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SPACE TELESCOPE SCIENCE INSTITUTE

Newsletter

Highlights of this issue:

Astronomy with HST

Host Galaxies Around Luminous Black Holes

by Meg Urry and Renato Falomo

Active Galactic Nuclei (AGN) like quasars and BL Lac objects are thought to be powered by accretion onto massive central black holes. The active nucleus can be hundreds or thousands of times more luminous than an entire galaxy of starlight, yet, since the accreting matter ultimately comes from a surrounding galaxy or companion merging galaxy, there must be a connection between ordinary galaxies and active galaxies.

BL Lac objects are very luminous, rapidly variable, radio-emitting AGN. They are similar to extreme radio quasars but have fairly weak emission lines (i.e., little visible ionized gas). The prevailing model of BL Lac objects is that they are characterized by a relativistic jet pointing toward the Earth. Relativistic effects cause the observed emission from this jet to be strongly boosted in the forward direction, making the BL Lac appear extremely luminous (and even more rapidly variable). The many similar objects with jets pointed away from the Earth beam their luminosity elsewhere, and so look like more common radio galaxies — quite different from what we would call a BL Lac object.

This so-called "unification" hypothesis can be tested by observing properties not affected by beaming, such as the luminosities and morphologies of the galaxies in which BL Lac objects and radio galaxies sit. While

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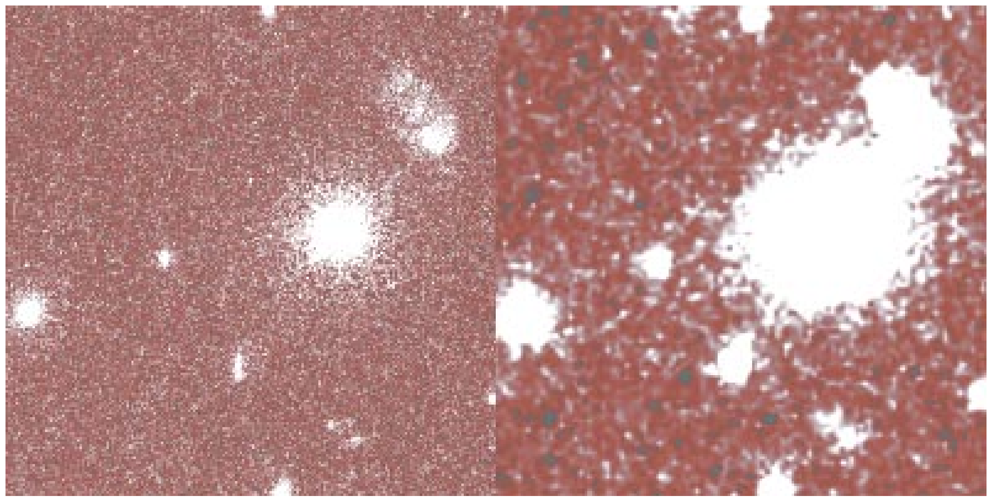

HST PC2 image (right) of the BL Lac object 1823+56 (bright fuzzy object in center right), compared to a ground-based image obtained in 0.7 arcsec seeing with the Nordic Optical Telescope. In the HST image, the galaxy can be studied at a few tenths of an arcsec from the BL Lac nucleus; the morphologies of close companion objects are also much more detailed.

HST Observes Comet Hyakutake

by Melissa McGrath

Discovered by Japanese amateur astronomer Yuji Hyakutake using 25×150 binoculars on 30 Jan 1996, comet Hyakutake (C/1996 B2) quickly became the brightest comet visible from Earth since IRAS-Araki-Alcock in 1983. An intrinsically bright comet and an unusually close approach to Earth of ~15 million kilometers (~40 times the Earth-Moon distance) combined to produce an easily identifiable naked eye object with a spectacular tail extending tens of degrees. At closest approach on 24-25 March, the comet had a very large apparent motion of 1 arcmin/minute, relative to the background stars. Its orbit well above the ecliptic plane took the comet near the bright star Arcturus, through the Little Dipper near Polaris, and finally below the northwest horizon at the end of April before the comet reached perihelion on 1 May 1996.

Radar observations of the comet by Steve Ostro (Jet Propulsion Laboratory) and colleagues indicate a nucleus of 1-3 km in size (for reference comet Halley measured 15×8 km). Comet Hyakutake is the first comet ever detected in the x-ray spectral region, in ROSAT observations led by Mike Mumma (Goddard Space Flight Center). The x-ray emission is thought to be produced by scattering of solar x-ray photons. Four HST Target-of-Opportunity programs were activated in early February and executed during

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Director's Perspective

Most of the news coming out of HST and the Institute in recent months has been scientific in nature, the desirable result of a properly functioning telescope. A few weeks ago we celebrated the sixth anniversary of the launch of HST, and it has been more than a year since the last safe mode occurred. The most serious glitch in HST's performance over that time has been the loss of one of the three tape recorders several months ago. Since there is redundancy in the tape recorders, the science program has been affected insignificantly. Meanwhile, the 'on target' time for HST has now reached an average efficiency of over 50%, a figure that was believed unattainable at the time of launch. The HST data archive is alive and well and is being accessed increasingly, with more data now being sent out to users on a daily basis than is ingested from the telescope. The Institute home page on the World Wide Web is one of the most accessed in the world, ranking among the top 40 of all Web sites.

