo hints at a possible intermediate-age population, which may be revealed in deeper parallels.

Proposal Category: GO
Scientific Category: Cool Stars
ID: 9100
Title: High-Velocity Collimated Outflows and Equatorial Toroids in Cool Stars: A Study of V Hydrae and PI^1 Gru
PI: Raghvendra Sahai
PI Institution: Jet Propulsion Laboratory, Caltech

The two cool red giant stars V Hya and PI^1 Gru show strong observational evidence for the presence of high-velocity collimated outflows and equatorial toroids, both of which have been postulated to play significant roles in the formation of bipolar planetary nebulae. However the limited resolution of existing ground-based observations makes it impossible to unambiguously identify structures which reveal the mechanism of jet formation or elucidate the cause of bipolarity. We propose HST imaging and long-slit spectroscopic observations of the circumstellar environment of V Hya and PI^1 Gru. These observations will provide the first high-resolution images at any wavelength of these key objects. We will thus obtain an unprecedentedly high-resolution glimpse of AGB stars transitioning into preplanetary nebulae, allowing us to probe the structure and kinematics of their very fast outflows and the relationship of those outflows to the structures seen in molecular line emission. Our HST study of these transition objects should elucidate the nature and history of the mass-loss processes which terminate the AGB evolution of intermediate-mass stars and begin their transition into the proto-planetary and planetary nebula phases.

Proposal Category: SNAP
Scientific Category: ISM and Circumstellar Matter
ID: 9101
Title: Toward Understanding the Bipolar Geometries of Preplanetary Nebulae with High-Velocity Polar Flows
PI: Raghvendra Sahai
PI Institution: Jet Propulsion Laboratory, California Institute of Technology

Most planetary nebulae (PNs) show bipolar morphology, in striking contrast to the largely round shapes of the circumstellar envelopes of the AGB stars from which they evolve. Several lines of evidence, including high spatial-resolution imaging with HST, suggest that high-velocity collimated outflows occuring during the transition from AGB to the PN phase -- the preplanetary nebula (PPN) phase -- are significant agents for imposing bipolarity on the circumstellar environment. Unfortunately, kinematic data at a comparable spatial resolution has been lacking, limiting our understanding of the physical mechanisms responsible for the bipolarity. We have therefore begun a multiwavelength program, including interferometric spectral-line imaging in the radio and HST imaging, to study PPNs in detail. We find, for two bipolar PPN, that the spatio-kinematic distribution of the OH masers relative to the HST optical structure is consistent with the hypothesis that the optical lobes result from a fast outflow interacting with the slow, dense AGB wind, producing an increasing radial velocity from the equator to the poles. We propose imaging of 17 PPNs with WFPC2 for comparison with high-resolution spectral-line images (being obtained with VLA/MERLIN/ATCA), enabling us to test this hypothesis, and to understand the fast outflow and how its hydrodynamical interaction with the AGB wind produces a bipolar nebula.

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Proposal Category: GO
Scientific Category: ISM and Circumstellar Matter
ID: 9102
Title: A YSO-like pulsed astrophysical jet and bipolar nebula in a dying star: WFPC2/STIS study of He2-90
PI: Raghvendra Sahai
PI Institution: Jet Propulsion Laboratory

We have discovered an extended, highly-collimated, bipolar jet in He2-90, an object long classified as a planetary nebula (PN). The discovery images (obtained with WFPC2/HST) show that the morphology of He2-90 does not look like that of any known PN, but resembles that of a classical young stellar object (YSO). This appears to be a unique object. We will determine the speed of the jet (only slightly inclined to the sky plane) through proper motion observations of the knots in the jet: a 2nd-epoch WFPC2 H-alphapha image will be obtained for comparison with the Sep99 discovery image. It is crucial to observe the velocity field of the flow at the highest spatial-resolution, as close as possible to the origin of the jet in order to constrain theories for

how the jet is driven, and the nature of the central object. We propose to do this by mapping the jet near the central source using the long-slit, medium resolution mode of STIS. We also propose supplemental observations: low resolution STIS spectra for obtaining nebular diagnostics, coupled with narrow-band imaging with WFPC2 in emission lines such as NII, OI and OIII and continuum filters for mapping excitation variations in the nebula and jet and the extinction in the central dense dusty disk region. Coordinated Chandra X-ray observations (with ACIS-I) will be made to check the association of an EGRET >~mma-ray source which lies in the direction of He2-90.

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Proposal Category: GO
Scientific Category: Star Formation
ID: 9103
Title: Resolving New Examples of, Edge-on Young Stellar Object Disks
PI: Karl Stapelfeldt
PI Institution: Jet Propulsion Laboratory

Edge-on, optically thick circumstellar disks have been imaged by the Hubble Space Telescope in association with several nearby young stars. In these systems, the central star is occulted from direct view, large PSF artifacts are absent, and the disk reflected light is clearly seen. It is for these objects in nearby star-forming regions that HST has provided the best, highest resolution (7-10 AU) views to date of disks which may form planetary systems like our own. Comparison of edge-on disk images with scattered light models has allowed key structural parameters such as the disk outer radius, vertical scale height, radial density profile, total mass, and dust grain properties to be determined. To reveal the diversity of protoplanetary environments, it would be very valuable to identify and study additional examples of edge-on disks. The edge-on disks detected thus far share a signature characteristic: they are unusually faint in the near-infrared yet still optically visible. In a review of the literature, we have uncovered an additional eight optically visible young stars associated with nearby molecular clouds whose faintness in the near-IR suggests that they are edge-on disks seen entirely by scattered light. Three are sources of Herbig-Haro jets. We propose R and I band imaging of these eight objects, the faintest nearby T Tauri stars.

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Proposal Category: GO

Scientific Category: Star Formation
ID: 9104
Title: A WFPC2 Study of Proplyds and a Protostellar Condensation at the Center of M20
PI: Farhad Yusef-Zadeh
PI Institution: Northwestern University

The Trifid nebula (M20) is a well-known prominent optical HII region trisected by bands of obscuring dust lanes and excited by an O7.5 star HD 164492A. Our recent study of near-IR ground-based observations of this region at J, H, K and L show all seven components of HD 164492 (A to G) identified optically. Our sub-arcsecond radio continuum VLA and ground-based observations of M20 also show free-free emission from three stellar sources (B, C and D) and a bright rim outlining a protostellar condensation (TC1) lying close to the O7V star (HD 164492A) at the center of the nebula. Based on a number of strong arguments, these stars have disks associated with them and their envelopes are photoionized externally by the UV radiation from the hot central star, HD 164492A. The proposed WFPC2 observations are intended to search for neutral protoplanetary disks ``proplyds'', to study the optically bright rim of ionized gas associated with TC1 for signs of star formation, and to make a detailed subarcsecond determination of extinction toward the dust lanes of M20 using HAlpha and 6cm data.

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Proposal Category: GO
Scientific Category: Cool Stars
ID: 9105
Title: Determination of the Distances and Masses of 3 Galactic Cepheids
PI: Derck Massa
PI Institution: Raytheon ITSS

We propose to continue a successful observing strategy which enabled us to accurately measure angular separations < 10^-2 with the FOC for binaries with Cepheid primaries and main sequence B or A star secondaries (our accuracy should improve to ~ 10^-3 with STIS). Once measurements are available at two carefully selected phases and these are combined with spectroscopic orbits, the angular information will enable the masses and distances for the binaries to be determined from Newton's laws and Euclidean geometry. The

distances determinations amount to bypassing two rungs of the cosmic distance ladder: the moving-cluster distance to the Hyades and main sequence fitting of clusters containing Cepheids. The mass determinations will provide the first direct dynamical mass measurements for Cepheids, providing sorely needed quantitative information on this poorly understood stage of massive star evolution.

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Proposal Category: GO
Scientific Category: Galaxies
ID: 9106
Title: The Biggest Black Holes
PI: Douglas Richstone
PI Institution: University of Michigan

Searches for supermassive black holes in galaxy centers have led to the discoveries that (1) most or all hot galaxies contain massive dark objects at their centers, presumably black holes; (2) there is a tight correlation between the black-hole mass and the luminosity-weighted velocity dispersion of the hot component of the galaxy. This remarkable relationship suggests a strong link between black-hole formation, AGN activity, and galaxy formation, and once it is understood this link should advance our understanding of all three processes. Guided by the mbh-Sigma relation, we will search for the most massive black holes in galaxies within ~100 Mpc. Our results should (1) explore the nature of the mbh-Sigma relation for the most luminous galaxies and the most massive black holes; (2) identify the local remnants of the brightest quasars, which should have larger black-hole masses than any yet detected; (3) test whether black-hole masses depend on the nature of the central region of the host galaxy (core or power-law). High-mass black holes are difficult to detect, and thus have traditionally been under-represented in HST surveys; however, in the past decade our group has used HST photometry and spectroscopy to investigate the central regions of over 15 galaxies, and we have well-honed observational and theoretical tools for this task.

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Proposal Category: GO
Scientific Category: Galaxies
ID: 9107
Title: The Fundamental Plane for Nuclear Black Holes
PI: Douglas Richstone

PI Institution: University of Michigan

Searches for supermassive black holes in galaxy centers, conducted with HST and other telescopes, have led to the discoveries that (1) most or all hot galaxies contain massive dark objects at their centers, presumably black holes; (2) there is a remarkably tight correlation between the black-hole mass and the luminosity-weighted velocity dispersion of the hot component of the galaxy. This mbh-Sigma relation has a scatter which is <0.3 dex in mbh and consistent with zero. This relationship suggests a strong link between black-hole formation, AGN activity, and galaxy formation, and once it is understood this link should advance our understanding of all three processes. The goal of this proposal is to investigate the scatter in the mbh-Sigma relation and the role of possible second parameters, by examining a sample of galaxies at fixed velocity dispersion Sigma=200+/- 20 kms. This approach decouples the effects of a second parameter from uncertainties in the shape of the mbh-Sigma relation, and minimizes spurious correlations because all of the galaxies will be studied using the same well-tested observational and modeling techniques. The sample is chosen to explore second parameters such as environment, X-ray properties, Hubble type, luminosity profile, etc. This work thus treads a path similar to the one that took us from simple bivariate relationships among galaxy properties to the deeper concept of a fundamental plane of galaxies.

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Proposal Category: GO
Scientific Category: Hot Stars
ID: 9108
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: Cool Stars
ID: 9109
Title: Mapping the Chromosphere of the K Supergiant in the Eclipsing Binary 31 Cygni
PI: Philip Bennett
PI Institution: University of Colorado

Red supergiants (RSGs) are responsible for returning the greatest contribution of mass to the ISM, but this mass loss process, can not be modeled in a fundamental way because the physical mechanism responsible remains uncertain. This difficulty has profound implications for stellar population sythesis and galactic evolution. We propose to address this problem by observing the chromosphere and wind of the supergiant primary in the long-period (10.36 yr) eclipsing binary 31 Cygni. This binary has the largest orbital separation relative to primary size (and the least interaction) of the known Zeta Aur binaries. The next eclipse in 2003 will be the last available during the lifetime of HST; if this project is to be done at all, it must be started now

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Proposal Category: GO
Scientific Category: Solar System
ID: 9110
Title: A Search for Kuiper Belt Object Satellites
PI: Michael Brown
PI Institution: Caltech

The large number of collisions thought to have taken place in the primordial Kuiper belt suggests that many Kuiper belt objects (KBOs) could have suffered binary-forming collisions similar to that which formed the Pluto -- Charon

binary. Detection of such KBO satellites would allow us to measure KBO masses, would help us to understand the past collisional environment of the Kuiper belt, and would give a context to the otherwise unique-seeming formation of the Pluto -- Charon binary. We propose a STIS CCD search for satellites around a large sample of KBOs for which we can obtain sufficient signal-to-noise and angular separation to robustly detect Charon-analog satellites. The time is right to invest in such a large survey: our preliminary HST search for satellites is just completing and has demonstrated a highly successful observing strategy; the number of bright KBOs has now increased to the point where a statistically meaningful sample can be observed; and many studies of KBO properties and history will benefit greatly from having a concrete knowledge of KBO masses. We are performing complementary deep searches around each of these KBOs with Keck, but only HST resolution will allow us to probe the inner ~0.5 arcseconds where we expect collisionally formed satellites analogous to Charon to appear. We have carefully constructed a program optimized to detect any such very close satellites.

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Proposal Category: GO
Scientific Category: Hot Stars
ID: 9111
Title: The UV Light Echo of Shock Breakout During SN 1987A
PI: Arlin Crotts
PI Institution: Columbia University

Light echoes (transient reflection nebulae) from SN1987A were discovered in the optical in 1988 and have been detected in the vacuum ultraviolet by IUE. The UV data would be the first ``direct'' observation of the hot spectrum emitted by a supernova shock destroying its progenitor star; unfortunately the large aperture and pointing instabilities of IUE make these data difficult to calibrate and interpret in great detail. The breakout signal has also been modified by the spectral reflectance of the echoing dust. We propose to confirm the UV detection and to disentangle the incident SN spectrum from the dust reflectance by observing the UV echo at two scattering phase angles and combining them with HST and ground-based data. Sampling two echoes at widely-spaced spectral points and two scattering angles will provide us with enough independent information to factor these separately. The resulting early UV spectrum of SN 1987A will allow a direct test of theoretical models of supernova shock propagation and breakout from a star, as well as provide an

accurate input ionization spectrum for understanding the excitation and recombination of gas in the observed circumstellar nebulosity around SN1987A. This study will also strongly constrain the physical properties of interstellar dust in the Large Magellanic Cloud.

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Proposal Category: GO
Scientific Category: Solar System
ID: 9112
Title: Composition of Saturn's rings, and its variation with location
PI: Dale Cruikshank
PI Institution: Ames Research Center

Saturn's rings have been a playground for dynamicists during the two decades since Voyager, and a variety of fascinating processes and structures have been identified and studied. One surprise has been that the ring system seems to be evolving dynamically and compositionally on geologically short timescales, and might be much younger than the solar system. However, there has been very little progress in understanding the composition of the rings during this time. While water ice is known to be the dominant constituent, the reddish color of the rings requires there to be other material there. Furthermore, studies of Voyager and HST-WFPC2 color images indicate that the ring color (and presumably therefore composition) varies dramatically from region to region, and has complex correlations with ring structure. Unfortunately, these multicolor observations are incapable of identifying specific constituents spectrally. The only existing moderate spectral resolution observations, on the other hand, have been ring-averages and smear all the diverse spectral contributions together. With STIS, we propose to separate out the known spatial-spectral variability with sufficient spectral resolution to make identifications of specific constituents. This will allow us to truly study the processes responsible for compositional evolution. It will also provide an excellent preparation and foundation for planning Cassini observations of the rings.

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Proposal Category: GO
Scientific Category: Cool Stars
ID: 9113
Title: Solar UV Radiation and the Origin of Life on Earth

PI: Sara R. Heap
PI Institution: Goddard Space Flight Center

Prior to 3.5 Gyr ago when life arose on Earth, the ultraviolet emission of the early Sun was more intense than at present. This radiation helped shape the chemical environment of the early Earth and hence influenced prebiotic evolution, the origin of life, and its subsequent early development. We propose to investigate this UV emission by making an efficient, systematic study of the UV spectra of 8 stars believed to resemble the early Sun. beginitemize em We will use the observed UV flux distributions as boundary conditions in photochemical models of the Earth's atmosphere, in order to estimate the concentrations of greenhouse gases and other molecules that may have played a major role in the origin of life. em We will also use the spectra to construct semi-empirical models of the chromospheres of these young solar analogs. The chromospheric models will enable us to predict the extreme-UV emission of the early Sun and its consequences for the erosion of the early Earth's atmosphere and the altered oxidation state of the planet. em We will investigate the effect of metallicity on the UV emission and its consequences for the photochemistry of Earth-like planets. enditemize

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Proposal Category: GO
Scientific Category: Hot Stars
ID: 9114
Title: SINS: The Supernova INtensive Study--Cycle 10
PI: Robert Kirshner
PI Institution: Harvard College Observatory

Supernovae create the chemical history of the Universe, energize the interstellar gas, stiffen the spine of the extragalactic distance scale and provide the only evidence for an accelerating universe. SINS is a program to study supernovae with HST: perfectly matched in field and scale for spatially-resolved observations of SN 1987A. There, a violent encounter is underway between the fast-moving debris and the stationary inner ring, as predicted by our team members and first observed by us. Monitoring this interaction will help solve the riddles of stellar evolution posed by the enigmatic three-ring system of SN 1987A. Our UV observations of Ly-Alpha emission reveal the present location and velocity of a remarkable reverse shock that provides a unique laboratory for studying fast shocks and a powerful tool for dissecting

the structure of the vanished star. For more distant events, we propose Target-of-Opportunity observations. In addition to one bright new supernova in Cycle 10 (discovered by any search,) we propose to discover two supernovae for study in the ultraviolet at times specificed in advance, using the world's most effective automated search system: the Lick Observatory Supernova Search. SINS will study the historic SN 1987A, explore UV emission from distant supernovae, and press late-time observations of supernovae into uncharted territory of infrared catastrophes, light echos, and stellar remnants.

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Proposal Category: GO
Scientific Category: Stellar Populations
ID: 9115
Title: The Evolution of Extreme Gas Rich Galaxies
PI: Patricia Knezek
PI Institution: Space Telescope Science Institute

We propose to observe a recently discovered sample of the closest known low surface brightness (LSB), very gas-rich dwarf galaxies outside of the Local Group. These galaxies represent an extreme star formation environment, where the fuel for star formation appears plentiful, the local environment (the Centaurus A group of galaxies) provides opportunities for tidally-induced star formation, and yet star formation appears to be surpressed (by two orders of magnitude) compared to other `typical' galaxies. Our goal is to understand the star formation history in this puzzling environment of low stellar density and high gas content. By resolving the underlying stellar component with WFPC2, we will obtain critical information on the mean metallicity and star formation history of these galaxies. The HST data will be combined with a vigorous ground-based program to study the ongoing massive star formation rate and the mean age of the stellar population, through a combination of broadband (UBVRI) and narrowband (H-alphapha and S II) imaging. The combined data sets will help us understand the star formation process in these extreme gas-rich LSB galaxies, and in gaseous galaxies in general. Such knowledge is key for our comprehension of the present day role of the most common type of potentially star forming galaxies in the Universe, and may aid us in interpreting results at high redshifts on star formation in the early universe.

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Proposal Category: GO

Scientific Category: Hot Stars
ID: 9116
Title: Understanding high-redshift and starburst galaxies: A UV spectroscopic survey of B-stars in the SMC
PI: Daniel Lennon
PI Institution: Isaac Newton Group Telescopes

In Cycle 7 we successfully applied to carry out a high resolution UV spectroscopic survey of O-stars in the SMC. The primary aim of this program, GO-7437, is to construct a high quality spectral library at low metallicity in order to synthesize the UV spectra of high redshift star-forming galaxies and nearby starbursts. This program is almost completed and in the present proposal we ask to extend the survey to B-stars in the SMC. There are important reasons for doing so. Chief among these is that recent work, some of it prompted by GO-7437 results, indicates that B-stars are significant contributors to the observed UV spectrum of high redshift galaxies such as the important MS 1512-cB58. In the present survey we also propose to extend the wavelength coverage into the near-UV in order to cover the most distinguishing feature in B-star UV spectra, the Fe, iii multiplet between 1900 and 2000Angstrom . This feature is a key diagnostic of B-stars and an excellent discriminant against O-stars. The combined survey of O and B stars will constitute the definitive UV spectral library of massive stars at low metallicity and will offer powerful diagnostic capabilities in many other areas of astronomy, particularly in the area of massive star evolution and its dependence on metallicity and rotation.

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Proposal Category: GO
Scientific Category: Galaxies
ID: 9117
Title: Spatially Resolved Spectroscopy of Super Star Clusters in the M82 Starbursts
PI: Robert O'Connell
PI Institution: University of Virginia

M82 is the prototype starburst galaxy and the nearest analogue to the star forming galaxies recently identified at high redshifts. There is good evidence that M82 has experienced multiple starburst episodes over the past ~ 800 Myr. No other galaxy affords the opportunity to study both an active starburst and

the subsequent post-burst phase at such close range (3.6 Mpc) and with such a wealth of complementary data from other space and ground-based telescopes. In our Cycle 1 and 7 HST imaging programs on M82, we identified numerous super star clusters, which seem to be hallmarks of intense star formation. We propose to obtain spatially-resolved STIS spectroscopy of 20 such clusters in M82's active starburst core and also in its ``fossil'' starburst region (of age >~ 200 Myr) as a means of tracing the history of star formation and its propagation. With the spatially-resolved spectra, we will be able to study the internal structure of the clusters, evidence for internal mass segregation, their interaction with their surroundings (including M82's superwind), and the character of the bright, diffuse non-cluster populations.

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Proposal Category: GO
Scientific Category: Cosmology
ID: 9118
Title: Tracing the Cosmic Expansion to z>1 with Type Ia Supernovae
PI: Brian Schmidt
PI Institution: The Australian National University

Type Ia supernovae provide evidence for an accelerating universe, an extraordinary result that needs to be rigorously tested. The case for cosmic acceleration rests almost entirely on the observation that the observed SN Ia at z~0.5 are 0.25 magnitudes fainter than expected for a non-accelerating Universe. We propose to follow five SN Ia in the range 0.95<z<1.2 with HST using the 850LP filter. When combined with a ground-based J-band follow-up campaign, we can expect to measure the mean luminosity distance of the sample at z~ 1.05 to better than 5 At these redshifts the effect of Omega_Lambda has all but vanished and the Universe was decelerating due to its known matter content. Because any simple systematic error will deviate substantially from the non-monotonic effect of a Omega_Lambda > 0 cosmology, this experiment is a powerful and straightforward way to assess the reliability of the SN Ia measurements. In addition, if SN Ia are reliable standard candles, the proposed observations will significantly increase the precision with which we measure Omega_Lambda and Omega_M.

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Proposal Category: GO
Scientific Category: Solar System

ID: 9119
Title: Io's Prometheus Plume, and the Composition and Spatial Distribution of Io's Atmosphere
PI: John Spencer
PI Institution: Lowell Observatory

We propose to obtain the most detailed view yet of Io's dynamic SO_2 / S_2 atmosphere, and the first spectroscopic observations of a Prometheus-type plume, to test models of plume and atmospheric chemistry and dynamics. We will use STIS on eight HST orbits, spread over four Io days, to obtain a spatial profile of S_2 and SO_2 gas abundance across a region of Io that includes a wide variety of terrain types and latitudes, centered on the Prometheus volcano. In addition, we will obtain two orbits of G140L wide-slit STIS data, which provides an image of Io in reflected Lyman-Alpha which we will compare to our SO_2 distribution data to test the hypothesis that Io's dark equatorial region in these images results from absorption of Lyman-Alpha by SO_2.

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Proposal Category: GO
Scientific Category: ISM and Circumstellar Matter
ID: 9120
Title: Planetary Nebulae in the LMC: a study on stellar evolution and Populations.
PI: Letizia Stanghellini
PI Institution: Space Telescope Science Institute

The final phase of the evolution of low- and intermediate-mass stars, the Planetary Nebula (PN) ejection, is thought to provide the main source of carbon and nitrogen enrichment in galaxies. Stellar generations forming from a carbon- and nitrogen-enriched medium are a necessary condition for planetary and life evolution. It is essential to understand how stars go through the process of shedding their chemically-enriched shells, and to test the predictions of stellar evolution theory on the relationship between stellar mass and elemental enrichment. LMC PNe are ideal probes for this study. Their abundances can be directly related to the mass of the central stars and to that of the stellar progenitor, without the great (distance and reddening) uncertainties that affect Galactic PNe. The UV lines are essential for calculating the abundances of the element related to stellar evolution (C, N,

O) and progenitor populations (e.g., Ne). We propose to acquire STIS UV spectroscopy for LMC PNe whose morphology has been previously determined with HST. We will derive the (C, N, O) abundance-to-mass relation, and determine the extent to which the mass of the progenitors of asymmetric PNe exceed that of symmetric PNe.

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Proposal Category: GO
Scientific Category: AGN/Quasars
ID: 9121
Title: Evolution of the Host Galaxies in Low-Power AGN
PI: Meg Urry
PI Institution: Space Telescope Science Institute

HST has provided definitive observations of AGN host galaxies, over a large redshift range. These can be used to measure the cosmic evolution of host galaxies and to assess the connection between the formation and evolution of active nuclei (black holes) and galaxies. This requires covering a range in luminosity at each redshift, however, in order to distinguish dependences on redshift and on luminosity, which (unfortunately) are automatically well correlated in flux-limited samples. Yet *very* few low-power AGN have been imaged at high redshift (z >~ 0.5) with HST. We propose to fill this critical gap by observing 10 BL Lac objects in the STIS CCD long-pass filter (to maximize sensitivity and spatial sampling). BL Lacs are the only low-power AGN in complete samples to sufficient redshift (z>~1) to detect the effects of passive evolution of the host galaxies. Results for a closely matched sample at redshifts z <=sssim 0.5 are already available from our HST snapshot survey of BL Lac objects, which yielded detailed information on host galaxy morphologies, magnitudes, surface brightness profiles, and effective radii at low redshift^1-8. The proposed study thus probes the evolution of low-power AGN host galaxies to z~1.3, and allows direct study of how the formation and life cycles of radio-loud AGN depend on intrinsic power.

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Proposal Category: GO
Scientific Category: AGN/Quasars
ID: 9122
Title: The Physics of X-Ray/Optical Jets
PI: Meg Urry
PI Institution: Space Telescope Science Institute

An important new probe of the physics of large-scale radio jets is possible with the discovery of resolved X-ray/optical jets. The optical emission comes from high energy electrons, which have short radiative lifetimes and so pinpoint particle acceleration sites. Spectral energy distributions of knots in two jets suggest the X-rays come from lower energy electrons inverse-Compton scattering the (beamed) cosmic microwave background. This requires the jet to be still relativistic on kiloparsec scales (out to ~1 Mpc for the high-redshift jets

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Proposal Category: GO
Scientific Category: AGN/Quasars
ID: 9123
Title: Synchrotron self-Compton Emission from the Radio Hot Spots of Cygnus A
PI: Andrew Wilson
PI Institution: University of Maryland

We have recently studied the radio galaxy Cygnus A in X-rays with Chandra. All four of the radio hot spots are detected with similar morphologies to the radio maps. The X-ray emission is almost certainly synchrotron self- Compton emission from the radio synchrotron emitting electrons. The predictions of this model are in excellent agreement with the Chandra spectra and also imply a magnetic field strength close to equipartition. We propose here to image the predicted SSC emission from the hot spots in the optical with HST. Our goals are a) to confirm the optical fluxes predicted by the SSC model, and b) to use the radio synchrotron and optical SSC brightness distributions at ~eq 0.1 arc sec resolution to determine the internal structures of the magnetic fields and relativistic particles within the two brighter hot spots (A and D).

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Proposal Category: SNAP
Scientific Category: Galaxies
ID: 9124
Title: Mid-UV SNAPSHOT Survey of Nearby Irregulars: Galaxy Structure and Evolution Benchmark
PI: Rogier Windhorst
PI Institution: Arizona State Univ., Physics & Astronomy

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. Distant galaxies are primarily observed by HST in their restframe mid-ultraviolet (3000Angstrom). They resemble nearby late-type galaxies, but are they really physically similar classes of objects? We propose to address this question through a SNAPSHOT survey in the WFPC2 mid-UV filter F300W (2930Angstrom) of 98 nearby late-type, irregular and peculiar galaxies. These are thus far missing from the Archive and Cycle 9 samples. Our sample is carefully selected for size and surface brightness to be doable in SNAPSHOTS. We have been collecting ground-based UBVRIJHK images for a variety of these objects. 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 nearby late-types from 0.29-2.2 Mu, providing a local benchmark that we can redshift to z~1-->2 for quantitative comparison to the morphological and photometric properties of high redshift galaxies; 2. Map the spatial distribution, luminosities, and sizes of star forming regions responsible for the UV morphology, and relate these to global galaxy properties.

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Proposal Category: GO
Scientific Category: Star Formation
ID: 9125
Title: Are there Large Dust Grains in Orion's Proto-Planetary Disks?
PI: John Bally
PI Institution: University of Colorado

We propose to acquire dithered PC images of six of the largest circumstellar disks in the Orion nebula to study the unique properties of dust within these systems. Previous observations of these disks indicate the dust has begun to coagulate to sizes much larger than ISM particles in the first steps toward planetary formation -- even as the disks are rapidly photoevaporated by luminous O and B stars in the nearby Trapezium cluster. By extending the wavelength range and improving the the spatial resolution of existing observations, we will be able to make definitive tests for the existence of large grains within Orion's proplyds, and explore the dynamics of these grains as the disks are being photoevaporated away. Our observations will provide

insight into key scientific questions of fundamental importance: Under what conditions can planets form? Must planets form rapidly? How can we detect the earliest stages of planetary formation?

Proposal Category: GO
Scientific Category: Galaxies
ID: 9126
Title: Galaxy Mass and the Fate of Luminous, Blue Compact Galaxies at z~0.6
PI: Matthew Bershady
PI Institution: University of Wisconsin-Madison

We propose to obtain STIS long-slit spectra for a sample of 6 luminous, blue, compact galaxies (LBCGs) at z ~ 0.6. Despite being very luminous (M_B~-20), LBCGs have velocity widths Sigma ~ 60 kms and half-light radii r_e ~ 0.5'' (or R_e ~ 3Kpc). Small sizes and velocity widths suggest LBCGs are low-mass stellar systems (Mla10^10M_dot), while their blue colors, strong emission lines and low M/L-ratios indicate they are undergoing a major starburst. If the star-forming process halts after the current burst, models predict that LBCGs will fade by ~2-4 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. However, recent observations suggest LBCGs are not a monolothic populations; some LBCGs may have different fates. 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 LBCGs are indeed uniformly low-mass stellar systems; and ii) evidence for substructure associated with SN-driven galactic winds, that may shed light on the ultimate fate of the ISM in LBCGs, and thus on whether it is reasonable to expect star formation to quench after the current burst.

Proposal Category: GO
Scientific Category: ISM and Circumstellar Matter
ID: 9127
Title: The UV interstellar extinction in nearby galaxies: M33
PI: Luciana Bianchi
PI Institution: The Johns Hopkins University

We previously used HST to determine the UV extinction curve in M31. Our result in M31, together with other studies of the Magellanic Clouds and Milky Way, suggests that dust properties vary in different environments and from galaxy to galaxy. Thus average Galactic dust properties cannot be usefully employed to correct for dust effects in different galaxies. We propose to enlarge our sample by studying the UV extinction properties of dust in M33, sampling different galactocentric distances and levels of star formation activity. The extinction curves will be derived by comparing stars with the same spectral type, but different extinction amounts, in M33. This eliminates uncertainties in using standard stars from other galaxies, that may have different intrinsic spectra. For the targets we have U, B, V and UV photometry, and accurate spectral types from ground based spectra. UV extinction gives information on the properties of dust, which is an important tracer of global heavy element abundances. The steepness of the FUV extinction affects the ionisation and molecular chemistry of a galaxy. Knowledge of the extinction curve also allows accurate corrections of observed fluxes: ultimately, relating dust properties to global galaxy parameters will enable better extinction corrections in distant galaxies and AGN. We also request WFPC2 parallel imaging to continue our stellar population studies.

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Proposal Category: SNAP
Scientific Category: ISM and Circumstellar Matter
ID: 9128
Title: A SNAPshot Survey of Absorption Lines from High Velocity Clouds in the Milky Way
PI: David V. Bowen
PI Institution: Princeton Observatory

Through STIS moderate resolution spectroscopy, we propose to search for Mg II and Mg I absorption from Galactic High Velocity Clouds (HVCs) along the sightlines of 51 of the brightest QSOs, BL Lacs and Seyfert 2 galaxies in the sky. The origins of the HVCs are still not known with certainty, despite the fact that they are probably the direct manifestations of the physical processes which drive and regulate the Milky Way's interstellar medium. Detection of Mg II at our anticipated sensitivity level would correspond to a neutral hydrogen column density of ~ 2* 10^17 cm , a factor of five below that which has been detected in 21 cm surveys. We aim to: establish the

covering factor of gas at this level across the sky; search for absorption with no corresponding 21 cm emission; examine the velocity structure of the absorbing clouds with the G230MB's resolution of 20 kms ; and establish a database of HVCs toward the brightest UV background sources to enable future researchers to study the clouds in more detail. Past studies with HST have probed only 10 lines-of-sight through the Galactic halo at resolutions of < 200 kms , and our SNAPshot survey should more than triple the sample of HVCs identified from their absorption lines.

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Proposal Category: GO
Scientific Category: Hot Stars
ID: 9129
Title: Evolution of the Bow Shock in the Guitar Nebula
PI: James Cordes
PI Institution: Cornell University

We propose WFPC2 observations of the Guitar Nebula, a bow shock produced by the high-velocity (V>1000 kms) pulsar B2224+65. By comparison with a previous observation in 1994, a new narrowband HAlpha image will allow exploitation of the change in pulsar location (~ 1"), in order to: (a) quantify ambient interstellar density variations on scales <=sssim 10^-3 pc that perturb the shape of the bowshock near the contact discontinuity (size ~ 0.2"); and (b) better model the bowshock to determine the orientation of the pulsar velocity vector. The results will be combined with a prior ROSAT image and a deep X-ray exposure (Chandra, October 2000) and ground based images from Palomar Observatory that constrain the shock heating and large scale structure of the nebula. PSR B2224+65 has the highest estimated space velocity of any pulsar: these results will also improve the pulsar distance and velocity estimates, which are important inputs for the study of pulsar kicks and supernovae asymmetry.

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Proposal Category: GO
Scientific Category: Hot Stars
ID: 9130
Title: The iron abundance in the Magellanic Clouds and Bridge
PI: Philip Dufton
PI Institution: Queen's University of Belfast

The spectra of early-type main-sequence stars provide excellent probes of the current chemical composition of galaxies. The physics of their atmospheres are well understood, while their surfaces will normally be unaffected by the products of interior nuclear reactions. We have previously used optical spectra of such targets to map the abundances of light metals (such as C, N, O, Mg, Si) in our Galaxy, in the Magellanic Clouds and in a Bridge of material connecting the latter. However, we have been unable to obtain iron group abundances for the Magellanic System due to the intrinsic weakness of the optical Fe, ii/ iii spectra and the system's low metallicity. Here we propose observations of strong Fe, iii ultraviolet lines for two Bridge stars, plus an LMC target. These will be supplemented by AAT and ESO optical spectroscopy plus HST spectra for two previously observed targets in the middle of the Bridge and in the SMC. Using non-LTE model atmosphere and careful differential methods, relative abundances accurate to 0.1 dex should be achievable. These five stars will allow us to determine key element abundances and ratios (e.g. O/Fe) in both Clouds and across the Bridge. As well as providing the first detailed comparison of the Bridge's metallicity with those of its parent Clouds, it will clarify the evolutionary history of this system.

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Proposal Category: SNAP
Scientific Category: Cosmology
ID: 9131
Title: Imaging the Host Galaxies of High Redshift Type Ia Supernovae
PI: Richard Ellis
PI Institution: California Institute of Technology

We propose to complete our STIS snapshot survey of distant galaxies of known redshift which hosted supernovae (SNe) of Type Ia found via the Supernova Cosmology Project (SCP). The Hubble diagram of these SNe yields measurements of the cosmological parameters (Omega, Lambda) that are inconsistent with a flat Universe of zero cosmological constant. Even if the universe is not flat, Lambda > 0 is indicated with strong statistical confidence (>99 confidence is now limited more by the possibility of systematic errors than statistical uncertainty. In particular, it is important to justify convincingly that environmental differences between low and high redshift SNe are accounted for by current lightcurve width-color-luminosity correction methods. Tackling

systematic effects in the SCP dataset via detailed studies of the host galaxies is being undertaken both with this HST snapshot program (where the SNe Hubble diagram is being examined with respect to the host galaxy morphology and galacto-centric distance for each SN) and an associated spectroscopic campaign on the Keck telescope (which constrains the likely stellar populations and extinction variations at the SN site). The first results from both aspects are encouraging and support the SCP's conclusions. However, only 33 of the 63 originally-requested snapshot images have been secured. We thus request the snapshot program be continued to completion in Cycle 10.