Cycle 6 observations have begun, and preparations are underway for the receipt and evaluation of proposals for Cycle 7. The Cycle 7 Call for Proposals should now be in your hands, with observing proposals due in September (see the schedules at the end of the Newsletter). The Key Projects that were begun in Cycle 1 are now coming to an end, and new Large Programs are being solicited and will be awarded time in each of the coming cycles, based upon peer review.

A great deal of effort went into the Hubble Deep Field project, and the large quantity of data created by the observations were made available immediately, with no proprietary period. It has been gratifying to see the stimulus that a large non-proprietary dataset can have on research within our science. I hope that this experience with the HDF will help establish more of a balance in the midst of a strong culture which has maintained for some years that an essential component of the scientific success of space missions is the proprietary data rights period that restricts access to the data to the PI for a one year interval. This is not the only way to go, and I am pleased to say that the Key Projects advisory committee agreed with this point of view in recommending to me that future Large Programs have the waiver of the data rights period as one of the criteria for their evaluation by the TAC.

Many within the Project and the Institute are now focused on the upcoming second servicing mission, now on the manifest for a night launch on 13 February 1997. The highlight of the mission will be the installation of two new instruments, STIS and NICMOS, to replace the FOS and GHRS. With these new instruments, HST will for the first time have infrared and long-slit spectroscopic capabilities. In addition, the mission calls for installation of two new data recorders, one of which will be a solid-state device, and for a replacement of one of the Fine Guidance Sensors with one that has been refurbished and upgraded. This "new and improved" HST will support new types of observations that should yield exciting scientific results.

Without losing our focus on the immediate future of the telescope, we have engaged the community in beginning to plan for the long term future of ultraviolet, optical, and infrared astronomy in space. The HST and Beyond committee, chaired by Alan Dressler, is about to issue its final recommendations to NASA for future directions and missions, and they have already made public the fact that these will include a recommendation to NASA that the lifetime of HST be extended an additional five years, to the year 2010, in a mode in which no servicing missions take place and operations are handled as cheaply as possible and with minimal maintenance of operating systems. Other recommendations include major missions aimed at the discovery and study of earth-like planets around nearby stars, and a 'next generation' follow-up to HST which consists of a 4m or larger IR-optimized, passively-cooled telescope.

NASA has requested the HST Project at Goddard to lead a study of the technical feasibility and design alternatives for a second generation HST, a "Next Generation Space Telescope" (NGST). The Project is involving other NASA centers, ST ScI, industry, and individual scientists in this study, which is a wide-ranging effort that should result in plausible design concepts for an NGST that is commensurate with the HST and Beyond recommendations. The results of this study will be incorporated into the triennial Strategic Plan of the Office of Space Science at NASA headquarters.

For the present, as it participates in the many aspects of the HST mission, the Institute will continue to give priority to its main responsibility: maximizing the scientific productivity of Hubble Space Telescope.

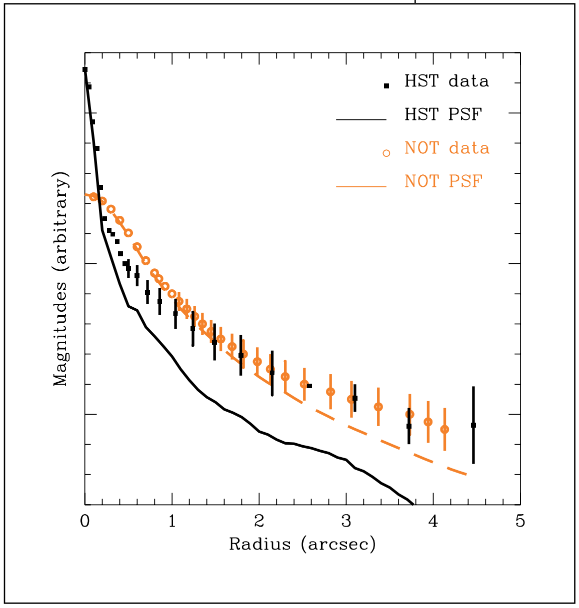
Bob Williams

Host Galaxies *from page 1*

host galaxies of BL Lac objects have indeed been detected from the ground, the high brightness of the central point source makes it much more difficult to study the morphology and luminosity of the host, particularly for distant BL Lac objects.