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Proposal Category: GO
Scientific Category: Cosmology
ID: 9132
Title: Resolving the Puzzling Dark Mass Concentration in Abell 1942
PI: Thomas Erben
PI Institution: Max-Planck-Institut f. Astrophysik

Exhaustive ground-based studies have not resolved the physical nature of the highly significant gravitational lensing signal observed by Erben et al in the field of the rich cluster Abell 1942 (z=0.22). Independent lensing analyses of two optical datasets reveal a striking mass concentration ~eq7 arcmin south of the cluster centre with no obvious visible source counterpart. Placed at the redshift of the cluster the implied mass would be M(0.5h^-1mboxMpc) >= 1* 10^14M_dot. The absence of an obvious excess of faint sources in suitably deep infrared images makes it highly unlikely that such a strong lensing signal can be caused by a projected background cluster of galaxies. Accordingly we must take seriously the possibility of either the detection of a new type of extragalactic object or some hitherto undiscovered uncertainty in the weak lensing mass reconstruction techniques. The former is of obvious importance but so would be the latter given the increasingly important role lensing plays in constraining the mass power spectrum. A modest HST allocation will significantly improve the precision and localised position of this puzzling signal enabling the first detailed examination of both possibilities.

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Proposal Category: GO
Scientific Category: Cosmology

ID: 9133
Title: HST Imaging of Gravitational Lenses
PI: Emilio Falco
PI Institution: Smithsonian Astrophysical Observatory

Gravitational lenses offer unique opportunities to study cosmology, galactic structure, galaxy evolution, quasar hosts and extinction. They are also the only sample of galaxies selected on the basis of their mass rather than their luminosity or surface brightness. While gravitational lenses can be discovered with ground-based optical and radio observatories, converting them from curiosities into scientific tools requires HST. With typical image separations of ~ 1", HST is the only instrument that can in each case precisely locate the lens galaxy, measure its luminosity, color and structure and search for lensed images of the source host galaxy. We will obtain WFPC2 V and I images of new lenses lacking any HST observations and filt lenses where observations in one of these two standard filters is missing. We will reobserve bad lenses for which existing HST data are not quantitatively useful. We also propose to observe isc lenses which will be discovered during the course of Cycle 10. As in previous cycles, we request that the data be made public immediately.

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Proposal Category: GO
Scientific Category: ISM and Circumstellar Matter
ID: 9134
Title: Giant H II Regions and the Connection with Starbursts and Diffuse Ionized Gas
PI: Donald Garnett
PI Institution: University of Arizona

Giant H II regions in nearby galaxies are an intermediate link between energetic starbursts in distant galaxies and local star-forming complexes in the solar neighborhood. They provide an opportunity to study the connection between massive star formation regions, ionized supershells, and the diffuse ionized gas that pervades many star-forming galaxies. Although giant H II regions have been modeled extensively, key questions remain unresolved: (1) what is the connection between the giant H II region and the diffuse ionized gas? (2) how do Wolf-Rayet stars influence the observed spectrum of the H II region? (3) is there significant leakage of ionizing radiation from giant H II

regions into the ISM? (4) are the observed emission line ratios and ionization structure consistent with predictions based on stellar photon fluxes? One important key to answering these questions is high resolution imaging of giant H II regions and the surrounding regions. Here I propose an imaging study of one of the nearest giant H II regions, NGC 604 in the spiral galaxy M33 with the WFPC-2. This object has extensive archival WFPC-2 imaging in broad-band filters and some emission lines. I will obtain new imaging in other important diagnostic lines (e.g. O II, S III, and HBeta) to provide a more accurate picture of the ionization structure, and compare the emission-line imaging with the known stellar populations and ionization modeling.

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Proposal Category: GO
Scientific Category: Cosmology
ID: 9135
Title: A New High-z Galaxy Cluster with Extraordinary Lensed Arcs From Multiple Sources
PI: Mike Gladders
PI Institution: University of Toronto

In the course of the Red-Sequence Cluster Survey (a 100 deg^2 optical imaging survey), we have discovered a stunning new example of strong lensing by a relatively high redshift (z~0.7) cluster. This lens system has more bright arcs, with better cluster azimuthal coverage than examples of lower z lenses previously imaged by HST (e.g., Abell 370, CL2244-0221), and is the only known lens at z>0.6 with such significant lensing. At least 4 separate arcs are detected in our initial survey data, at 3-4 different cluster-centric radii and hence likely corresponding to at least 3 different background sources at 3 different redshifts. Moreover, these arcs are relatively bright (R_c~21.5-24.2) and hence redshifts should be readily obtainable using 8m class telescopes. The proposed HST WFPC2 imaging, in conjunction with proposed VLT spectroscopy, offers an unprecedented opportunity to measure the core mass distribution of a cluster at such a high redshift. In combination with requested coordinated Chandra X-ray imaging, this will enable a direct comparison of the dark matter and baryonic components of the cluster, and enable a measure of cosmology via sources at different z. Furthermore, the arcs are bright enough to allow a detailed look at several high-z galaxies, via image reconstruction of the unlensed sources (only possible with HST images) and detailed spectroscopy.

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Proposal Category: GO
Scientific Category: Star Formation
ID: 9136
Title: T Tauri Star Coronagraphic Survey: A PMS Protoplanetary Disk Census
PI: Carol Grady
PI Institution: Eureka Scientific

Millimeter and IR studies suggest at least 50 solar-mass stars, the T Tauri stars, have circumstellar disks similar to the disk from which our planetary system formed. High spatial resolution, high dynamic range imaging of such systems maps the spatial distribution of material around the star, constraining the disk sizes and inclinations, and provides a first assessement of when structure in the disk, such as cleared central zones and annuli, which has been linked to planet formation, develops. HST coronographic studies have probed circumstellar material around older solar-mass stars (NICMOS), and intermediate-mass stars (STIS). WFPC2 direct optical imaging has revealed the disks only for 10 detections more common among the younger (~ 10^4-10^5 yr), heavily embedded objects. Understanding the nature of planet formation requires comparable coverage of disks around solar-mass stars with ages of a few Myr. We propose filling this gap in the current survey coverage with STIS broadband, optical, coronagraphic imaging of a sample of ~1-3 Myr old T Tauri stars. Our program stars have firm indications of disks from the millimeter, but require deeper optical imaging such as can only be provided by STIS.
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Proposal Category: GO
Scientific Category: Quasar Absorption Lines and IGM
ID: 9137
Title: Quasar Absorbers and Large Scale Structure
PI: Chris Impey
PI Institution: University of Arizona

We propose STIS spectroscopy of 15 bright (V < 18) quasars in a 22 deg^2 region that has well-sampled galaxy redshifts. This is a unique asterism of quasars of this brightness. The spectra will yield ~183 Lyman-Alpha absorbers, ~119 of which will be in the range 0 < z < 0.2, with rest equivalent widths complete to ~ 0.21 Angstrom. This grid of probes will allow the most

sensitive test of absorber-absorber and absorber-galaxy clustering ever. On the typical transverse scales between lines of sight of 1-2 h_100^-1 Mpc, we will be able to detect absorber-absorber correlation that is 10-20 times weaker than galaxy-galaxy correlations. With a typical number of absorbers per sightline of ~13, the ~630 h_100^-1 Mpc depth of the volume can be used to locate absorbers with respect to sheets and voids in the galaxy distribution. The coherence length and correlation strength of the absorbers will be compared against cosmological hydrodynamic simulations of the local universe, using similar methods to select absorption lines in the data and the simulations. The quasar spectra can be used to directly measure the power spectrum of fluctuations on scales of 1-10 h_100^-1 Mpc, and the quiescence of the cosmic velocity field on scales of 1-2 h_100^-1 Mpc. Lyman-Alpha absorbers are expected to trace the underlying dark matter potential, and their use in measuring large scale structure is an important complement to the use of galaxy redshift surveys.

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Proposal Category: GO
Scientific Category: AGN/Quasars
ID: 9138
Title: Host Galaxies of Gravitationally Lensed Quasars
PI: Chris Impey
PI Institution: University of Arizona

Imaging studies of quasar host galaxies at high redshift are biased toward detecting luminous hosts. Gravitational lensing combined with optical and near-IR imaging enhances their detectivity and has nearly doubled the number of known hosts at z>1. Lens studies have successfully imaged hosts with lower luminosities (L < L_*$), at farther distances (1 < z < 4), beneath a larger fraction of quasars (~70 imaging of non-lensed quasars. We propose deep WFPC2 followup imaging of five lensed systems in the F555W and F814W filters, which offer unique opportunities for detailed studies of faint, high-redshift, quasar hosts. This science can not be achieved by imaging of unlensed quasars, or from the ground, because of their small angular sizes. Based on their favorable image geometry, pre-existing near-IR fluxes, and predicted colors, we will detect them with reasonable exposure times. We will measure the colors and luminosities of these 5 quasar hosts in order to study their stellar populations, star formation histories, dust, correlations with properties of the AGN central engine, and black hole growth rate. Resolving

the host structure will also help to determine the dark matter distribution of the foreground lens galaxies.

Proposal Category: SNAP
Scientific Category: AGN/Quasars
ID: 9139
Title: Variability in the UV Spectrum of 3C 279: Testing Models for the Gamma-Ray Emission in Blazars
PI: Anuradha Koratkar
PI Institution: Space Telescope Science Institute

>~mma--ray emission dominates the power output of many luminous blazars, yet we do not know the physical scale on which it is produced i.e., where in the jet most of the kinetic power is dissipated. We know the production of >~mma--rays depends critically on the blazar line emission: ambient photons from broad emission lines (primarily LyAlpha) are upscattered to >~mma--ray energies by relativistic electrons in the blazar jet. Rapid large-amplitude >~mma--ray variability implies that both electrons and LyAlpha photons must vary rapidly. This suggests some broad-line clouds are photoionized by synchrotron flares in the jet (the ``mirror model''). We propose a critical test to determine if >~mma-rays are produced on the scale of the broad line region, using multi-epoch STIS UV snapshots of 3C 279 to find and characterize its LyAlpha variability. This will validate the mirror model for generating the intense >~mma--ray emission from blazars, which could then be quantified with (much more resource intensive) coordinated >~mma--ray and HST observations. 3C 279 is the best-studied blazar from radio to >~mma--ray wavelengths, showing frequent large flares over days to months. Variability in the UV continuum and LyAlpha will directly reveal any coupling between the jet ionizing flux and the broad-line region emission, providing clues to the physics and energetics of all radio-loud AGN.

Proposal Category: GO
Scientific Category: Hot Stars
ID: 9140
Title: Is GRO J1655-40 a runaway Black Hole?
PI: Felix Mirabel
PI Institution: CEA-Service de Astrophysique

The formation of black holes is one of the most intriguing problems in astronomy. In the case of stellar-mass black holes, several theories propose that they are born with large space velocities. To test this idea we wish to determine the space velocity of X-ray Nova Scorpii 1994 (GRO J16155-40), which is one of the best black hole candidates of stellar mass, and a source of jets with apparent superluminal motions. This intriguing object is located ~eq 2.5^degrees above the galactic plane and the centre of mass of the system is known to be moving with a large anomalous radial velocity (~eq -114 km s^-1) with respect to the Local Standard of Rest. Since GRO J16155-40 has already been imaged with the WFPC2 in 1995, one more image with the same instrumental set-up could allow us to measure its expected proper motion with an accuracy of a few percent. The observation proposed here may provide the first unambigous evidence for a black hole formed in the Milky Way that is migrating into intergalactic space.

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Proposal Category: GO
Scientific Category: ISM and Circumstellar Matter
ID: 9141
Title: Fine Scale Temperature Fluctuations in Gaseous Nebulae
PI: C.R. O'Dell
PI Institution: Vanderbilt University

In spite of superb theoretical models for photoionized Galactic and Planetary Nebulae there is a basic problem, known as the t^2 problem, which prevents the accurate determination of relative abundances of the elements. Nebulae are in practice more inhomogeneous in electron temperature than theoretically expected. The purpose of this proposal is to determine just how inhomogeneous the two closest bright exemplars of their class are and what is the source of those inhomogeneities. This will be done by imaging the Orion and Eskimo nebulae in filter sets that will allow determination of O III 5007 and 4363 Angstrom flux ratios, which is a well calibrated electron temperature determinant. We'll use the detailed method of WFPC2 filter calibration developed by the PI, which is necessary since most of the emission line filters do not adequately isolate the emission lines. We'll then compare the zones of high and low electron temperature with the known features in the nebulae, in order to determine if they arise from the best candidates (shock heating and/or shadow cooling), or an unanticipated process. From these results we expect to be able to estimate the uncertainties in the abundances

derived for more distant objects and to suggest corrections for reducing those uncertanties.

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Proposal Category: GO
Scientific Category: AGN/Quasars
ID: 9142
Title: The Structure and Physics of Extragalactic Jets
PI: Eric Perlman
PI Institution: University of Maryland, Baltimore County

As part of an ongoing investigation into the physics of jets, we propose to obtain WFPC2 polarimetry of the jets of 3C 264, 3C 78 and 3C 346. We are motivated by our recent findings of strong radio-optical polarimetry differences in the M87 jet, which imply that radio and optical synchrotron emitting electrons must occupy physically distinct regions, with high-energy particles concentrated closer to the jet axis, and affected more by shocks, than lower-energy particles. This is the first clear evidence regarding the internal structure of a relativistic jet. Here we propose to test whether our model holds in jets with different morphologies and luminosities, by obtaining high-resolution optical polarimetry of a sample of optical jets. This will produce fundamental gains in our knowledge of the structure and physics of extragalactic jets. By comparing the total intensity and polarized structures in the optical and radio, we will probe the magnetic field configurations in both optical and radio emitting regions. This will allow us to test the level of stratification in these jets, and uncover whether the magnetic field geometry is largely fixed at formation, or dominated by subsequent flow dynamics. By adding to the picture our optical spectral information, we will gauge the impact of shocks, the need for in situ particle acceleration, and test jet models.

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Proposal Category: GO
Scientific Category: AGN/Quasars
ID: 9143
Title: STIS Spectrophotometry of Nearby Seyfert 2 Nuclei: Can we eliminate the Seyfert 2 class?
PI: Richard Pogge
PI Institution: The Ohio State University

Seyfert 2s are distinguished by the absence of the broad emission lines characteristic of Seyfert 1s and more luminous QSOs. Are Seyfert 2s fundamentally different from Seyfert 1s and their brighter cousins? Or is the broad emission line region in Seyfert 2s simply suppressed by obscuring material as postulated by the unification model? If the latter model is correct, the weak broad emission lines in the Seyfert 2s may simply be overwhelmed by starlight from the circumnuclear region, particularly in the case of recent star formation. We propose to determine if all Seyfert 2s have (weak) broad emission line regions by obtaining long-slit STIS spectroscopy for a well-defined sample of 20 Seyfert 2s (3 archival, 17 new). Compared to previous ground-based spectroscopy, the HST/STIS angular resolution of 0arcs1 provides a 10* increase in spatial resolution and a 20--50* increase in contrast between the active nucleus and surrounding starlight. Medium-resolution spectra around HAlpha will be used to search for broad HAlpha emission. Low-resolution blue spectra (2900-5700A) will be used to quantify the nuclear and extranuclear contributions from hot stars or other sources to the featureless continuum, and measure emission lines. If we detect broad lines in the large majority of the Seyfert 2s by using STIS to avoid most of the circumnuclear starlight, it will effectively eliminate the Seyfert 2 class.

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Proposal Category: GO
Scientific Category: Galaxies
ID: 9144
Title: Calibrating Star Formation: The Impact of Environment
PI: Daniela Calzetti
PI Institution: Space Telescope Science Institute

One missing piece for placing star formation within the broader context of galaxy evolution is the quantification of the feedback mechanisms between a starburst and its host galaxy. We propose to obtain WFPC2 UV, V, and I broad-band and HAlpha, OIII, SII, and HBeta emission line images of three nearby, sub-L^*, starburst galaxies to: map the young stellar populations and star clusters, locate the obscuring dust clouds, and diagnose conditions in the ionized ISM. Our sample is carefully selected to probe a range of environments for the host galaxy, from isolated to group-interacting, for constant morphology, luminosity and metallicity. The galaxies are all closer than ~4 Mpc, giving ~2 pc resolution with the WF so we can chart the detailed

structure of each starburst. This project is designed to: (a) establish whether starbursts are large-scale coherent or chaotic processes by investigating the presence of sequential/propagating star formation; and (b) explore the influence of the external environment on the evolution of the starburst. For this purpose we will measure: (1) the recent star formation history of both stellar clusters and young diffuse population; (2) the dust distribution; and (3) the structures in the shocked and photo-ionized gas. This study will provide a physical basis, in terms of energetics, evolution, and internal structures, for the interpretation of blue galaxies at intermediate and high redshifts.

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Proposal Category: SNAP
Scientific Category: AGN/Quasars
ID: 9145
Title: A Snapshot Survey of the Optically Selected Type-2 Quasars
PI: S. George Djorgovski
PI Institution: California Institute of Technology

We identified a population of emission-line objects in DPOSS, which can be plausibly interpreted as the long-sought type-2 quasars. They have high-ionization Seyfert-2 like spectra, but with narrow-line luminosities comparable to those of the luminous type-1 quasars in the same redshift range. Keck spectropolarimetry confirms the presence of hidden QSO nuclei in them. This provides a major piece of evidence in favor of the unified schemes for AGN, and it should help extend our understanding of AGN in general. This population may be a major contributor to the cosmic hard x-ray background. It is complementary to the optically dull hard x-ray sources found by Chandra. We propose to obtain multi-color images of a representative sample of these objects, in order to examine their morphology with the superior angular resolution of the HST. We may be able to detect point-like nuclei which are not detectable in ground-based images, the dust lanes hiding them from our view, possible evidence for tidal interactions and the overall morphology of their hosts, etc. We also propose for Chandra observations for a subsample of 5 objects, in order to probe the column densities of the obscuring material and to constrain their bolometric luminosities. This study would greatly increase our understanding of these objects, which are an important missing link in the overall picture of AGN populations in the universe.

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Proposal Category: GO
Scientific Category: Cool Stars
ID: 9146
Title: Cepheid Masses: Y Car
PI: Nancy Remage Evans
PI Institution: Center for Astrophysics

Quantitative understanding of classical Cepheids provides confidence in their use as primary extragalactic distance indicators, as well as in the understanding of the evolution of more massive stars and more evolved stars. HST UV spectroscopy provides a unique opportunity to contribute to the dramatic improvement in the precision of fundamental stellar parameters by determining the mass of the double mode Cepheid, Y Car, the only known double mode Cepheid in a binary, which makes it arguably the top priority Cepheid mass. In this project, the orbital velocity amplitude of the hot main sequence companion is to be measured from STIS echelle spectra and combined with the orbital velocity amplitude of the Cepheid from the ground-based orbit and the mass of the main sequence companion to provide the Cepheid mass. We have already reduced the uncertainty of the amplitude of the ground-based orbit of the Cepheid from +/- 0.8 km sec^-1 to 0.2 km sec^-1. The sensitivity of the STIS spectrograph makes possible a higher dispersion observation over a wider wavelength region than the previous GHRS medium resolution spectra. We expect the radial velocities measured from the STIS spectra to reduce the uncertainty (s.d.) in the mass of Y Car from 32.
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Proposal Category: GO
Scientific Category: AGN/Quasars
ID: 9147
Title: Probing the structure of the shocks in the narrow line region of M 51
PI: Pierre Ferruit
PI Institution: CRAL -- Observatoire de Lyon

Despite many studies, the question of whether nuclear or shock-induced photoionization dominates the gaseous ionization in the narrow-line region (NLR) of LINERs and Seyfert galaxies remains unanswered. One critical issue is the determination of the input of mechanical energy in the NLR through jet/ISM

interactions. According to Bicknell et al. (1998), the latter could actually suffice to power the NLR in most Seyfert galaxies. Previous approaches to this problem have obtained integrated UV/visible line flux ratios, which are sensitive to uncertain reddening. We instead propose to exploit the high spatial resolution of HST/STIS to map several spectral lines across the shock/precursor complex in the spatially extended, jet-driven NLR of the nearby Seyfert 2 galaxy M 51. With spatial resolution of 4--5 pc (unprecedented for a galaxy jet/ISM interaction), we will map the spatial distribution of kinematic subsystems, the ionization structure, and the gaseous density, across this structure. These HST/STIS observations (probing the shock structure) will be combined with proprietary CHANDRA/ACIS data (probing the hot, shocked gas component), ground-based 3D spectroscopy (probing the more diffuse, extended structures) and radio maps. The resulting data set will be unique, and will allow us to derive quantitative measurements of the amount of mechanical energy injected in the NLR by the jet/ISM interaction.

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Proposal Category: SNAP
Scientific Category: ISM and Circumstellar Matter
ID: 9148
Title: Light Echos and the Nature of Type Ia Supernovae
PI: Peter Garnavich
PI Institution: University of Notre Dame

HST has resolved light echos around two Type Ia supernovae, SN 1991T and 1998bu and demonstrated that the distance between a supernova and dust clouds in the host galaxy disk can be determined with an accuracy of better than ~ 20pc. We propose to take STIS snapshot images of a subset of 43 well observed Type Ia supernovae (SN Ia), most of which have been discovered in late type galaxies over the last 40 years to make a systematic search for light echos around SN Ia. We will also observe a sample of 10 SN II and SN Ib/c, which are believed to be the result of massive star core collapse and, therefore, to be thin-disk population objects, in order to make an empirical calibration of the accuracy of our method for determining scale heights. The SN Ia sample will provide a direct as well as accurate estimate of the scale height of SN Ia which is an important clue to the progenitors of these events. The results will also test the possibility that a dusty environment favors the occurrence of SN Ia in late type galaxies as found for SN 1991T and 1998bu.

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Proposal Category: GO
Scientific Category: Cosmology
ID: 9149
Title: The nature of the most luminous star-forming galaxies in the redshift range 0.4 to 1.5
PI: Franccois Hammer
PI Institution: DAEC, Observatoire de Paris-Meudon

ISO deep surveys have uncovered a population of galaxies which are making stars at the fantastic rate of > 100 M_odotyr^-1 in the redshift range from 0.4 to 1.5. However this population evolves rapidly and luminous star-forming galaxies are 5 to 10 times more numerous at z=1 than today. Combination of ISO data with radio (VLA), sub-mm (SCUBA) and optical data shows that they contribute a major fraction (30-50 representing only a few percent of the field galaxy population. HST imaging of a small subsample of these galaxies indicates that most of them are disks showing disrupted morphologies or possessing companions, emphasizing the role of merging in their star formation history. We propose to image the two CFRS fields which contain the largest number of bolometrically luminous galaxies ever observed at all wavelengths. Together, they cover 36 times more area than the HDF and 8 times more area than the ultradeep ISO field and contain nearly 200 ISO/SCUBA/VLA sources at a few 100 MuJy level, most of them being luminous star-forming galaxies. Morphology and (V--I) colors of ~ 80 of these objects, combined with deep spectroscopy at the VLT and Keck, will allow us to probe the nature and formation of these objects which may be progenitors of today's massive galaxies.
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Proposal Category: GO
Scientific Category: ISM and Circumstellar Matter
ID: 9150
Title: Understanding the Warm Ionized Medium of the Galactic Halo
PI: J. Christopher Howk
PI Institution: The Johns Hopkins University

We propose to obtain stis observations of the post-AGB star von Zeippel 1128 (l = 42.5; b=+78.7; z=9.5 kpc) in the globular cluster M 3, which will be

used to study the warm ionized medium (WIM) of the Galactic halo. The proposed observations, together with fuse data, will cover key diagnostics of the warm ionized medium, namely [S II]I, Al III, and Fe III. We will use the proposed observations to study the interactions and energy exchange between the WIM, the warm neutral medium, and the hot ionized medium along this sightline. We will do this by determining the relative dust content of the warm ionized and neutral media, by producing a census of and determining the relative ionization states of each phase along the sightline, and by investigating the relative kinematics of each of the three phases. The observations will provide the highest quality dataset yet available for studying the global connections between the warm ionized, hot ionized, and warm neutral phases of the Galactic halo. They will be a critical link between the extensive database of emission line observations of the WIM and absorption line studies of the other phases of the ISM. A by-product of this work will be a set of high-quality gas-phase abundances for the integrated Galactic halo; the relative abundances (e.g., Zn/Cr, Zn/Fe) for this sightline will be important for comparison with the high-redshift damped Lyman-Alpha absorbers.

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Proposal Category: SNAP
Scientific Category: Galaxies
ID: 9151
Title: STIS UV Snapshot Observation of Nearby Star Forming Galaxies
PI: Myungshin Im
PI Institution: University of California, Santa Cruz

We propose to obtain FUV and NUV images of nearby emission-line galaxies with existing star-formation rate (SFR) measurements from their HAlpha flux. Recently, the use of the UV flux as a measure of SFR has gained much popularity for estimating SFRs at different cosmic epochs ($0 < z < 5$). However, the SFR estimated from UV flux could be greatly biased due to dust extinction. The KPNO International Spectroscopic Survey (KISS) provides a large sample of nearby HAlpha-selected starforming galaxies for which rich optical spectra are available for measuring metallicity and dust extinction through line ratios. By observing a subset of nearby emission-line galaxies in the KISS sample with the STIS FUV and NUV MAMA, a direct comparison between UV and HAlpha SFR estimates will be possible. This will allow us to understand the effect of dust extinction on UV flux for star-forming galaxies over a wide

range of HAlpha luminosity (10^39-43 erg/sec), metallicity (0.1 to 2 * solar), absolute magnitude (-14 to -21), and B-V color (0.2 to 1.2). A rough dust extinction curve will be constructed for such objects, making it possible to test plausible dust extinction curves used in previous SFR studies of the distant universe. Also, high-resolution UV images will allow us to search for plausible local counterparts to high redshift galaxies whose rest-frame UV morphology is available from existing optical HST data.

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Proposal Category: GO
Scientific Category: ISM and Circumstellar Matter
ID: 9152
Title: Circumstellar Gas Around HR 4796A
PI: Michael Jura
PI Institution: University of California, Los Angeles

We propose to use STIS to study the circumstellar gas around HR 4796A, an 8 Myr old star with a debris disk of ~1.5 * 10^27 g of dust. By searching for circumstellar CO, ionC1 and ionZn2, we hope to determine the dust to gas ratio and to constrain the physical conditions in the gas. Is there enough gas to form a Jovian planet; are comets forming?

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Proposal Category: GO
Scientific Category: Hot Stars
ID: 9153
Title: The Black Hole (?) in BG Gem
PI: Scott Kenyon
PI Institution: Smithsonian Astrophysical Observatory

We propose to acquire low resolution ultraviolet spectra of the long period black hole binary candidate BG Geminorum. STIS spectra allow an unambiguous test of the nature of the 4.5 M(sun) primary star, which makes no measurable contribution to the optical spectrum. Detection of a strong ultraviolet continuum or ultraviolet absorption lines from Si II and Si III (among others) would indicate a B-type primary; failure to detect these features or detection of (broad) high ionization emission lines would favor a black hole primary. If it contains a black hole, BG Gem would be the longest period black hole binary known (by a factor of ten), challenging current theories of black hole formation. It would also be the only eclipsing binary known to contain a

black hole, which would provide a unique laboratory for testing accretion disk models for black hole binary systems.

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Proposal Category: GO
Scientific Category: Star Formation
ID: 9154
Title: Spatial distribution of the gas inside the Beta Pic disk
PI: Alain Lecavelier des Etangs
PI Institution: Institut d'Astrophysique de Paris, CNRS

The gas and dust disk surrounding Beta Pictoris gives clues to the understanding of the late stages of planetary formation. However many aspects of its dynamics remain mysterious. With a pilot program in Cycle 5, we demonstrated the feasibility of a new observational technique aimed at mapping the distribution of gas within the disk through the faint fluorescence emission lines with the spectrograph slit placed off the star. This previous program led to the detection of Fe II emission lines, providing original and new information on the dynamics, density and distribution of gas within the disk (Lecavelier et al. 2000). A tentative detection of si is also to be confirmed. Here we propose new STIS observations of the two sides of the disk to confirm these detections and to substantially improve our knowledge of the gas properties. The echelle grating will be used to measure the faint emission lines formed by resonant scattering of the star light by Fe II, Mg II , nii and ii in the disk. The absorption of dust scattered light by si and ci due to gas at larger distances will also be investigated. This program will be able for the first time to map the spatial distribution of the gas around Beta Pic, and will give very new clues to the understanding of activity in young planetary systems.

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Proposal Category: GO
Scientific Category: Cosmology
ID: 9155
Title: The Cepheid Distance to NGC 1637: A Direct Comparison with the EPM Distance to SN 1999em
PI: Douglas Leonard
PI Institution: University of California at Berkeley

Opportunities to directly compare distances estimated by two primary

extragalactic distance indicators are rare. The appearance of supernova 1999em, a bright, extremely well-observed type II plateau (II-P) event in the nearby SBc galaxy NGC 1637 (v = 717 km s^-1), offers the best chance to test the consistency of the Expanding Photosphere Method (EPM) of supernova distance determination with that derived from Cepheid variable stars. Although EPM distances have been measured to 18 type II supernovae out to 180 Mpc and used to determine Hubble's constant independent of the Cepheid distance scale (H_degrees = 73 +/- 7 km s^-1 Mpc^-1 Schmidt et al. 1994a), there have never been any measurements of Cepheids in a galaxy that has hosted a normal type II-P supernova, the classic variety of core-collapse event to which EPM-derived distances are most robust. We thus propose to determine the distance to NGC 1637 through the discovery and analysis of its Cepheid variable stars. Since previous distance estimates to NGC 1637 exist using the Tully-Fisher relation (d = 8.9 Mpc) and the galaxy's brightest red supergiants (d = 7.8 Mpc), a Cepheid distance will further refine the calibration of these secondary distance indicators as well. Cycle 10 observations of NGC 1637 will also provide rare late-time light curve measurements of a type II-P supernova more than two years after explosion.

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Proposal Category: GO
Scientific Category: Hot Stars
ID: 9156
Title: Spectrum and pulse profile of PSR 0656+14 in the near-UV
PI: Peter Lundqvist
PI Institution: Stockholm Observatory

We propose to do STIS/NUV/TIMETAG prism observations of the middle-aged (~ 10^5 year) pulsar (PSR) 0656+14. This would make this pulsar the second (after the Crab pulsar) for which a UV pulse profile was established. For the 8 orbits we request we would obtain a pulse profile for the NUV which is better than the groundbased optical pulse profile, at the same time as we obtain the spectral shape with good signal-to-noise (S/N ~ 15 per 100 Angstrom wavelength bin.) PSR 0656+14 has been shown from previous HST observations to experience a spectral turn-over in the NUV, most likely due to a shift in importance between nonthermal and thermal radiation from the neutron star. The combination of the spectral and time-resolved capability of STIS/NUV/TIMETAG prism spectroscopy makes it possible to resolve also what fraction of the UV emission is pulsed, and from the shape of the pulse, we could better

distinguish between the nonthermal and thermal radiation components. In particular, the pulsed fraction is rather poorly constrained from the ground. Our proposed observation will resolve this, and for a plausible pulsed fraction we are even likely to detect spectral variations over the pulse period, from which we can draw conclusions about the surface and magnetospheric structure of the neutron star.

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Proposal Category: GO
Scientific Category: Cool Stars
ID: 9157
Title: Fundamental properties of L-type dwarfs in binaries
PI: Eduardo Martin
PI Institution: Institute for Astronomy

We propose to characterize the physical properties of eight L-dwarfs in four binary systems. Our goal is to obtain astrometric, photometric and spectroscopic measurements of each component that will yield basic information on their atmospheric and dynamical properties. The high angular resolution of HST is essential because all these systems have angular separations <=0.5 arcsec. They do not have bright enough stars nearby that can be used for natural guide adaptive optics in ground-based telescopes. In Cycles 10 and 11 we propose to obtain WFPC2 and STIS data, allowing the determination of parallax, proper motion, position and spectral type for each component. In Cycle 12 we plan to obtain additional WFPC2 images for follow-up of the orbital motion and refinement of parallax and proper motion. We will also monitor possible intrinsic photometric variability in two filters (F675W and F814W). The STIS observations will provide spectral types, gravity sensitive indicators, and chromospheric activity (H_Alpha emission) for each component. These 4 systems will constitute benchmarks for determining dynamical masses of L dwarfs, and inferring the age-mass-spectral type relationship of this new spectral class.

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Proposal Category: GO
Scientific Category: Quasar Absorption Lines and IGM
ID: 9158
Title: ionO6 Gas as an Indicator of the Diffuse Web of Baryons
PI: Eric Miller
PI Institution: University of Michigan

Most of the baryons in the local universe are expected
to be in a hot phase (10^5--10^7 K), yet direct detection of this material is challenging. The most suitable way of detecting this gas in the UV is through the high-ionization ionO6 doublet at 1035 Angstrom, which traces collisionally ionized gas at 3eex5 K. However, ionO6 can also be produced through photoionization in cooler gas (< 5eex4 K), which is not part of the web of hot baryons. Tripp & Savage (2000) suggest that they have finally detected the hot baryonic gas in an ionO6 absorption system without measurable ionN5, although this combination occurs often in photoionized systems. We propose to resolve this ambiguity by measuring the ionC4 line, which for the photoionized case occurs at about the same equivalent width as the ionO6 line.

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Proposal Category: GO
Scientific Category: Hot Stars
ID: 9159
Title: Test of a New Observational Method for Stellar Seismology
PI: M. Sean O'Brien
PI Institution: Space Telescope Science Institute

We propose to test a new method for identifying the spherical harmonic index of pulsation modes in variable white dwarfs, pre-white dwarfs, and central stars of planetary nebulae. Once the mode-indices are found for such stars, the observed periods can yield accurate measurements of mass, luminosity, rotation rate, magnetic field strength, and interior structure. Unfortunately, so far only a single star, PG1159--035, shows a pulsation spectrum rich enough for unambiguous identification of both ell=1 and ell=2 modes via its observed pattern of periods alone. Theory predicts that limb darkening should cause the amplitudes of ell=1 and 2 modes to vary differently with wavelength in the UV. However, previous UV observations directed at determining mode indices in DA white dwarfs show that the models must be calibrated before this method can prove truly useful. We therefore propose to measure amplitude versus wavelength for the 20 known ell=1 and 9 known ell=2 modes in PG1159--035 using the STIS FUV-MAMA. We will thus measure the limb-darkening law for pre-white dwarfs, calibrate models for future application to other post-AGB pulsators, and truly test a new observational tool of enormous potential.

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Proposal Category: SNAP

Scientific Category: Star Formation
ID: 9160
Title: Disks and Envelopes of Nearby Nebulous Young Stellar Objects: A Snapshot Survey
PI: Deborah Padgett
PI Institution: California Institute of Technology

Recent HST observations have provided the best resolved images of young circumstellar disks yet seen. In several cases, of which HH 30 is the best known example, nebulous young stars are resolved by HST into bipolar reflection nebulae several hundred AU in extent separated by a central dark absorption lane obscuring direct view of the star. Modeling suggests that these systems are edge-on optically thick circumstellar disks which occult the radiation from the star and near-stellar disk environment out to far-IR wavelengths. We propose a snapshot survey of nearby nebulous young stellar objects to study the detailed morphology of the their disks and envelopes and probe the effect of inclination on the infrared spectral energy distribution of disk/envelope systems.

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Proposal Category: GO
Scientific Category: AGN/Quasars
ID: 9161
Title: The Ultraviolet Properties of Obscured QSOs
PI: Paul Smith
PI Institution: University of Arizona

The Two Micron All-Sky Survey (2MASS) is compiling a large sample of new, red, active galaxies. These objects add significantly to the number density of known active galactic nuclei (AGN) and could be important contributors to the cosmic far-infrared and X-ray backgrounds. The optical polarizations and near-IR--to--optical flux ratios of 2MASS AGN are generally higher than for UV-selected objects, indicating the presence of substantial obscuration toward the nuclear energy source. We propose STIS ultraviolet spectroscopy of a subset of 2MASS-discovered QSOs to: 1) determine if UV absorption-line features are present as seen in several other highly polarized AGN populations; 2) test relationships between X-ray (through an approved Chandra Cycle 2 GO program) and UV/optical attenuation, AGN spectral type, optical polarization, and detected UV absorption-line features; and 3)

characterize the spectral energy distributions (SEDs) and UV properties of obscured QSOs. Comparison with AGN selected by other means will allow us to place the new sources in context, and in particular, whether they are the missing ``obscured AGN'' that are predicted by the Unified Scheme.