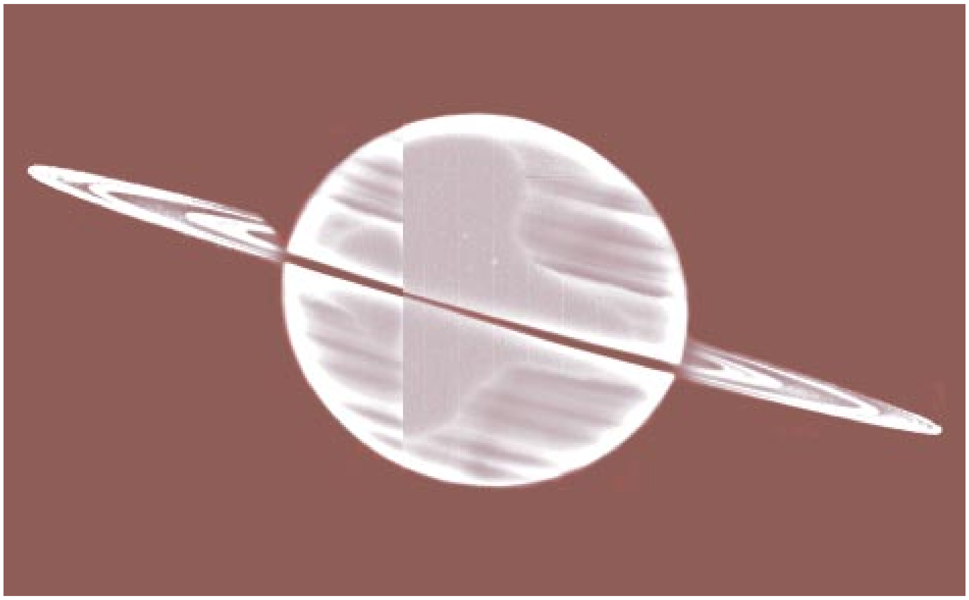
With its superior spatial resolution, HST is proving an excellent tool for studying host galaxies of quasars and BL Lac objects, and we present here some results from our ongoing HST program. The first figure shows a distant BL Lac (z=0.664), known as 1823+56, as imaged by HST (top) and with 0.7 arcsec seeing at the Nordic Optical Telescope (bottom). The advantage of HST for imaging the innermost regions of the host galaxy, as well as for studying the morphologies of nearby objects, is obvious. This is illustrated also in the radial surface brightness plot shown in the second figure. While the HST and ground-based host galaxy profiles (blue squares and red circles, respectively) agree well several arcsec from the nucleus, the ground-based data are inevitably affected (even at sub-arcsec seeing) within 2 or 3 arcsec, as can be seen from a comparison of the HST point spread function (solid black line) and the NOT point spread function (dashed red line).

For this BL Lac object and others, HST is extending the range over which the host galaxy is well observed from a few arcsec to a few tenths of arcsec — over an order of magnitude improvement in many cases. With additional data on larger samples, such studies will greatly enhance our understanding of the BL Lac phenomenon.



Surface brightness profiles of 1823+56 from the HST (black squares) and NOT (red circles) images. Also shown are the point spread functions for HST (black line) and the NOT (red line). From the ground, galaxy light is only detected outside a few arcsec, and then only marginally. With HST, the galaxy is detected down to a few tenths of an arcsec, an order of magnitude improvement over the ground.

Sunset on Saturn's Rings



This is a rare view of Saturn's rings seen just after the Sun has set below the ring plane, taken with the Hubble Space Telescope on November 21, 1995. This perspective is unusual because the Earth is slightly above (2.7 degrees latitude) Saturn's rings and the Sun is below them. Normally we see the rings fully illuminated by the Sun. The photograph shows three bright ring features: the F Ring, the Cassini Division, and the C Ring (moving from the outer rings to the inner). The low concentration of material in these rings allows light from the Sun to shine through them. The A and B rings are much denser, which limits the amount of light that penetrates through them. Instead, they are faintly visible because they reflect light from Saturn's disk. Scientists believe that the F Ring is slightly warped because it disappears part way around on the right (West) side. Hubble's high resolution shows that the A Ring's shadow obscures part of the F Ring (right).

Comet Hyakutake *from page 1*

the first week of April. Their Principal Investigators were Michael A'Hearn (University of Maryland), Jack Brandt (University of Colorado), Michael Combi (University of Michigan), and Harold Weaver (ARC).

Observations from the Combi program were made to study water photochemistry in the new bright comet. The investigation was designed to make measurements simultaneously of hydrogen, hydroxyl (OH), and oxygen, which are the most abundant constituents in the coma of a comet, produced when ultraviolet light from the sun dissociates water molecules that are evaporated from the comet nucleus. The observations were made on April 2 and 3, when the comet had passed closest approach and was receding from Earth at 53 km/s. A key part of the program was the measurement of the expansion speeds of the hydrogen atoms, made by observing H I Lyman-alpha emission at 1215.67 Angstroms using the echelle-A grating of the GHRS. The Ly-α line profile was measured at six locations around the coma, ranging from nucleus-centered to 100,000 km sunward of the nucleus. Images of the hydrogen coma were also made using WFPC2. The Faint Object Spectrograph was used to measure the hydroxyl abundance.

In the Weaver program, at least 25 bands of the CO fourth positive group and at least seven bands of the forbidden CO Cameron band system were detected via FOS spectroscopy. Since these latter bands are produced at least partly by prompt emission following the photodissociation of CO_2, they provide a unique tracer of CO_2 in the cometary nucleus. The S_2 molecule was clearly detected via fluorescence in multiple bands between 285.0 and 312.0 nm. This is the first time that S_2 has been definitely detected in a comet since its initial discovery during IUE observations of the Earth-grazing comet IRAS-Araki-Alcock in 1983. The Hyakutake spectra also have several as-yet unidentified emissions that are being investigated.

A pointing problem prevented the Weaver program from doing PC imaging near the time of closest approach to Earth. However, WFC images of Hyakutake were taken through *B*, *V*, and *R* filters on 26 March and 1 April, at a plate scale of 7.6 km/pixel. These images provide a detailed view of the inner coma. Preliminary indications are that the nucleus was not detected; the upper limit to the size is significantly larger than the estimated values from Ostro's radar imaging. Assuming Ostro's result of 1-3 km size for the nucleus is correct implies that the surface of Hyakutake's nucleus must be very different from that of most periodic comets. Most of Hyakutake's surface area must have been "active" (i.e., actively producing gas and dust), whereas most periodic comets seem to be covered with a relatively involatile "mantle" of particulates (e.g., only ~10% of Halley's surface was active, while the number is thought to be closer to 1% for other short-period comets).

The A'Hearn program had the goal of determining the ratio of C_2 Mulliken to Swan bands as a function of distance from the nucleus in the near-nuclear region using FOS spectroscopy. They observed a very complicated spectrum with many emission bands not previously seen, and the richness of the spectrum has confounded the original goal. The spectrum of diatomic sulfur, seen also in Hal Weaver's program, is quite strong at somewhat higher spectral resolution because a smaller entrance aperture was used. A preliminary estimate is that the S_2 abundance relative to water is similar to that in comet IRAS-Araki-Alcock. This confounds any interpretation of S_2 as an unusual coincidence at IRAS-Araki-Alcock and it suggests that upper limits derived with IUE for other comets may be overly optimistic.

The region of the Mulliken bands is extremely rich with bands of CO (both the fourth positive system and the Cameron system) and it appears that the C_2 is formed rotationally very hot, just as is seen in the laboratory when it is formed in the dissociation of C_2H. Furhter analysis is needed to confirm this result. Other new identifications are still under investigation. Because the rotational structure of the bands is not resolved, identification must rely on a combination of chemical plausibility and relative intensities of several different bands. Calculating the expected relative intensities is still in progress.

HST Programs and Observations

The User Support Coordinating Committee — What it is and what it does

Chris O'Dea

ST ScI assigns two support staff to each accepted General Observer program. The Program Coordinator (PC) is part of the Project to Re-Engineer Space Telescope Observing (Presto). The PC helps the observer to develop a valid and feasible observing program, and then processes the program through the implementation and scheduling software; that prepares the program for placement on the observing schedule for a given week. The Contact Scientist (CS), from the Science Support Division (SSD), provides scientific guidance to the observer and Program Coordinator during the program development, performs a scientific and technical review of the program, and assists with data reduction and analysis issues after execution of the program.

If you are a current HST observer, you may have heard from your Program Coordinator or Contact Scientist that a change request or duplication issue for your program was being reviewed by a group called the User Support Coordinating Committee (USCC). You may have wondered what this committee does.

The User Support Coordinating Committee has the charter to establish, maintain, and improve a coordinated plan for user support at ST ScI that spans the various groups that have routine user interactions. User support is a critical for both SSD and Presto, and this support needs to be coordinated across the instrument and support groups.

The USCC has seven members from SSD (at least one from each instrument group) and three from Presto (including two from the Presto PC Team). The USCC has several functions. One is as

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Improvements to HST Observing Efficiency

by Glenn Miller and Peg Stanley

One of our most important goals is maximizing scientific output from HST without compromising the high quality of the observations.
One measure of the observatory's output is spacecraft time efficiency, which is defined as the fraction of time on target (from the end of the previous visit to the end of the current visit), minus times where observations cannot be made (such as earth occultations, or passage through the South Atlantic Anomaly).

The figure shows the history of HST efficiency, from a few months after launch to the present. The thick red line shows the quarterly efficiency while the thin line is an annual sliding average. We have made impressive gains in observatory efficiency over the mission. We now operate at 55% efficiency, fully two-thirds better than the ~33% we experienced in the first years of operations. For reference, the shaded line at 35% efficiency denotes the pre-launch goal for the maximum sustainable efficiency. We've broken this barrier for over three years.

The increases in efficiency come from several factors which are part of a continuing, long-term effort. In the summer of 1993 we began to use two of the three onboard tape recorders for science data (the third recorder has been used for engineering telemetry). Previously one of the tape recorders had been reserved for safemode data collection. The science tape recorders (STRs) automatically switch to safemode data collection when needed, and safemodes have been rare. Use of two STRs allowed science observations to proceed without waiting for communications contacts to download the data from a full recorder.