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Proposal Category: SNAP
Scientific Category: Cosmology
ID: 9162
Title: Local Galaxy Flows and the Local Mass Density
PI: R. Brent Tully
PI Institution: University of Hawaii

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Proposal Category: GO
Scientific Category: Galaxies
ID: 9163
Title: Kinematics of emission-line gas disks in radio-quiet galaxies
PI: Gijs Verdoes Kleijn
PI Institution: Leiden Observatory

It is a long-standing puzzle why some early-type galaxies are radio-loud, while others are radio-quiet. We have been pursuing a program to address this issue by studying a sample of the 21 nearest powerful radio galaxies. We have obtained WFPC2 imaging in Cycle 6. In Cycle 8 we are obtaining STIS spectroscopy of the nuclear gas detected in these galaxies, to measure central black hole (BH) masses from the rotation rate of the emission-line gas, and to determine the nature and structure of the gas disks. From inspection of the HST/WFPC2 archive we have identified three galaxies with no radio jets and with H-alphaphaNII emission, which have dust disks similar to those commonly seen in our sample of radio-loud active galaxies. The difference in radio properties of these early-type galaxies may be related to differences in their BH mass and/or the absence of accretion of the present fuel. We propose to observe these galaxies with STIS. This will yield the first BH mass measurements from HST rotation measurements of emission-line gas disks in radio-quiet galaxies (previous studies such as for M87, M84, NGC 4261, etc. were all for radio-loud systems). The results will advance our understanding of the nature of BHs in radio-loud and radio-quiet galaxies and its relation

to the radio activity and the formation and physics of radio-jets. Only HST offers the high spatial resolution required for this study.

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Proposal Category: GO
Scientific Category: Star Formation
ID: 9164
Title: Helical Flows and Rotation in Protostellar Jets
PI: Jennifer Wiseman
PI Institution: The Johns Hopkins University

We propose to study the velocity structure of protostellar jets transverse to the jet flow axis through 2-D long-slit STIS spectroscopy. In particular, HST resolution would allow the first detection of emrotation, i.e. a helical flow pattern, around the axis of an optical jet. Such a detection would provide strong evidence that jets act as outflowing channels for angular momentum, thus allowing infalling material to fully accrete onto the protostar. A study of the kinematics across the jet axis would also provide a discriminating test for different jet flow models and processes such as precession, flows along toroidal magnetic field lines, X-wind wide-angle flows, and Kelvin-Helmholtz shear instabilities. Mapping the transverse flow kinematics in protostellar jets will provide important information for star formation and may also provide clues for understanding propagation effects in AGN jets.

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Proposal Category: GO
Scientific Category: Quasar Absorption Lines and IGM
ID: 9165
Title: A Damped LyAlpha System in a Close Separation Lens
PI: Lutz Wisotzki
PI Institution: Institut fuer Physik, Universitaet Potsdam

Damped LyAlpha absorption systems hold key information about galaxy formation and chemical evolution of the universe. We propose to conduct spatially resolved absorption line spectroscopy in the only presently known DLA system with two independent lines of sight. This object was discovered recently by us in the course of an ongoing HST snapshot survey as a double QSO at z=1.57 with an image separation of only 0arcs 63, almost certainly due to gravitational lensing. The ground-based composite optical spectrum shows an exceptionally strong ionMgii+ionFeii absorption system at z=0.93, which clearly indicates

the presence of a damped LyAlpha absorber (DLA) in the line of sight. Here we propose to obtain direct imaging and medium-resolution spectra in the wavelength range 1700--5700 Angstrom , with the following principal aims: (1) Confirm the gravitational lens (vs. physical binary) hypothesis. (2) Estimate hydrogen column densities N(ionHi) along both lines of sight, and test competing DLA models. (3) In combination with already granted ESO-VLT observations, measure absolute metal abundances and compare the variation of metallicities between the two lines of sight. (4) Derive the extinction curve and dust properties of the z=0.93 lensing/absorbing galaxy.

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Proposal Category: GO
Scientific Category: AGN/Quasars
ID: 9166
Title: Fossil Gaseous Halos of Massive Galaxies at z~1
PI: Andrew Zirm
PI Institution: The Johns Hopkins University

Host galaxies of high-redshift, powerful radio sources are likely the progenitors of present-day gE and cD galaxies, and therefore provide important laboratories in which to investigate the formation of massive galaxies in the early Universe. At z~gt 2, many high-redshift radio galaxies (HzRGs) exhibit giant, (~ 100 kpc-size) Ly-alpha halos; similar nebulae without associated radio sources have recently been discovered in a galaxy overdensity at z = 3.09 (Steidel et al. 1999). The LyAlpha luminosity of these halos (~ 10^44 erg s^-1) is comparable to the total X-ray luminosities of low--z X--ray clusters, and may reflect the hot, cooling gas reservoir from which the galaxy/cluster is forming. Although these halos are easily observable in z~gt 2 HzRGs (LyAlpha is redshifted into the optical window), their redshift evolution has not yet been studied, primarily because the LyAlpha emission in the z<1.8 galaxies lies at UV wavelengths inaccessible to ground-based telescopes. We propose to use STIS on HST to search for Ly-alpha halos around giant radio galaxies and in rich cluster environments at z ~ 1. This will test both their redshift evolution (are they unique to the youngest phases of galaxy formation?) and their association with dense cluster environments.

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Proposal Category: GO
Scientific Category: Cool Stars

ID: 9167
Title: FGS Astrometry of the Extrasolar Planet of Epsilon Eridani
PI: G. Fritz Benedict
PI Institution: University of Texas

We propose observations with HST/FGS in Position Mode to determine the astrometric elements (perturbation orbit semimajor axis and inclination) of the extra-solar planet around the K2 V star Epsilon Eridani, recently detected by radial velocity techniques. These observations will also permit us to determine the actual mass of the planet by providing the presently unknown sin i factor intrinsic to the radial velocity method. High precision radial velocity (RV) measurements spanning the years 1980.8--2000.0 for the nearby (3.22 pc) star Epsilon Eri show convincing variations with a period of ~ 7 yrs. These data represent a combination of six independent data sets taken with four different telescopes. A least squares orbital solution using robust estimation yields orbital parameters of period, P = 6.9 yrs, velocity K-amplitude = 19 ms, eccentricity e = 0.6, projected companion mass M_B sin i = 0.83 M_Jupiter. An estimate of the inclination yields a perturbation semi-major axis, Alpha = 0arcs0022, easily within the reach of HST/FGS astrometry.

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Proposal Category: GO
Scientific Category: Hot Stars
ID: 9168
Title: The Distances to AM CVn stars
PI: Paul Groot
PI Institution: Harvard-Smithsonian Center for Astrophysics

We propose to determine the parallaxes and proper motions of the five brightest of the seven known AM CVn systems using the HST Fine Guidance Sensors. AM CVn systems are binaries where mass is transferred from a completely hydrogen-deficient, degenerate mass donor to a white dwarf primary through a helium accretion disk. A better understanding of these systems is crucial for a number of reasons:, o to study the late stages of binary evolution;, o to study the effect of chemical composition on the physics of accretion discs; , o to estimate their contribution to the Supernovae Ia rate and , o to estimate their contribution to the gravitational radiation background. All these studies rely critically on a determination of the

distances to the currently known systems. With brightnesses in the range 13<V<17 and estimated distances <400pc they are ideal targets for the HST-FGS.

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Proposal Category: SNAP
Scientific Category: Hot Stars
ID: 9169
Title: An Interferometric Harvest of Double Degenerates
PI: Edmund Nelan
PI Institution: Space Telescope Science Institute

The white dwarf (WD) mass and age distributions hold clues to the star formation history of our Galaxy and the age of the disk. To extract this information we need to carefully calibrate the WD mass-radius relation and the WD cooling curve. But to do so, we must directly determine the masses for a variety of WDs of different sub-types. The only direct method is through the orbital analysis of resolved WDs in non-interacting binary systems. Sadly, this has been done, with varying quality, for only 4 WDs (40 Eri B, Sirius B, Procyon B, and Stien 2051B), mainly because it is extremely difficult to resolve WDs in binary systems with periods less than ~50 years. We propose a high angular resolution Snapshot survey with FGS1r to observe cool WDs with the objective of discovering (resolving) double degenerate systems with modest separations and periods as short as 25 years, ideal binaries for follow up mass determinations. By carefully selecting our targets, about 10 such systems should be revealed. This will dramatically increase the number of WDs available for dynamical mass measurements (its 2 for 1

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Proposal Category: GO
Scientific Category: Hot Stars
ID: 9170
Title: The Post-CE Status of the Massive WD Binary LB11146
PI: Edmund Nelan
PI Institution: Space Telescope Science Institute

By analysis of its spectrum, LB11146 was discovered to be a binary system composed of magnetic/nonmagnetic white dwarfs each having a mass estimated to be ~0.9 M_dot, making it the only known double degenerate system with a combined mass exceeding the Chandrasekhar limit. HST/FOC imaging failed to resolve the system down to ~0.030". This places a 50 by less than ~1 A.U. and

suggests that they shared a common envelope (CE) one or more times in the past as their massive progenitors evolved through the asymtotic giant branch. However, null results from radial velocity observations constrain the orbit to be larger than 0.1 A.U., which suggests that if this is a post-CE system, the orbital shrinkage was not extreme. We propose to observe this object at high angular resolution with FGS1r. With an angular resolution of ~7 mas, FGS1r can measure or place tighter constraints (down to 0.3 A.U.) on the WD separation to unambiguously determine if this is a post-CE system. If the system is resolved, followup studies can determine dynamical masses. If the system is found to to be post-CE, it will offer a rare opportunity for observationally estimating the elusive CE efficiency parameter alpha_CE. This is of great interest for evaluating the prospects of merging post-CE massive WDs as the mechanism for SN Ia.

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Proposal Category: GO
Scientific Category: Cool Stars
ID: 9171
Title: High Speed Photometry of the Transiting Planet HD 209458b
PI: Alfred Schultz
PI Institution: Computer Sciences Corporation

HD 209458b is the only extrasolar giant planet (EGP) detected that has an orbit inclined enough toward the Sun for the transits to be detected. Differential photometry of HD 209458 with respect to comparison stars showed a transit depth of 1.5 a transit time of 3.2 hours. Transit ingress and egress are ~25 minutes in duration suggesting the planet transits along a short chord instead of the full stellar disk. We propose to observe the transit ingress (1-orbit) and egress (1-orbit) with a Fine Guidance Sensor (FGS) used as a high-speed photometer (40 Hz). An FGS can be used to obtain relative photometry with better than milli-mag accuracy and one-minute time resolution. FGS photometry of the ingress and egress will allow an independent determination of the planet radius and the inclination of the orbit. We also propose to observe the ingress and egress at least five times during Cycle 10 (10 orbits requested) to determine any variability of transit times that would indicate precession of the orbit caused by secondary bodies in the HD 209458 system. As a secondary goal, we will search for structure in the photometry that would indicate the presence of planetary satellites.

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Proposal Category: GO
Scientific Category: Quasar Absorption Lines and IGM
ID: 9172
Title: Molecular Hydrogen in the Damped LyAlpha Absorber of Q1331+170
PI: Jill Bechtold
PI Institution: Steward Observatory

We wish to search for the Lyman and Werner absorption lines of molecular hydrogen (rest LambdaLambda = 1104 to 911 Angstrom) associated with the well-studied damped LyAlpha and 21-cm absorber at z=1.776 in Q1331+170. The rare detection of C I absorption in this system make this a promising candidate for a search. After detecting H_2, we plan to measure the relative population in the individual rotation states. The J = 0, 1, 2, 3 states will yield the kinetic temperature of the gas, while the weak J = 4 and higher states will measure (or limit) the local UV radiation field and hydrogen density. The detection of C I^* has been used to measure the cosmic microwave background temperature at z=1.776, and test the validity of the Big Bang model. The observed population of the fine structure levels of C I can be explained entirely by the expected CMB radiation, with surprisingly strong limits on local sources of excitation. The H_2 spectrum will enable us to check this result, by allowing us to make an independent estimate of the rate of UV and collisional pumping of the C I^* levels.

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Proposal Category: GO
Scientific Category: Quasar Absorption Lines and IGM
ID: 9173
Title: The Pattern of Heavy Element Abundances in a Damped LyAlpha Galaxy
PI: Jill Bechtold
PI Institution: Steward Observatory

We propose to observe the quasar PKS 1127-143 (z=1.18) with the STIS E230M. We have detected X-ray absorption associated with an intervening 21-cm and damped LyAlpha$ absorber at z=0.312 in its spectrum with Chandra. The advantage of the X-ray measurement is that the derived metallicity is insensitive to ionization, inclusion of an atom in a molecule, or depletion onto grains. The X-ray absorption is mostly due to oxygen, and the abundance agrees with the

oxygen abundance of 16-40 lines in a galaxy at the redshift of the absorber. The STIS spectrum will allow us to measure Zn II, an undepleted iron peak element. Comparison of the oxygen group measured in the X-rays with the iron peak nuclei measured by STIS will reveal whether the absorber has a Pop II, halo-type abundance pattern or a Pop I, disk-like abundance pattern. We also request a deep WFPC image so that we can characterize the morphology of the absorbing galaxy.

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Proposal Category: GO
Scientific Category: Galaxies
ID: 9174
Title: Using Optically Faint Radio Sources to Pinpoint Dusty Proto-galaxies
PI: Scott Chapman
PI Institution: Carnegie Observatories

vspace-3mm Deep radio and submillimeter surveys show that at least one-half of the star-formation in the distant Universe remains hidden from optical surveys. We have recently isolated a number of high redshift, dusty starburst galaxies that remain invisible in ground based images to I_AB=25 and I_AB=28.5 in the Hubble Deep Field. These galaxies appear as faint radio sources with bright submillimeter counterparts (S_850>5 mJy), demonstrating they are very dusty systems. The luminosities of these galaxies (10^12-13 L(sun)) suggest they are in the process of converting the bulk of their gas mass into stars, and will likely evolve into present day massive ellipticals. We propose to obtain deep STIS imaging for 7 of our high redshift (1< z <3) optically `invisible' ultraluminous galaxies, chosen from amongst our submillimeter-detected sample to display some hint of optical flux in our present ground-based imagery (I~26, 2Sigma). The STIS images will thereby identify their dust obscured optical counterparts, and allow comparison of their optical and radio morphology in matching 0"pt 1 images. Do these distant ultraluminous galaxies resemble local analogs (e.g., Arp 220)? Are the optical counterparts to sub-mm/radio selected sources isolated collapsing spheroids or merger driven starbursts?

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Proposal Category: GO
Scientific Category: Cool Stars
ID: 9175

Title: The Best Brown Dwarf Yet?: FGS Astrometry of the Companion to the Hyades Eclipsing Binary V471 Tau
PI: Edward Guinan
PI Institution: Villanova University

The analysis of over 30 yr of 161 eclipse timings of the Hyades eclipsing binary V471 Tauri shows the presence of a low mass tertiary companion. A third body was found from periodic variations in the observed arrival times of the eclipses -- known as the ``light time'' effect. The light time effect occurs as the relative distance (and light travel time) changes as the eclipsing binary moves around the barycenter of the triple system. Our analysis yields an orbital period of P_3=27.4+/-0.2 yr, e_3=0.34+/-0.02, a semi-major axis of a_3=10.5+/-0.1 AU, and a tertiary mass M_3 in i_3 =0.036+/-0.001 M_dot. For orbital inclinations ga30^degrees the mass of the third body would be below the stable hydrogen burning limit of M~0.07 M_dot and thus would be a brown dwarf. We propose HST/FGS observations of V471 Tau over the next 3 years (2 HST orbits/year) to determine its astrometric orbit. These HST observations, when combined with Hipparcos astrometry and the light time orbit, will unambiguously yield the orbital inclination and the mass of the third body. The identification of a brown dwarf in V471 Tau will provide the first direct dynamical mass determination of a brown dwarf with a known age (tau (Hyades)=625 Myr), chemical composition, and distance. In a few years (near maximum elongation), it should be feasible to obtain IR images and spectra of this object that will provide crucial tests of brown dwarf models.

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Proposal Category: GO
Scientific Category: Cool Stars
ID: 9176
Title: LMC Eclipsing Binaries with Cepheid Components: The Key to the Extragalactic Distance Scale
PI: Edward Guinan
PI Institution: Villanova University

The distance to the LMC and the Cepheid P-L law form the backbone of the Cosmic Distance Scale and the determination of H_degrees. Unfortunately, in spite of concerted efforts of many investigators, the zero point of the Cepheid P-L law and the LMC distance remain controversial and uncertain to ~10-15 our ongoing program of using eclipsing binaries (EBs) as ``standard

candles'' (Guinan et al. 1998; Fitzpatrick et al. 2000) to include two recently discovered LMC eclipsing binaries (EBs) with Cepheid components. HST/STIS observations of these extraordinary systems hold the key to determining simultaneously the Cepheid P-L zero point and the LMC distance, and provide a direct test of the Baade-Wesselink parallax method. The proposed targets are a 17th mag LMC EB with P_ orb~800 d, which contains a classical Cepheid with P=2.03 d, and a 14.5 mag LMC EB with P_ orb=397.25 d with a 4.97 d Cepheid. HST/STIS low-dispersion spectroscopy will be used to determine T_ eff, Fe/H, and A_Lambda. HST/STIS medium-resolution 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 EBs offer the unprecedented opportunity to minimize the dependence of the Cosmic Distance Scale and H_degrees on zero point uncertainties.

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Proposal Category: GO
Scientific Category: Galaxies
ID: 9177
Title: Tidal Disruption of Stars by Massive Black Holes in Galaxy Nuclei: After the Flare
PI: Jules Halpern
PI Institution: Columbia University

A supermassive black hole will rip apart a star that strays within its tidal radius, causing an Eddington-limited UV/X-ray flare for several months as the orbiting debris accretes. While such events are predicted to occur at most once in 10^4 yr per galaxy, an experiment was performed in 1990-91 which sampled hundreds of thousands of galaxies in the ideal wavelength band, i.e., the ROSAT All-Sky Survey. Three galaxies had unusual X-ray flares, but no evidence for nuclear activity in ground-based spectra. To establish beyond a reasonable doubt that these were tidal disruption events, we propose to make a sensitive search for permanent Seyfert activity, the only possible alternative to the disruption hypothesis. Nuclear optical spectra obtained through a narrow slit will reject most of the starlight and place limits on AGN-like emission line activity below those of the weakest Seyferts. If necessary, we could return over the next decade to ensure that any weak emission lines are decaying. Establishing the UV/X-ray properties of genuine tidal disruption events is important for the next generation of sky surveys that will monitor

millions of galaxies. Growing evidence that supermassive black holes are ubiquitous in galaxy nuclei means that the frequency of tidal disruption as a function of galaxy mass and type could be determined. Masses of black holes could be studied by monitoring the outburst light curves and the spectra of the tidal debris.