The next step was taken in the winter of 1993-1994. Based on the results of a number of experiments, software used at the ST ScI was enhanced to perform "orbit packing," meaning that the distribution of exposures across orbit boundaries was optimized for best efficiency while still preserving scientific constraints. Cycle 5 observations began in July 1995, and that saw the introduction of HST time being allocated in orbits. Also, RPS2 was introduced; it allowed orbit packing under the control of the observer with graphical displays and new special requirements such as "expand".

You may notice a dip in efficiency around June of 1995. That arose from the boundary between observing Cycles 4 and 5: Cycle 4 observations were mostly complete while Cycle 5 observations were only beginning, and

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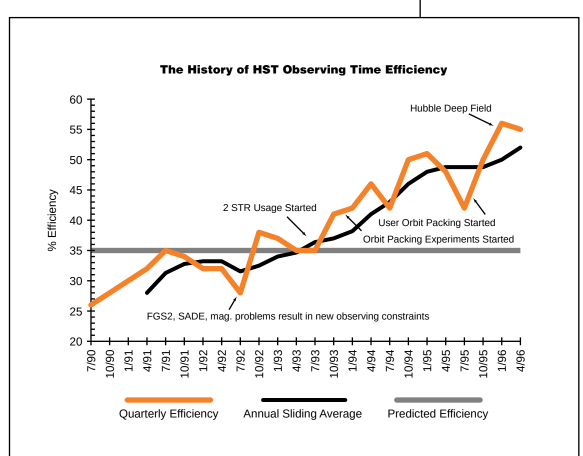

Coordinating Committee *from page 5*

from page 5

a forum to work out issues of coordination between the various groups. The committee resolves working-level issues among the groups on procedures, and makes recommendations to SSD and Presto management on policy matters related to user support which span the groups. These issues include the Program Coordinator and Contact Scientist program, visitor support, archive user support, and documentation for users. As part of its charter, the USCC maintains a "Guide to User Support Policies and Procedures," which will be used by the groups in carrying out user support.

Specific responsibilities of the USCC include:

- Establishing and maintaining a set of procedures for Contact Scientists and Program Coordinators which carry out ST ScI and division policies for user support, and which ensure good working relationships between the PCs and CSs.
- Aiding the Director's Office in resolving duplication conflicts and major change requests to ensure consistency and fairness in all dealings with PIs and recommending changes to duplication policies and procedures.
- Reviewing SSD and Presto documentation and documentation standards to ensure we are providing the information users need in a consistent, integrated manner.
- Overseeing the operation of the SSD hotseat (`help@stsci.edu`), especially in terms of monitoring the promptness and accuracy of the information provided.
- Reviewing visitor support and documenting SSD policy for visitor support to ensure a well-defined level of support across the instruments.
- Developing plans for and monitoring SSD support for archival users.
- Organizing user surveys to provide metrics for evaluating SSD user support and provide input for improvements. Surveys should cover all aspects of SSD and Presto user support (CS and PC support, hotseat, visits, documentation, etc).
- Making recommendations to division management with regard to changes in user support policies which would better serve the community given the level of support available within the groups.

The major part of the work of the USCC, and the role which is perhaps most likely to directly affect an HST observer, is that of reviewing major change requests and duplication conflicts. Occasionally, during the implementation phase of an HST program, the observer thinks of a change which would improve the scientific return. The PI submits this as a "change request" to the PC or CS. Minor change requests include changes in gratings or filters or exposure times which do not change the scope of the program or its total allocation of spacecraft orbits. These minor change requests can be handled directly by the PC or CS. Major change requests include requests for additional orbits, changes in targets, and changes in the scope of the program; e.g., from imaging to spectroscopy or vice versa. Major changes are carefully reviewed by the USCC and then sent to the Director for consideration. The USCC recommendation to the Director is based on the scientific justification for the request, the resources available to implement the change, the recommendations of the TAC, any relevant ST ScI and NASA policy, as well as the strong desire to treat HST observers in a consistent and fair manner.

When a duplication conflict is discovered in Phase II, the CS sends a report on the duplication to the USCC, which then reviews the information and communicates a recommendation to the Director. This may include loss of observing time from the program, or an embargo on the observer's access to the data. The main concerns of the USCC are to protect the proprietary rights of the Guaranteed Time Observers and General Observers, and to avoid waste of HST time because of needless duplication of existing observations.

Suggestions for improving user support can be sent to the USCC chair Chris O'Dea, `odea@stsci.edu`.

Cycle 7 Call for Proposals

B. Blacker and M. Urry

ST ScI has now issued the Call for Proposals (CP) for Cycle 7 of HST observations. The proposal deadline for full electronic or paper-plus-electronic submission is Friday, September 13, 1996. Paper-only submissions will be accepted ONLY from those proposers who have no access to e-mail, and will have an earlier deadline of Friday, September 6, 1996. Proposers will be notified of the results of the Cycle 7 Proposal Review at the end of December.

The second HST servicing mission (SM97) is scheduled for launch on February 13, 1997, and there are several changes relevant for Cycle 7 proposers. Two new science instruments, the Space Telescope Imaging Spectrograph (STIS), and Near Infrared Camera and Multi-Object Spectrometer (NICMOS), will replace the Goddard High Resolution Spectrograph (GHRS) and the Faint Object Spectrograph (FOS), respectively. A new Solid-State Recorder (SSR) and a refurbished analog tape recorder will both be installed, providing much improved data transfer capabilities. A refurbished Fine Guidance Sensor (FGS) with improved optics and resulting greater sensitivity will replace FGS-2 (but at least for Cycle 7, FGS-3 will remain the science astrometer).

The on-orbit testing ("Orbital Verification") of the new hardware should be complete by the nominal 1 July 1997 start date for Cycle 7. Some specialized uses of the new instruments and many of the detailed on-orbit science calibrations will be phased in during Cycle 7. Cycle 7 proposals may request use of FGS, FOC, NICMOS, STIS and WFPC2. Use of the FOC f/48 camera will be allowed for long-slit spectroscopy only. Archival proposals can address HSP, FGS, FOC, WFPC2, GHRS, or FOS data.

In past cycles we have issued both a Call for Proposals and Phase I Proposal Instructions. In an attempt to simplify the proposal process, we have merged those two documents into one for Cycle 7.

Also, in past cycles the CP mailing included updated Instrument Handbooks. With the Cycle 7 mailing of the CP we want to hold down costs and reduce waste by limiting automatic mailing of paper copies of the Instrument Handbooks to Libraries only. Please note that all the documentation needed for writing Phase I Proposals is now available on-line via our World-Wide Web (WWW) server: `http://www.stsci.edu/proposer.html`

Individuals may still obtain paper copies upon request via the WWW server. For additional information or help, please contact the ST ScI HELP Desk (e-mail `help@stsci.edu`, or call 800-544-8125 or 410-338-1082).

Observing Efficiency *from page 5*

the mix could not be scheduled efficiently. We learned from this experience, and there is no dip in efficiency due to the cycle boundary this year.

The all-time peak in efficiency seen in December 1995 is due to the Hubble Deep Field (HDF) observations, when the telescope pointed at one field for 10 straight days; a one week best-ever efficiency of 74% was achieved. This field was chosen to be at the northern pole of the HST orbit, where observations are uninterrupted by earth occultations (but the South Atlantic Anomaly still interrupted observations). The HST orbit precesses with a 56 day period, so that the HST's "Continuous Viewing Zone" (CVZ) sweeps a small circle on the celestial sphere. It is clear that CVZ observations are very efficient, and the long range planning process uses CVZ and near-CVZ opportunities whenever feasible.

Since launch we have worked to minimize the time needed for spacecraft and instrumental overhead. Where the overhead times can not be reduced, efforts are made to "hide" such activities during slews and earth occultations.

The figure shows both prime and snapshot science. Parallel science contributes about 5% more to the overall efficiency. Also, many of the instrument calibrations can be done "internally" during earth occultation periods, so that on-target time is used for science observations. Exposure time efficiency (the "shutter open" time) is not indicated on the chart but has improved along with the overall observing efficiency. Exposure time efficiency started out at about 10% and is now routinely 35% to 40%, an even more dramatic improvement.

At least as important as observing efficiency is our fundamental mandate to obtain high quality data. All potential efficiency improvements are examined for their effect on data quality, and ST ScI carefully monitors the quality of all observations.

Efforts to improve HST observing efficiency continue at the ST ScI. We are evaluating scattered Earth light in an attempt to decrease the Earth avoidance angle constraints without jeopardizing science observations. Decreasing the Earth avoidance angles will increase time on target availability and increase the frequency and duration of CVZ passages.

Hubble Deep Field Proposal Review

B. Blacker, M. Urry, B. Williams

In mid-January of this year, the ST ScI released a special Call for Archival Research Proposals for the study of the Hubble Deep Field (HDF) data set. The entire HDF data set, including reductions done by a group of ST ScI scientific staff members, has been placed in the public domain. These data are freely available to the community without the necessity of responding to the solicitation for proposals; proposals were required only for funding to support further work on the HDF. The deadline for proposing was March 15, 1996.

A special evaluation committee, chaired by Dr. P. J. E. Peebles (Princeton), met on April 13-14 at ST ScI. Other panel members included Craig Hogan (University of Washington), Roger Blandford (Caltech), Simon Lilly (University of Toronto), Alvio Renzini (ESO), and Stefi Baum (ST ScI). The committee evaluated the HDF archival proposals, and recommended proposals to the Director for approval and funding.