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Proposal Category: GO
Scientific Category: ISM and Circumstellar Matter
ID: 9178
Title: NGC 2610: A Benchmark for Photoionization Physics
PI: J. Patrick Harrington
PI Institution: University of Maryland

While it is commonly thought that photoionized gases are well understood and that codes that model them have been tested exhaustively, this is not the case. Tests have been spotty and are undermined by the morphological complexity revealed by HST. It has proved difficult to model high-T, high-excitation objects. There is a fundamental need for clean observational tests of our photoionization codes. NGC 2610 is a high-excitation planetary nebula which, even at HST resolution, is smooth and symmetric. Due to its high ionization -- helium is He^++ throughout -- it has a meager optical spectrum. But its high electron temperature (18,000 K) results in very strong ultraviolet lines. It is the best object we know of to test the performance of photoionization codes without the complication of morphological substructures. With a radius of 18", STIS long-slit observations will provide excellent spatial resolution to test against models. We propose STIS observations with a wide slit to observe lines of H I, He II, C III, C IV, N IV, N V, O III, O IV, Ne III, Ne IV, and Ne V from 1240Angstrom to 6563Angstrom. He II Lambda1640/Lambda4686 will determine the (small) reddening accurately. These observations will provide a benchmark against which we can test our understanding of high T_e nebulae, which are ubiquitous in low abundance environments, but which have proved difficult to model.

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Proposal Category: GO
Scientific Category: Hot Stars
ID: 9179
Title: Calibrating convection efficiency with quasi-molecular features in magnetic white dwarfs

PI: Stefan Jordan
PI Institution: Universitaet Kiel

We have discovered quasi-molecular absorption features of Lyman Alpha (at ~ 1400 and 1600 Angstrom) in UV spectra of magnetic white dwarfs taken with IUE; hitherto such features have only been known in non-magnetic objects where they offered a very accurate determination of the atmospheric parameters. With high quality HST/STIS UV spectra of five white dwarfs we will for the first time be able to study the molecular potential of H_2 and H_2^+ under the influence of a magnetic field and to compare the results to theoretical calculations. Besides the relevance for atomic and molecular physics, the HST observations will be a tool to precisely determine effective temperatures and gravities (and thereby age and mass). Even more important is the possibility to test the efficiency of convection under the influence of a strong magnetic field and to find out how strongly the degree of ionization equilibrium is modified by the magnetic field. Convection is a completely free parameter in the computation of the model atmospheres and the analyses of all magnetic white dwarfs with effective temperatures between 10000 K and about 17000 K suffer from this uncertainty. Finally, one of our target stars is within an close binary (AM Her-type), and provides us with the possibility to test how the quasi-molecular features change due to the enrichment of the hydrogen atmosphere with heavy elements from the secondary star.

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Proposal Category: GO
Scientific Category: Galaxies
ID: 9180
Title: Gamma-ray burst progenitors: probing their environment
PI: S. R. Kulkarni
PI Institution: California Institute of Technology

Gamma-ray burst astronomy is a field maturing at a phenomenal rate. Only three years after the discovery of fading long-wavelength counterparts, we now have distance measurements for dozens of events, we have developed a detailed theoretical framework for understanding the X-ray -- radio afterglow lightcurves, and observational evidence now ties the progenitors of long GRBs (those studied to-date) to the collapse of massive stars. While progress has been rapid, three important new observational and theoretical discoveries, formulated over the last twelve months, allow us to address new and in many

cases more sophisticated questions than could have been posed a year ago. These developments: the discovery of X-ray lines in GRB 991216; the observation that N_H as deduced from X-ray afterglow are one to two orders of magnitude larger than the dust extinction inferred from optical afterglow; and the growing realization that the afterglow emission may exhibit features of dust echoes, appear to offer unexpected and new diagnostics that will directly inform us about the progenitor, the circum-progenitor material and the immediate interstellar environs. These motivate us to propose an aggressive program for cycle 10. As one of the most actively evolving areas in astronomy today, we anticipate the contributions of HST to be part of the foundations of this new and important field.

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Proposal Category: GO
Scientific Category: AGN/Quasars
ID: 9181
Title: Exploratory Observations of a New Bright Quasar
PI: Karen Leighly
PI Institution: The University of Oklahoma

The VLA FIRST radio survey recently discovered a new, extremely bright quasar that is the second brightest optical object in the sky at z > 0.1. Optically classified as a Narrow-line Seyfert 1 galaxy (NLS1), PHL 1811 is not typical of this class of objects because it is a very weak X-ray source. We propose short exploratory UV spectroscopic observations of this new bright quasar that will reveal its true nature and permit us to identify potential applications of future deeper observations. PHL 1811 may be the brightest luminous NLS1, in which case the study of the profiles and ratios of the emission lines will be valuable. Alternatively, PHL 1811 may be the brightest BALQSO, and the structure and composition of the BAL flow may be studied. PHL 1811 may be a useful probe for local LyAlpha absorption and follow-up high resolution spectroscopy will be indicated; furthermore, the proposed HST STIS observation will support the FUSE observation scheduled for this fall. We also request short Chandra observations to identify the origin of the faint X-ray emission.

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Proposal Category: GO
Scientific Category: Hot Stars
ID: 9182

Title: The Thermal Glow of Gamma Ray Pulsars
PI: Roger Romani
PI Institution: Stanford University

We propose time- and energy- resolved UV observations of two young Gamma-ray pulsars using the HST STIS/MAMA detectors. Our targets, the Vela and Geminga pulsars, are the brightest neutron stars spanning the critical 10^4-10^6y age range, where the thermal surface emission is detectable. The UV lightcurves we obtain will provide phase-resolved colors that will isolate this thermal emission and test the Equation of State and fundamental interactions of matter at supernuclear densities. In addition, combining the UV results with our IR/optical and X-ray data we will map spectral variations in the non-thermal pulsations and probe the acceleration physics of these GeV gamma-ray machines.

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Proposal Category: GO
Scientific Category: Cool Stars
ID: 9183
Title: Completing the Astrometric Orbit for a Pair of Pre-Main Sequence Low-Mass Stars
PI: David Soderblom
PI Institution: Space Telescope Science Institute

During the past two cycles we have pushed the limits of the FGSs to resolve a visual binary that is part of the closest system of pre-main sequence stars: HD 98800. The system is 50 pc away and this binary has a period just under a year, meaning the separation is about 20 milliarcsec. The two stars have similar brightnesses. The goal is to determine an astrometric orbit which, when combined with radial velocity observations, leads to the first dynamically-determined masses for low-mass pre-main sequence stars. We have succeeded in resolving the pair of stars with FGS1R, but not at all points in the orbit. Now that we have some FGS data in hand, we know the orbit well enough to fill in the missing pieces. With a full data set we can determine the stellar masses to within about 5. FGS1R can resolve the Ba-Bb pair and can determine the relative orbit and luminosities for the two components. In this program we propose to complete the orbit solution for the HD 98800 Ba-Bb pair by obtaining five visits near apastron.

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Proposal Category: GO

Scientific Category: Quasar Absorption Lines and IGM
ID: 9184
Title: A Survey for Missing Baryons in Highly Ionized Intergalactic Gas at Low Redshift
PI: Todd Tripp
PI Institution: Princeton University Observatory

Hydrodynamic cosmological simulations predict that at z ~ 0, 30-50 of the baryons are in shock-heated intergalactic gas at 10^5 - 10^7 K. Gas with T <=q 10^6 K may be detected via O VI absorption lines in the spectrum of a background QSO. With STIS, we have recently discovered a surprising number of low redshift O VI absorption line systems in the directions of two QSOs, and the remarkably high number per unit redshift suggests that these absorbers are indeed a major baryon reservoir. However, the sample is very small. To substantially improve the sample size, we propose to observe six additional low-z QSOs with the STIS FUV E140M echelle mode (7 km s^-1 resolution). Combined with archival data, this will increase the sample redshift path by a factor of ~7 compared to the published data. With the echelle data, we will (1) measure the number of O VI absorbers per unit redshift (dN/dz) and their minimum cosmological mass density with a limiting equivalent width of W_Lambda ~50 mAngstrom , (2) examine whether the O VI absorption arises in photoionized, collisionally ionized, or multiphase gas, and (3) study the dependence of the O VI system properties on environment. In addition to testing this prediction regarding the location of the missing baryons, the data will have applications to many other topics such as low-z LyAlpha absorbers and the physical properties and abundances of gas in the Milky Way halo.

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Proposal Category: GO
Scientific Category: Solar System
ID: 9185
Title: UV Spectroscopic Investigation of any Bright, Newly Discovered Comet
PI: Harold Weaver
PI Institution: The Johns Hopkins University

We propose a Target of Opportunity program to investigate any bright comet (mboxV<=sssim7) that is newly discovered during Cycle 10, including comets of

any dynamical class. Our main scientific objective is to obtain accurate abundance measurements for several key cometary species: CO from the CO 4PG bands,CO2 from the CO Cameron bands, two from the two B-X bands, two from CS emissions, and water from OH emissions. The UV Cameron band emission is currently the only way to probe CO2 in comets. The high sensitivity and long-slit capability of STIS will allow us to characterize the spatial distribution of the coma species, so that we can identify those derived from an extended source (e.g. CO), study the decay of short-lived molecules (e.g. two and two), compare the dust and gas spatial distributions, and investigate the importance of e-impact on CO for the excitation of the Cameron bands (the latter for any comet having mboxV<=sssim5). If an exceptionally bright (V<=sssim2) comet is discovered, we would then request Director's Discretionary time to measure the D/H ratio. This program is a continuation of our successful efforts in previous cycles to observe as many comets as possible with HST, so that we can eventually make abundance intercomparisons on a statistically meaningful sample. Our ambitious scientific objectives are only possible on bright comets, and given the paucity of data on several of the species listed above, these opportunities should not be missed.

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Proposal Category: GO
Scientific Category: Quasar Absorption Lines and IGM
ID: 9186
Title: D/H in Lyman Limit absorbers with simple velocity structure
PI: John Webb
PI Institution: University of New South Wales

The deuterium abundance in QSO absorbers provides a direct measurement of the baryonic density of the Universe. To resolve the conflict between D/H measurements at high and low redshifts it is imperative to secure a sample of 20--30 measurements. Here, we propose to use STIS to obtain new high resolution data of two carefully selected, intermediate redshift absorption systems. Existing high quality FOS data constrain the velocity structure of these systems to be simple and show that they have sufficiently high neutral hydrogen column densities to detect deuterium in the new higher resolution observations we propose here. These data will provide two new intermediate redshift D/H measurements and stringent constraints on the baryonic density

parameter for comparison with existing low and high redshift results.

Proposal Category: SNAP
Scientific Category: Quasar Absorption Lines and IGM
ID: 9187
Title: A Lyman Limit snapshot survey: the search for candidate D/H absorbers
PI: John Webb
PI Institution: University of New South Wales

Measuring D/H in gas clouds seen against background QSOs provides a unique and fundamental cosmological probe of the baryonic density parameter. To date, most of the QSO absorption line D/H constraints have been derived at high redshift (e.g. z_abs=3.57 towards Q1937-1009). In this proposal we wish to investigate a lower redshift range, because there are two potentially crucial advantages to be gained by carrying out D/H measurements at intermediate redshift. First, the background of HI forest lines is lower and contamination of the DI feature is significantly reduced. Second, a far larger sample of very bright QSOs exists. A large sample is important since a reliable determination of the primordial D/H requires a statistical approach. A 3-stage approach to target selection optimizes use of telescope time. In this proposal we would like to obtain low resolution spectroscopy of a sample of 30 bright (Mv < 16.5) QSOs (of which ~ 1/3 are new objects from the Hamburg bright QSO survey, Wisotzki et al 2000) in order to identify Lyman limit absorbers. The spectra we obtain will be carefully analyzed to select absorption systems with simple velocity structure, which are suitable for measuring D/H.

Proposal Category: GO
Scientific Category: AGN/Quasars
ID: 9188
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 2 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: AR
Scientific Category: AGN/Quasars
ID: 9189
Title: Probing the High Redshift Universe with Quasar Emission Lines
PI: Jack Baldwin
PI Institution: Michigan State University

A quasar's emission line spectrum appears to be the result of two, possibly correlated quantities - the continuum SED at ionizing energies and the gas metallicity (Korista et al. 1998). Both are important on their own - the continuum shape for the central object physics and effects on ionization of the IGM, and the metallicity for telling us about the early evolution of massive galaxies. This proposal builds on each by extending the observed line and continuum data base to well below LyAlpha, which will greatly improve our ability to measure the ionizing continuum shape and metallicity on an object-by-object basis. As an initial step, we wish to sort through the ~650 QSO spectra in the HST archives that cover the 600--1000Angstrom region, and see how good a sample can be assembled with a minimum of new HST observations. Direct observation shows that the observed continuum is not sufficient to power the clouds. We will use these new lines to develop the emission line indicators that will measure what continuum the clouds do see, and to critically test the reliabilty of our proposed metallicity indicators. This will result in major improvements of our understanding of the inner environment of a quasar by measuring both the continuum shape and metallicity, and is a necessary step to being able to use quasars as probes of the high

redshift universe.

Proposal Category: AR
Scientific Category: Cool Stars
ID: 9190
Title: Calibrating the Optical Field Angle Distortions of FGS1r
PI: G. Fritz Benedict
PI Institution: University of Texas at Austin

The analysis we propose will complete the commissioning of FGS1r as a sub-milliarcsecond astrometric science instrument for Cycle 10 and all future HST cycles, and permit the final reduction and analysis of ~100 orbits of FGS1r data acquired by a variety of GO programs during HST Cycles 8 and 9. As our team consists of members from the original astrometry Instrument Definition Team (STAT) and STScI's FGS Instrument Scientist, we have already performed this calibration for FGS3, and we are uniquely qualified to do so for FGS1r. Using data obtained from an approved FGS1r Cycle 8 Calibration program (Prop 8469), we will map the optical field angle distortions of FGS1r to facilitate the goal of millisecond of arc precision astrometry for FGS1r's Position Mode. Our results will populate the FGS1r calibration database and will be available to all FGS GOs through the use of STScI's calibration pipeline. A second result will be an improved M35 calibration field, one that takes into account proper motions in the catalog. This will allow for more accurate monitoring of the FGS1r plate scale and distortions during future HST cycles.

Proposal Category: AR
Scientific Category: Stellar Populations
ID: 9191
Title: Post-AGB Stars and the Population II Distance Ladder
PI: Howard E. Bond
PI Institution: Space Telescope Science Institute

The visually brightest members of Population II are post-AGB (PAGB) stars evolving through spectral types F and ANull. They are easily recognized through their huge Balmer jumps, if a filter at ~$3400 Angstrom is used, such as the F336W filter on WFPC2. PAGB stars are superb candidates for building a Population II distance scale because of their sharply peaked luminosity function, high luminosities, ease of detection, and relative freedom from

reddening, metallicity, and age issues. PAGB stars are 4 visual magnitudes brighter than RR Lyrae variables and 1.5 mag brighter than the red-giant tip. Unlike RR Lyrae stars (and Population I Cepheids), PAGB stars only require a single epoch of observation and are thus extremely efficient in terms of telescope usage. In this Archival program, we will use existing HST WFPC2 images to find PAGB A-F type stars in the Local Group dwarf ellipticals M32 and NGC 205, and in the more distant, massive elliptical Centaurus A (NGC 5128), all of which of course lack Cepheid variables. We expect to establish distances with <10 Moreover, we will demonstrate the feasibility of our technique with HST, laying the foundation to find PAGB stars in more distant ellipticals as far away as the Virgo Cluster.

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Proposal Category: AR
Scientific Category: Stellar Populations
ID: 9192
Title: Are Young Globular Clusters Forming in Quiescent Spiral Galaxies?
PI: Rupali Chandar
PI Institution: The Johns Hopkins University

Systems of globular clusters (GC) in nearby ellipticals and spirals, and systems of young GCs in starburst and merging galaxies have been the subject of intensive study in recent years, because they provide important clues to galaxy formation and evolution. However, because young massive clusters (YMC) are rare in the Milky Way, these have not been studied in quiescent spirals until very recently. The ground based work of Larsen & Richtler (1999) suggests that we need to revise our understanding of the conditions necessary for the formation of massive, compact young clusters. We propose to use archival HST WFPC2 observations of 11 nearby, non-interacting late type galaxies, covering a range of Hubble types to: (i.) determine whether YMC have physical and structural properties similar to ancient globulars; (ii.) differentiate between cluster systems which formed in a burst, and those which formed continuously, (iii.) determine whether YMC systems are preferentially formed in later-type spirals; (iv.) look for differences in structural parameters of clusters in rich vs. poor systems, which constrain cluster formation mechanisms. Further, these data will allow us to find more intermediate mass (so-called ``populous'') clusters, which have not been studied in galaxies beyond the Local Group. If these are found in large

numbers, this may represent a relatively common (albeit quiescent) mode of cluster formation.

Proposal Category: AR
Scientific Category: ISM and Circumstellar Matter
ID: 9193
Title: Looking Out From the Galaxy
PI: Jane Charlton
PI Institution: The Pennsylvania State University

We aim to study the distribution many ionization stages of gas by looking out from the Milky Way galaxy along 33 lines of sight toward various AGNs and QSOs. The HST archive is rapidly accumulating high resolution UV spectra of these objects with STIS/E140M and E230M. The majority have been observed to study absorption by intervening galaxies by the AGN/QSO itself. However, the kinematically complex, redshift zero absorption features in these spectra can be used to survey the gas in the disk, halo, and extended group environment of the Milky Way. With the archival spectra we will conduct a survey for high velocity clouds in the vicinity of the Milky Way and Local Group, much more sensitive than traditional 21-cm probes. We will also consider the physical conditions of gas related to the extended corona surrounding the Milky Way disk, focusing on the kinematic distributions of high ionization transitions. The local environment, where we can study directly the structures, star formation rate, and distribution of HI, is a calibrator for studies of complex metal--line absorption systems at higher redshifts. Of particular interest is the evolution of galaxy coronae and the origin of ``satellite'' high velocity absorption features seen in many strong Mg II absorption line systems, i.e. their relationship to Galactic high velocity clouds.