We received 42 proposals that requested approximately $2.6M in funding. Fourteen proposals were approved, and they were awarded a total of $802K. Here are the approved programs:

PI	Institution	Title
Brown	*Caltech*	*A Search for High Inclination Kuiper Belt Objects*
Cohen	*Caltech*	*A Deep Redshift Survey within the Hubble Deep Field*
Connolly	*Johns Hopkins University*	*The Multicolor Evolution of Galaxies*
Cowie	*University of Hawaii*	*A Study of Near-Infrared Selected Galaxies in the HDF*
Dickinson	*Space Telescope Science Institute*	*Multicolor Infrared Imaging: A Fourfold Extension of the HDF Wavelength Baseline*
Ferguson	*Space Telescope Science Institute*	*Detailed Tests of Galaxy Evolution Models with Hubble Deep Field Images*
Griffiths	*Johns Hopkins University*	*Deep Mining of the HDF-The Faintest Sources and Fluctuations in the EBL*
Illingworth	*Lick Observatory, University of California*	*Kinematics and Structure of HDF Galaxies*
Impey	*University of Arizona-Steward Observatory*	*Absorption Line Probes of the Hubble Deep Field*
Kellermann	*National Radio Astronomy Observatory*	*VLA Observations of the Hubble Deep Field*
Koo	*Lick Observatory, University of California*	*Objective Analysis of Multicolor Photometric and Structural Parameters of Faint Field Galaxies*
Kundic	*Caltech*	*Strong Lensing in the Hubble Deep Field*
Madau	*Space Telescope Science Institute*	*Primeval Galaxies in the Hubble Deep Field*
Neugebauer	*Caltech*	*Analysis of Deep Near Infrared Keck Observations Coordinated with the HDF*

Announcement

We note, with sadness, the death of Dr. Jason Cardelli, on May 14. Dr. Cardelli, of Villanova University, was struck by a heart attack. He played a major role in evaluating the performance of the GHRS and in pursuing innovative studies of the interstellar medium with the spectrograph. We have all benefited from his efforts in the design and implementation of the GHRS orbital calibration program. His work to obtain extremely high signal-to-noise from the GHRS is especially noteworthy. We will all miss his friendship, enthusiasm, spontaneity, humor, and drive.

Instrument News

Faint Object Camera

R. Jedrzejewski

The Faint Object Camera continues to operate nominally, with excellent data being produced by the F/96 camera, and steady progress is being made in characterizing the F/48 longslit spectrograph.

A minor problem was experienced in the early part of the year. The FOC focus, which is determined by the position of the COSTAR deployable optical bench, was found to be noticeably different from the optimum. The error, corresponding to a few microns of secondary mirror movement, arose because the shrinkage of the optical telescope assembly due to desorption was not compensated for adequately for the FOC, which is particularly sensitive to small focus errors. The build-up of this effect had not been noticed partly because of the low rate at which data suitable for determining the focus had been obtained, and partly because data which were suitable gave anomalously "good" values for the focus measurement. The effect on science data was marginal, and the affected GOs have been notified. After the secondary mirror move of March 14th, 1996, FOC observations are again correctly in focus.

The FOC was highlighted as one of the instruments used by the "Live from HST" team. Mark Buie and collaborators used the FOC to take high-resolution images of the Pluto-Charon system, building on their Cycle 4 data that had resulted in a NASA press release showing surface details on Pluto.

FOS

Tony Keyes

During the past three months FOS instrument operation has continued to be nominal. During this period three important Instrument Science Reports have been published by the group:

1. ISR-146: analysis of FOS Darks for cycles 1-4
2. ISR-147: FOS Calibration Plan for Cycle 6
3. ISR-148: Observed White Light PSFs and LSFs for both pre- and post-COSTAR periods

FOS observations were successfully obtained in March and April as part of the multi-instrument campaign on Comet Hyakutake.

The FOS/RD flat field calibration suite failed guide star acquisition in April. It will be repeated. The FOS/BL flat suite completed successfully.

WFPC2

John Biretta

WFPC2 recently passed the 30,000 exposure mark and continues to perform extremely well, and very little long-term change has been seen in its performance. The far-UV throughput has remained remarkably constant, once the large monthly variations associated with decontaminations are removed. Measurements in filter F170W indicate that the largest long-term decline is about 1.3% (± 0.3%) per year in WF4. Surprisingly, the F170W throughput of PC1 appears to be increasing at about 5% per year, suggesting some initial contaminant is slowly evaporating. At Lyman-α wavelengths there is no evidence for long-term throughput decline, with an uncertainty of ~20%. The only area showing significant decline is the outputs of the VISFLAT and UVFLAT calibration lamps. The VISFLAT lamp output has declined by ~9% since launch, and we are working to reduce its usage by a factor of 2 to 3, which should extend its life well past 2010. The UVFLAT lamp underwent a rapid initial decline, but it is now used only semi-annually and the output is nearly constant.

The WFPC2 Instrument Handbook has been updated and expanded. A new chapter on observation strategies has been added, and material on exposure time estimation has been greatly expanded. Other topics significantly updated include dark current, charge transfer efficiency, PSF variations, image artifacts, UV throughput, and overhead times. Paper copies may be obtained by sending e-mail to `help@stsci.edu`, and a postscript version is available on the WWW.

The Hubble Deep Field project has produced a number of calibration and software related spin-offs. Efforts to understand the dark current have confirmed that it correlates strongly with cosmic ray flux. Apparently much of the dark current is caused by a cosmic ray induced glow of the MgF_2 field-flatteners immediately in front of the CCDs. While the standard dark calibration is adequate for most images, extremely deep exposures may benefit from special "dark glow" calibrations developed for HDF. Also, super-bias and super-dark calibration files have been generated and are available through the archive. Improved flat fields are being archived for most visible wavelength filters. On the software front, the CRREJ cosmic ray rejection program has been upgraded with the next STSDAS release, and new software for combining position dithered images is being completed.