Proposal Category: AR
Scientific Category: Galaxies
ID: 9194
Title: Galaxy Spectral Energy Distributions at High Redshift
PI: Andrew Connolly
PI Institution: University of Pittsburgh

The modeling of galaxy evolution (e.g. colors and spectral types) relies on a detailed understanding of the underlying galaxy spectral energy distributions

(SEDs). Comparison between the colors of galaxies and model SEDs work well for long lived stellar populations (i.e. restframe optical) but break down in the ultraviolet and near-infrared. This significantly limits our understanding of the evolution of high redshift galaxies (where the optical passbands sample the restframe ultraviolet). To alleviate these problems we require a set of SEDs that can reproduce the observed UV colors of intermediate and redshift galaxies. Undertaking such a task through spectrophotometric observations would be prohibitive in terms of telescope time. We have, therefore, developed a technique for extracting the SEDs of galaxies directly from multicolor photometry. From a pilot study, using 127 HDF galaxies, we have shown we can derive SEDs that better match the colors of high redshift galaxies than existing SED models. The resolution and accuracy of our reconstructed SEDs are currently limited by the number of galaxies in the HDF. We propose here to extend our analysis to >2000 galaxies in the HST archive with multicolor photometry and published redshifts. We will derive a high resolution set of SEDs of galaxies at z>0.3 (the high redshift equivalent of the Kennicutt SED sample) and use these data to quantify the spectral evolution of galaxies.

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Proposal Category: AR
Scientific Category: Quasar Absorption Lines and IGM
ID: 9195
Title: Transverse Structure in the Lyman Alpha Forest and a Program to Measure the Cosmological Constant
PI: Arlin Crotts
PI Institution: Columbia University

We propose to combine archival UV HST spectra of close QSO pairs with a large sample of similar optical spectra in order to determine the clustering strength of intergalactic H I absorption (the Lyman Alpha forest) with the intent of constraining hydrodynamic/gravitational models of structure formation in the early Universe. Furthermore, this dataset will allow a comparison of radial versus transverse clustering for weak overdensities in the Universe. Since radial versus transverse size for objects co-expanding with the Hubble flow is an excellent measure of the cosmological constant Lambda, and since the Lyman Alpha forest is relatively weakly clustered, the shape of its clustering function in radial versus transverse dimensions is an excellent prospect for uncovering the value of Lambda. We would like to fully analyze the close QSO pairs in the archive, including several that remain

unpublished after many years, and combine these with high quality optical spectra extending blueward to atmospheric cutoff in order to provide study of Lyman Alpha forest structure that is as free as possible of systematic errors due to interloping metal lines. Such a study might not only determine Lambda, but lead to an independent, new measure of the density of normal matter Omega_baryon, the strength of ionizing radiation flux in the early Universe, and better constraints on other cosmological parameters open to study after testing numerical models of the Lyman Alpha forest can be trusted.

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Proposal Category: AR
Scientific Category: Galaxies
ID: 9196
Title: Properties of Young Clusters in Spiral Galaxies
PI: Andrew Dolphin
PI Institution: National Optical Astronomy Observatories

Young star clusters provide a unique indicator as to the past star formation of a galaxy. In addition to providing a fossil record of past star formation activity (similarly to the stellar content), it appears that the amount and nature of cluster formation depends strongly on the environmental conditions. The nature of these objects (indistinguishable from bright or foreground stars from the ground) has made a detailed study difficult in the past; the advent of textitHST and its superior resolution circumvents this problem. Previous textitHST studies have focused on interacting systems and merger remnants (where young clusters are expected to be abundant), leaving a number of questions unanswered, such as: (1) Is the ratio of massive cluster formation to total star formation constant? (2) Are trends (if any) along the Hubble sequence analogous to those seen in larger OB associations and HII regions? We propose to address these and other questions through a survey of t

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Proposal Category: AR
Scientific Category: Galaxies
ID: 9197
Title: Archival Study of Acoustic Nuclear Spirals in Galaxies
PI: Debra Elmegreen
PI Institution: Vassar College

We plan to examine the dust morphology and model the opacity in the central

disk regions of 100 normal and active galaxies in order to study pressure-driven waves that are predicted to dominate over density waves in certain cases. Such acoustic waves may provide a mechanism for the transport of material into active centers of nonbarred galaxies. Our sample will include Seyfert and normal nonbarred and barred galaxies so that the results for nonbarred Seyferts can be compared with others of the same Hubble type. We will measure the dust-interdust contrast and do radiative transfer models to estimate the dust densities, and we will compare the dust spiral pitch angles and number of arms versus radius to compare with model predictions.

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Proposal Category: AR
Scientific Category: Solar System
ID: 9198
Title: Asteroid Trails in the HST Archive II
PI: Robin Evans
PI Institution: Gibbel Corporation

New images including the trails of small, main-belt asteroids are continuously being added to the HST Archive. The telescope's small field of view and lack of availability for follow-up observations are more than offset by a unique and remarkable advantage: HST asteroid trails are curved due to the parallax induced by the spacecraft's orbital motion. Using HST ephemerides to fit a trail's shape, an asteroid's geocentric distance can be derived from as little as 10 minutes of imaging data. The availability of accurate distances allows an absolute magnitude (size) distribution histogram to be constructed down to a limiting magnitude of V= 24 (H= 20; diameter ~ 0.3 km) without need of full orbit determinations. Over the past four years, we have surveyed 87,000 WFPC2 images and 7,000 STIS images for asteroid trails and uncovered 491 images with trails from 206 distinct objects. We propose to continue building the HST asteroid database in Cycle 10 by searching 110,000 new images and combining the results with our previous work. The results will provide fundamental constraints on models for collisional evolution of the main belt and a census of a major source region of Earth-crossing objects.

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Proposal Category: AR
Scientific Category: Stellar Populations
ID: 9199
Title: A Complete Study of Binaries and X-ray Sources in the

Globular Cluster 47 Tucanae
PI: Jonathan Grindlay
PI Institution: Harvard-Center for Astrophysics

As one of the closest and most massive Galactic globular clusters, and with a concentrated core, 47 Tuc has a diverse array of binary species including 20 millisecond pulsars, 9 X-ray sources, dozens of blue stragglers and 9 eclipsing binaries. Our already obtained data includes sensitive V/I time series and easily the deepest X-ray (Chandra) data ever obtained for 47 Tuc, but precise absolute photometry from HST is desired to extend and complete our binary studies. By analyzing two WFPC2 observations in the HST archive we plan to: (1) make the first photometric determination of the main sequence binary population in this cluster (this is a fundamental quantity, since MS binaries are the basic fuel for all of the accreting and compact binaries listed above), (2) confirm and extend our recent discovery of a new form of binary in this cluster, main sequence/giant star binaries, and (3) complement our Chandra and HST time series observations of this superb GC by identifying counterparts to X-ray sources (on the basis of color and variability), and searching for and studying He WDs and MSP counterparts in this cluster. Here, we have already made startling progress with the recent exciting discovery of a counterpart for the second brightest X-ray source in 47 Tuc, X5, a possible qLMXB, and the possible detection of He WDs. The results of these studies should have powerful ramifications for the evolution and dynamics of GCs.

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Proposal Category: AR
Scientific Category: ISM and Circumstellar Matter
ID: 9200
Title: Characterizing the CCD Spectroscopic Point Spread Function in STIS
PI: Theodore Gull
PI Institution: Goddard Space Flight Center

High spatial resolution spectral imaging, as done by HST/STIS, has come of age in the last few years with observations of stellar winds and outflows, extragalactic and galactic jets, and rotation curves of galaxies. The potential of this technique is only now becoming realized, since some of the most exciting applications, such as imaging of outflows on sub-arcsecond scales, and studies of the composition of circumstellar disks, require a

detailed understanding of the spatial component of the PSF in STIS's spectral imaging modes. Progress has been made toward this goal with observations (calibration proposal 8844) to characterize the wavelength-dependent PSF for 4 stars: BD+75D325, a white dwarf; HD141653, an A0V star; HD115617, a G0V star; and HD181204, an M III-I star. We request funding to complete a study of the wavelength-dependent STIS CCD PSF. This information is essential to fully characterize the instrumental scattered light that adds to the scattered light from the HST primary and secondary mirror. We plan to provide example spectral data as reference for users who intend to measure properties of faint objects in the vicinity of bright stars. Models of the scatter effects will be built to provide better understanding on what can be accomplished with STIS. Also, the data will feed into models for imaging faint sources in the close vicinity of bright point sources.

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Proposal Category: AR
Scientific Category: Cosmology
ID: 9201
Title: Demography of High Redshift Type Ia Supernovae and Their Progenitor Populations
PI: Craig Hogan
PI Institution: University of Washington

The Hubble diagram of Type Ia supernovae appears to show a significant acceleration of the cosmic expansion, interpreted as evidence for a new form of dark energy such as a cosmological constant. However, in order to establish this result securely we need to show that distance estimates are insensitive to evolving properties of the progenitor population such as age and metallicity. The best way to test these possibilities is by demographic studies of supernovae and their progenitor populations. We propose to study the environments of more than 26 high-redshift supernovae for which extensive HST WFPC2 data were taken to assemble the Hubble diagram. We will create deep multicolor images and catalog the properties of the host, companion and foreground galaxies. We will correlate supernova properties, such as peak brightness and distance residual, with other quantities known to correlate with progenitor population age and metallicity, such as the color of the host galaxy and the distance between the host centroid and the supernova. The results will either reveal or significantly constrain noncosmological systematics attached to the use of supernovae as distance indicators at

redshifts between 0.3 and 1.

Proposal Category: AR
Scientific Category: Hot Stars
ID: 9202
Title: An Archive Analysis of a Decade of HST White Dwarf Spectra
PI: Jay Holberg
PI Institution: University of Arizona

We propose to conduct a comprehensive analysis of the existing body of HRS and STIS spectra of the white dwarf stars. The primary objective of this investigation is to utilize the high spectral resolution and relatively high S/N of these spectra to perform detailed analyses of the line shapes of photospheric absorption lines in the spectra of hot DA white dwarfs. In particular, we are interested in clear evidence of chemical stratification in the photospheres of these stars, since it now appears that stratification can explain the occurrence of super-abundances observed in a number of stars and we now possess the theoretical models to address this phenomenon. In addition, we will obtain new statistically-based abundance analyses of a number of hot DO stars using a number of improved models and analysis techniques.

Proposal Category: AR
Scientific Category: Stellar Populations
ID: 9203
Title: Comparisons of Local Group Stellar Populations: Construction of a Public Database
PI: Jon Holtzman
PI Institution: New Mexico State University

We propose a continuation of a Cycle 9 archival proposal 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: 1) What are the relative ages of the oldest populations in Milky Way neighbors? 2) To what degree is star formation is ``bursty'' in

different Local Group galaxies? 3) Is there direct evidence for variations in the IMF in nearby galaxies? 4) What is the ``average cosmic star formation history" for dwarf galaxies in the Local Group? 5)What is the amount of mechanical and radiative energy input into the ISMs of different galaxies by massive stars? This proposal is a continuation of a successful archival proposal from last year (Cycle 9), the need for which was anticipated in last year's proposal. The current proposal shows results from initial work on the stellar populations of a subset of Local Group dwarfs that demonstrate that we can generate quality photometry and clearly suggest interesting returns.

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Proposal Category: AR
Scientific Category: Cosmology
ID: 9204
Title: The Ages of Very Red Spheroids and Bulges and Associated Disks at Redshifts z ~ 0.8
PI: David Koo
PI Institution: UCO/Lick Observatory, University of California, Santa Cruz

The ages of spheroids remain an important mystery amenable to direct attack with HST color images. Hierarchical galaxy formation models predict that bulges are redder than associated disks and that field spheroids should be younger (bluer) and have larger age scatter than their older, more coeval, cluster cousins. Using Keck and HST data, van Dokkum et al. have measured the galaxy half-light colors for 30 cluster E/S0's at z ~ 0.8 and find very red colors with small scatter. For 26 field galaxies at z ~ 0.7 - 1, we have measured separate colors for bulges and disks and find that the disks are indeed all bluer than the bulges. To our surprise, the field bulges are as red or redder than the cluster galaxies. These results are major steps forward, but unfortunately, the high-redshift field bulges are so red that the exposures were too shallow in the bluer band (2800s in V) to yield positive measures of color scatter for direct comparison to cluster results. Moreover, our surprise may be explained if the color of cluster bulges are redder than their galaxy's half-light color (which may be contaminated by bluer disks). We aim to remedy both problems with this archive proposal and thereby answer the cosmologically important question: What are the relative color (age) distributions of spheroids, bulges, and disks among high redshift z ~ 0.8 galaxies in both field and cluster environments?

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Proposal Category: AR
Scientific Category: Cosmology
ID: 9206
Title: HST + Keck Study of Disk Systems in Galaxy Cluster Cl0024+16 at Redshift z = 0.39
PI: David Koo
PI Institution: University of California Observatories/Lick Observatory

For over twenty years, distant galaxy clusters have been a key arena for galaxy evolution studies. Despite enormous strides, our understanding of the physical mechanisms that drive distant cluster evolution remain largely theoretical and untested. Infall of groups, merging, ``harassment'', quenching of star formation, starbursts, and ram-pressure stripping all remain viable ideas. Virtually all of these mechanisms involve disks and gas. Therefore, in contrast to recent studies that focus on spheroids, we believe a more promising approach to track these physical processes would be detailed studies of cluster disk systems. This archive proposal asks support to launch a two-pronged attack to analyze an ideal, rich data set --- and one that is already in hand. One prong exploits deep B and I HST imaging of Cl 0024+1654 at z ~ 0.39. The other prong complements the HST data with very high quality Keck spectra of over 80 sources within the HST WFPC2 field. With both data sets, we will answer two questions that highlight the physical processes which affect cluster disk evolution: (1) How do the structures, ages, and age distribution of S0 disks compare to S0 bulges at z ~ 0.4? (2) How does the Tully-Fisher relation and M/L of cluster disk systems differ from those in the field, and what properties of the cluster galaxies correlate with these deviations?

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Proposal Category: AR
Scientific Category: Solar System
ID: 9207
Title: Middle Ultaviolet Spectroscopy of Pluto and Charon
PI: Vladimir Krasnopolsky
PI Institution: The Catholic University of America

I propose to study the spectra of Pluto in the range of 2000-2500 Angstrom that were successfully observed with HST/FOS during 34 ksec (24 orbits) total and have not been analyzed. My preliminary work with those data resulted in a

mean spectrum with resolution of 10 Angstrom and S/N = 15-20 down to 2100 Angstrom. Our photochemical model for Pluto predicts the abundances of diacetylene C_4H_2 and cyanoacetylene HC_3N that may be detectable in the observed spectra. Detection of any new species on Pluto would be a breakthrough in our knowledge of that planet. The observed spectra show variations that significantly exceed the experimental uncertainties, are prominent below 2500 Angstrom, and indicate the presence of fine haze and/or rime and their variations. I will also study the spectra of Charon at 2200-3300 Angstrom that were also successfully observed with HST/FOS during 21 ksec (16 orbits) total and have not been analyzed. Averaging of these spectra results in a spectrum with resolution of 10 Angstrom and S/N >=20 above 2650 Angstrom and decreasing to ~ 7 at 2200-2500 Angstrom. These spectra are the only data on Charon in the middle ultraviolet and may add to our knowledge of its ices and rocks. The proposal covers the successful HST observations for 55 ksec (40 orbits) that otherwise will be lost.

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Proposal Category: AR
Scientific Category: Galaxies
ID: 9208
Title: The Dynamical Evolution of the Globular Cluster System of M87
PI: Arunav Kundu
PI Institution: Yale University

We propose to undertake a comprehensive, global analysis of the globular cluster luminosity function (GCLF) of the M87 system using the large amounts of high quality, archival WFPC2 data available in the V (F555W, F606W) and I-bands (F814W). The data set includes both primary WFPC2 programs with a broad range of science goals, and a large component of deep, parallel data. We propose to accurately determine the parameters of the GCLF, continuously from the core of the galaxy out to a galactocentric radius of 75 Kpc. This will allow us to sensitively test for the radial variation in GCLF properties predicted by various destruction mechanisms. By virtue of the very large database of observations and the richness of the M87 globular cluster system (GCS), our analysis will provide an observational sample that it at least an order of magnitude more sensitive to radial changes in the GCLF than existing data sets. It will almost certainly become the de facto standard against which current and future evolutionary models of cluster systems are tested. Our

proposed study will also allow us to quantify the usefulness of the GCLF as a distance indicator. The accurate determination of the radial profile of the cluster system density function will significantly improve the estimate of the total cluster population, and hence the theoretically important cluster formation efficiency in M87.

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Proposal Category: AR
Scientific Category: ISM and Circumstellar Matter
ID: 9209
Title: HST Archival Imaging of the Light Echo of SN 1987A
PI: Stephen Lawrence
PI Institution: Hofstra University

We propose to analyze archival HST imaging and spectral observations taken in the vicinity of SN 1987A in order to collect high spatial resolution data on the light echo. As of June 2000, there were over 600 potentiallly useful optical images taken within 8' of SN 1987A with the WFPC2, STIS, and WF/PC cameras. We will identify all sky areas within this region which have been imaged at multiple epochs through the same or similar filters. We will then apply the PSF-matched difference imaging technique developed by our group to study the three-dimensional spatial structure and physical properties of dust complexes in this region of the Large Magellanic Cloud. This technique has already proven very successful in detecting and monitoring faint new hot spots formed by the collision of the supernova ejecta with the inner circumstellar ring and also in discovering a previously unknown light echo structure located behind the supernova. We will also use the high-spatial resolution of single HST images to supplement our continuous ground-based monitoring of echo light curves in order to constrain the spatial sub-structure of the dust complexes.

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Proposal Category: AR
Scientific Category: Galaxies
ID: 9210
Title: Using the HST Archive to Study the Optical Counterparts of Chandra X-ray Point Sources
PI: Eliot Malumuth
PI Institution: Raytheon ITSS/Goddard Space Flight Center

Since it's deployment, the Chandra X-ray Observatory has been returning X-ray

images of unparalleled resolution. Chandra observations of nearby galaxies show large numbers of point-like X-ray sources. Most likely, these are X-ray binary stars. However, the true nature of these objects is unknown because there are no optical identifications. We will use the HST archive to retrieve, process and analyze all images in the fields of several Chandra X-ray images of nearby galaxies. There are over 300 images which may be of use. We have retrieved the data from one position in NGC 1399 to use as a test case. These data show that we will be able to find and study the optical counterparts of many of the hundreds of X-ray point sources in our images. We are also submitting companion snapshot proposals to cover X-ray objects not included in the archival data.

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Proposal Category: AR
Scientific Category: Solar System
ID: 9211
Title: Io's UV Emissions, 1994-1996
PI: Melissa McGrath
PI Institution: Space Telescope Science Institute

We request archival funding to analyse and publish three years of GHRS observations of Io's far-ultraviolet emissions acquired on 8 dates in 1994--1996. At present none of these data have been quantitatively analysed and published. Determination of the brightness and variability of the 10 sulfur and oxygen emission multiplets produced in the strong electrodynamic interaction of Jovian magnetospheric plasma with Io's upper atmosphere will allow us to determine the density of sulfur and oxygen in the atmosphere, and the ratio of sulfur to oxygen, which will provide a unique constraint for both the Io atmospheric models and the 3-d MHD models of the plasma interaction with the satellite. Io's electron-impact excited emissions provide the only direct, remotely observable tracer of this interaction. The ratio of sulfur to oxygen is also a critical input parameter to models of the Io plasma torus that at present has no observed constraint. Analysis of the emission spectra also allows determination of basic plasma diagnostic parameters such as electron density and temperature. The brightness of Io's emissions will also be correlated with the brightness of the auroral spot at the foot of the magnetic field lines connecting Io to the Jupiter atmosphere as measured from HST UV images.

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Proposal Category: AR
Scientific Category: Cosmology
ID: 9212
Title: Cosmic Shear at Cosmological Distances
PI: Kavan Ratnatunga
PI Institution: Carnegie Mellon University

Weak gravitational lensing has become an important probe of the geometry and large-scale structure of the universe. Galaxy-galaxy lensing is a well established result, and the focus has now shifted to the measurement of `cosmic shear', i.e. the weak gravitational lensing of galaxy images caused by the large scale distribution of dark matter. A number of ground based programs have announced the presence of this shear and using the HST Medium Deep Survey database we have tentatively detected such a shear at smaller angular scales, corresponding to larger cosmological distances. Confirmation and reduction of errors in the detection of this elusive effect has however, been complicated by various systematics in the observational data which can masquerade the true signal. The MDS database was optimized for galaxy morphology ignoring several second order effects which could not be addressed a few years ago. Recent reconstruction by ST-ECF of the jitter files for all HST WFPC2 observations, and the detailed models for the HST focus position has set the stage for a more rigorous reanalysis as required for a more confident measurement of cosmic shear. Well characterized WFPC2 observations from the rigorously monitored HST provide the best hope for the robust measurement of cosmic shear in the near future and will set the stage for more precise measurements with the Advanced Camera.

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Proposal Category: AR
Scientific Category: Quasar Absorption Lines and IGM
ID: 9213
Title: Constraints on the Metal Enrichment History from Observations of Highly Ionized Gas
PI: Michael Rauch
PI Institution: Carnegie Observatories

Galaxies up to very high redshifts appear to be embedded in a highly ionized, metal enriched gas of unknown origin. Based on the presence of OVI absorption in QSO spectra this gas has sometimes been speculatively associated with a

hot collisionally ionized phase, possibly ejected by winds or stripped from galaxies moving through an ambient medium. Recent hydrodynamical simulations of galaxy formation suggest an alternative explanation in that OVI may also trace diffuse photoionized gas ejected at high redshift during a `Population III' phase of star formation. In the latter case the gas would now be at a relatively low temperature, surrounding galaxies out to large distances, and falling into them at the epoch of observation. Both scenarios, current ejection of hot collisionally ionized gas (``galactic origin'') or infall of pre-enriched gas onto forming galaxies (``pre-galactic origin'') have observational consequences pertaining to the measurable absorption line width, column density, and cross-section. Studying absorption by the OVI gas in several ionic transitions in the high quality STIS spectra of QSOs already in the HST archive should be able to tell us which ionization process is responsible for the presence of OVI, and how widely intergalactic metal enrichment has spread, as a function of time.

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Proposal Category: AR
Scientific Category: AGN/Quasars
ID: 9214
Title: Radio-Quiet Quasar Hosts from z = 0.3 to z = 3
PI: Susan Ridgway
PI Institution: The Johns Hopkins University

Study of the host galaxies and environments of high redshift AGN is proving a valuable, complementary probe of current theories of how galaxies form and evolve. Results from our recent NICMOS imaging program have indicated that the hosts of z ~ 2 -- 3 faint radio-quiet quasars have luminosities only around local L_*, making them similar to Lyman-break field galaxies at the same redshifts, and similar to the hosts of low-z radio-quiet quasars with the same nuclear luminosities. These results are consistent with the theoretical predictions of Kauffmann & Haehnelt (2000) for the hierarchical buildup of galaxy hosts and their relation to their resident supermassive black holes. The luminosity of the AGN in these RQQ is key to understanding this relationship, however, and we have so far made only limited studies of the very lowest luminosity objects. In this proposal, we will outline plans for a comprehensive space-based imaging study of the hosts of radio-quiet quasars from low to high z at a range of nuclear luminosities. We will apply a consistent methodology to analyze much of the extensive HST archival imaging

data now available. This will allow us to characterize the relationship between nuclear luminosity and host properties, and assess the relationship between nuclear black hole mass and formation epoch.

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Proposal Category: AR
Scientific Category: Hot Stars
ID: 9215
Title: Diagnosing the UV Pulse of the Crab: HST Spectropolarimetry in Context
PI: Roger Romani
PI Institution: Stanford University

We propose a re-analysis of HST archival STIS-MAMA and HSP UV observations of the Crab pulsar. By correlating these results with our new ground and space-based Crab data, we can resolve for the first time the important spectral variations through the pulse from the IR through the X-ray. The UV HST spectroscopy and polarimetry play a central role in this analysis, since the synchrotron spectrum breaks through this energy range, providing unique diagnostics of the pulsar machine.

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Proposal Category: AR
Scientific Category: Stellar Populations
ID: 9216
Title: Faint Photometric Standard Fields for HST
PI: Abhijit Saha
PI Institution: NOAO

Some of the most important projects with the most expensive telescope ever built --- HST --- are hostage to the uncertainty in the absolute calibration of its photometric system. The standard practice in the past has been to calibrate faint objects (e.g. V=26) observed with long exposures using bright stars (e.g. V=13) observed with very short exposures. There is now good evidence that this is the main cause of uncertainty in the absolute photometric accuracy of WFPC2 on HST. We propose to use the Mini-Mosaic Imager on the WIYN telescope to establish faint star photomteric sequences to V=22 in carefully chosen fields that have already been repeatedly observed with WFPC2. This will allow us to retroactively recover the history of the absolute calibration of WFPC2 throughout its mission, and hence improve the

available photometric accuracy for all WFPC2 observations. Future HST observations of these fields will allow us to follow WFPC2's absolute calibration to the end of its mission, and may later serve as the basis for calibrating ACS and WFC3. This will greatly reduce the error budgets for a wide variety of fundamental projects (e.g., extragalactic Cepheids and RR Lyrae stars; supernovae; globular-cluster ages; distance and metallicity estimates from colors and magnitudes of red giant branch tips).

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Proposal Category: AR
Scientific Category: ISM and Circumstellar Matter
ID: 9217
Title: Determining D/H Ratios and Physical Conditions in Local Interstellar Gas Using White Dwarf Probes
PI: Meena Sahu
PI Institution: Goddard Space Flight Center

Using archival GHRS and STIS spectra toward 21 white dwarfs (WDs) located within 200 pc, we propose to determine the D/H abundance ratios and physical conditions in the intervening diffuse Local Interstellar Medium (LISM) clouds. Our study will result in emph7 new D/H ratio measurements (toward GD659, REJ0503-289, EUVEJ1126+18.6, V471 Tau, Feige 24, 2REJ1032+532 and 2REJ2156-543), which represents a 41 in the number of known D/H measurements in the LISM. Our results will be used to extend the 3D model of local clouds constructed by Linsky & collaborators. N/H measurements in the LISM are possible only by using WD spectra (as opposed to late-type star spectra). We will derive N/H ratios for these WD sightlines and compare them with the diffuse ISM value. We will test a recently reported claim on the anticorrelation of the D/H and N/H ratios in more distant diffuse ISM clouds and explore its possible causes and its implications for the LISM. We will obtain emph2 new electron density measurements in the LISM and combine them with published measurements to test predictions of the models constructed by Bruhweiler & collaborators which suggest that the electron density should vary in the Local Interstellar Cloud (LIC) and that it should increase near its interface with the surrounding 10^6 gas.

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Proposal Category: AR
Scientific Category: AGN/Quasars
ID: 9218

Title: AGN in the Groth Survey Strip: A Variability Study
PI: Vicki Sarajedini
PI Institution: Wesleyan University

We request funding to study two epochs of 20 WFPC2 images of the Groth Survey Strip (GSS). Our primary scientific goal is to detect variable low-luminosity AGN which often reside in much brighter host galaxies. The high resolution capabilities of HST are critical to isolate and measure variability of nuclei too faint to be detected from the ground. Using 3-pixel aperture photometry, we expect to detect variability for nuclei comprising as little as 5 V_606=22.5 and 15 This technique has already proven successful on HDF-N images separated by 2 years. Our proposal is being submitted in conjunction with a GO proposal to reobserve all 28 fields of the GSS resulting in complete 2 epoch coverage for the entire survey region and 3 epochs of data for 20 of these fields. We expect to find between 30 to 85 Seyfert-like AGN in this region of the GSS as well as ~7 regular QSOs. This sample of intrinisically faint AGN will, for the first time, yield the faint end of the AGN luminosity function at moderate redshifts. Of equal importance is the study of the morphology, nature, and evolution of AGN host galaxies. We already have ~600 GSS galaxy spectra from the Keck telescope and plan to use future observing time to specifically target the variable objects selected in this study to obtain redshifts and spectroscopic confirmations for the brighter AGNs.

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Proposal Category: AR
Scientific Category: Cosmology
ID: 9219
Title: Pushing the limits of variable stars detection with HST
PI: Dimitar Sasselov
PI Institution: Harvard-Center for Astrophysics

We propose to use the novel method of image subtraction designed to find variable stars, and apply it to HST/WFPC2 data of the galaxy NGC 4603. This galaxy has been observed to discover Cepheids and obtain a distance. It is the most distant galaxy in which Cepheids have been found and the resulting distance may be affected by systematic errors, most notably the fact that non-variable stars contaminate the sample of Cepheids. The image subtraction technique offers a better way to find variable stars in very crowded environments. We will use this technique to find Cepheids in NGC4603 and

obtain light curves. We will assess the reality of the variables found previously and it is likely that we will find more Cepheids. Combined with standard PSF photometry, we will be able to obtain a more accurate and more reliable distance to this galaxy.

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Proposal Category: AR
Scientific Category: Solar System
ID: 9220
Title: The structure of Neptune's zonal bands
PI: Lawrence Sromovsky
PI Institution: University of Wisconsin-Madison

Neptune has zonal cloud bands with latitude boundaries and relative intensities that vary substantially with wavelength and have evolved significantly between 1989 Voyager observations and the 1994-1998 period of HST observations. We propose to investigate the nature of these cloud bands using 1996 archived WPFC2 and IRTF NSFCAM observations, and 1998 WFPC2 and NICMOS archived observations. Latitude dependent cloud particle composition and scattering properties will be constrained by analysis of spectral variations and limb darkening characteristics. Zonal averaging will permit high signal-to-noise ratios that are needed to characterize relatively subtle features. We will explore effects of variations in cloud optical depth, single-scattering albedo, cloud scale height, and possible variations in methane mixing ratios, to evaluate possible causes for the banded appearance. This effort will extend beyond previous Neptune-directed analyses of these data sets, which focussed mainly on dynamics and the structure of discrete cloud features.

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Proposal Category: AR
Scientific Category: Quasar Absorption Lines and IGM
ID: 9221
Title: Determining the Statistical Properties of the Local Ly-alpha Forest
PI: John Stocke
PI Institution: University of Colorado, Boulder

We propose an archival study of the seven available (or soon to be) STIS E140M spectra of bright AGN that can be used to characterize the statistical nature

of the local Ly-alpha forest. In conjunction with two of our own spectra, these ~10 km s^-1 resolution spectra will probe a pathlength through the local Universe (z<=q0.3) of Delta z~1.6, which will allow us to improve significantly the column density and b-value distributions, as well as the two-point correlation function and absorber metallicities. These results will be compared with similar data in-hand at z=1.0-1.5 from HST and at higher z from Keck spectra. The primary science driver for this work is to determine more accurately the baryon content of the local intergalactic medium (IGM) as well as its physical conditions (e.g., ``effective equation of state'') and metallicity as a function of distance from the nearest galaxy. Our team is experienced in reducing and analyzing these data and have used our own medium resolution (~20 km s^-1), first-order grating GHRS and STIS spectra (Penton et al. 2000a,b) to obtain the first detailed assessment of the baryon content, b-value distribution, clustering and metallicity of the local Ly-alpha forest. This proposed archival study will improve significantly on all aspects of the current results from our group and others.

Proposal Category: AR
Scientific Category: Cosmology
ID: 9222
Title: The Fundamental Plane of field early-type galaxies from z~ 0.7 to z=0
PI: Tommaso Treu
PI Institution: Space Telescope Science Institute

The history of field early-type galaxies (E/S0) is a key ingredient to constrain galaxy formation theories: in hierarchical clustering models they form at z<~1 through major mergers, while in monolithic collapse models they form earlier and evolve passively thereafter. We are investigating the star formation history of field E/S0 using the redshift evolution of the Fundamental Plane (FP) as diagnostics. The first (z=0.1-0.4) part of the project-- based on HST images and ESO 3.6m spectra-- provided the following results: i) the FP exists and is tight out to z=0.4; ii) under the assumption of passive evolution of single burst populations, the z of formation is constrained to be z=0.8-1.6 (Omega=0.3, Omega_Lambda=0.7); iii) field and cluster data are consistent within observational errors and cosmic scatter. We are currently obtaining spectra at the VLT (30 hrs approved on FORS), in order to extend the project to z~0.7, where the diagnostics becomes

dramatically more sensitive. By going to z~0.7, we will pinpoint the epoch of formation, and we will be able to detect relatively small differences in star formation history between field and cluster. In order to perform the highest redshift--and most promising--part of the study, it is essential to analyze 107 HST-WFPC2 images, already available in the archive. With this proposal we are seeking the necessary funds.

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Proposal Category: AR
Scientific Category: AGN/Quasars
ID: 9223
Title: The Host Galaxies of Radio-Loud AGN: Removing the Luminosity-Redshift Degeneracy
PI: Meg Urry
PI Institution: Space Telescope Science Institute

The host galaxies of radio-loud AGN can be characterized extremely well with HST data. We propose to extend our survey of low-power radio-loud AGN to much higher power, over a matching redshift range (0.1<=sssim z<=sssim 1.5). Our study has two primary goals: beginitemize em(1) To assess the possible correlation of AGN nuclear luminosity with host galaxy magnitude, which might be expected from the black hole mass -- bulge mass correlation in local galaxies. This has profound implications for the origin and evolution of galaxies and black holes. em(2) To observe directly evolution of the host galaxies of radio-loud AGN, without the usual confusion caused by the (unphysical) L-z correlation inherent in flux-limited samples. enditemize The proposed archival project concerns 69 quasars and radio galaxies from the well-defined 2 Jy sample. Building on our strong record of HST results on low-power AGN, this work will lead to a uniformly analyzed sample of nearly 200 radio-loud AGN, spanning a broad range in nuclear power at each redshift. Host galaxies will be detected and well characterized for at least half the sample, with careful attention to error analysis, using our already-developed analysis software.

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Proposal Category: AR
Scientific Category: Star Formation
ID: 9224
Title: The Deep Coronagraphic STIS Point Spread Function
PI: Bruce Woodgate

PI Institution: Goddard Space Flight Center

The last 5 years have seen the study of young planetary systems move beyond theory and into the realm of fore-front observational astronomy. HST imaging campaigns have been a key component of these multiwavelength studies by capitalizing on the stable point spread function (PSF) of the telescope and the availability of coronagraphs to image circumstellar nebulosity within a few arcseconds of the target stars. In cycle 10, the only coronagraph available onboard HST is STIS. This instrument relies on the use of the unfiltered CCD in tandem with coronagraphic wedges; the resulting images have large PSF color effects, which can compromise the ability to successfully separate the residual PSF from circumstellar nebulosity. While this separation is straightforward for systems with detached nebulosity (e.g. debris disks) where the star can be approximated by a color-matched main sequence star, this process is more complicated for actively accreting systems which are either intrinsically and unpredictably variable in color as well as magnitude, or those systems which turn out to be close binary systems. For such stars, a library of stellar PSFs is needed. We propose a calibration study to assemble such a library, documenting optimal observing and data reduction strategies, and disseminating this information (via the STIS handbook) so that the full astronomical community can take advantage of HST's coronagraphic capability.

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Proposal Category: AR
Scientific Category: SP
ID: 9225
Title: The Stellar Populations Archive: Globular Clusters
PI: David Zurek
PI Institution: American Museum of Natural History

There are 101 Galactic globular clusters (GGC) with Hubble Space Telescope Wide Field Planetary Camera 2 (HST/WFPC2) observations. We propose to consistently reduce all 101 GGC using ALLFRAME, and to provide a web based archive for the astronomical community. This service to the community will encourage comparative studies of the GGC system and the stellar populations therein. As an example we will use our archive to create a complete catalog of GGC blue straggler stars (BSS) and horizontal branch (HB) stars; and to check if cluster density correlates with BSS numbers and/or HB morphology.

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