To get detailed and up-to-date information on any of the current instruments, you may wish to subscribe to one or more STANs (Space Telescope Analysis Newsletter). Subscriptions are done through a listserver, and instructions are at the ends of the STANs posted on each instrument's Web page.

Instrument News

GHRS

David Soderblom

The Goddard High Resolution Spectrograph operates well in all modes. Sensitivity at wavelengths below Lyman-α continues to decline, but at other wavelengths the changes are at most about 3% since the 1993 Servicing Mission. The origin of the short-wavelength decline is not known, but a special test will be made to see if it is related to contamination on the COSTAR mirrors. Just before the next Servicing Mission (within about two days), the COSTAR mirrors will be withdrawn and Side 1 of the GHRS used to assess its sensitivity without those mirrors in place. We will report on this further in the future.

These Instrument Science Reports have recently been issued:

1. ISR073: Short-Term Variations in GHRS Response: An Investigation into an Apparent Anomaly
2. ISR074: GHRS Calibrations in Cycle 6
3. ISR075: Summary of the GHRS Calibration Program During Cycle 4.

Flat field maps have recently been made that can be used to remove some of the photocathode granularity for observations made with grating G140L. The use of these maps is described further in the latest GHRS STAN and on our Web page.

NICMOS

David Axon

(Editor's note: This is a very brief update because NICMOS is at that stage when many things are happening quickly. We expect to provide a fuller description in the next issue.)

The construction of NICMOS is now complete and the instrument has recently been put through its acoustic testing at GSFC. We are pleased to report that it passed with flying colors, and that the instrument appears to be fully functional. Testing of the grisms will start in mid-June, followed by a full thermal-vacuum test in July. Potential users of NICMOS should look for updated information on the ST ScI NICMOS Web page by August 15.

The ST ScI data reduction pipeline for NICMOS is continuing on schedule. The first stage of the pipeline, CALNICA, has been written, and the second stage, CALNICB, is being tested.

Tools to help with computing integration times and signal-to-noise have been installed on the ST ScI NICMOS Web page. You can also find an on-line version of the Instrument Handbook there.

Space Telescope Imaging Spectrograph

S. Baum

Work on STIS has continued apace at Ball Aerospace, in Boulder, Colorado, where STIS is being constructed, at Goddard Space Flight Center, MD, where the core of the STIS Instrument Definition Team resides, and at ST ScI, where we are readying our ground system, pipeline and user support efforts for STIS. The first user documentation on STIS, the STIS Instrument Handbook, was released in June, in preparation for the Cycle 7 Call for Proposals (it may be requested from the help desk; `help@stsci.edu`).

Considerable progress has been made with the hardware, but the schedule remains extremely tight, with much work to be done between now and the final shipment of STIS from Ball in September. The MAMA (Multi Anode Microchannel Array) detectors STIS uses in the ultra-violet had experienced difficulty with the high voltage power supply and packaging this past fall. These problems appear to have been overcome and spare MAMAs were integrated with the instrument and used in in a series of vacuum alignment tests in March and April, producing over 300 spectrum lamp images. These images were used to align STIS, and the results are excellent; with the of widths of the lines indicating that specifications have been exceeded in almost all cases. These Spring Vacuum Alignment tests also provided rough confirmation of the efficiency of STIS's different spectrum modes. Much effort has also been devoted to debugging noise problems with the STIS CCD detector and categorizing the detector linearity; this work is ongoing.

Hardware efforts proceeded in two other major additional areas for STIS. STIS is being fitted with a simple external shutter, which will totally block the external light path from all the STIS optics; this will be crucial in helping to protect STIS optics from contamination, particularly immediately following deployment of STIS in the Second Servicing Mission. Also, thermal modifications to STIS are underway, with additional heat straps and pipes being added, and the enclosure being modified to allow adequate dissipation of heat from the instrument. The thermal changes are designed to allow the instrument to be operated in its preferred configuration, with all detector and power supplies left on.

STIS, fully integrated with its three flight detectors, its power supplies, computers, external shutter, and its modified thermal environment, is expected to be shipped to GSFC for a set of acoustic tests during late June. After that testing it is to be shipped back to Ball Aerospace for a series of thermal vacuum tests, which culminate in Science Calibration of the instrument in late August or early September, prior to final shipping back to GSFC and then to KSC for integration into the Shuttle.

HST Data Archive

Hubble Data Archive News

by Megan Donahue

What's New with StarView?

As of December, 1995, we have provided Principal Investigators with electronic access to their proprietary HST data. One common misconception is that PIs are automatically granted access to their data: this is NOT true! We want to take good care of your data, so if you're a PI who would like electronic access to proprietary data, or if you would like to grant access to your co-investigators, please send e-mail to `archive@stsci.edu` stating the proposal ID and the names of those authorized investigators. All investigators must be registered archive users before they can retrieve any data from the archive. Registration merely means we have your name and address, and we have granted you an archive username and password. Authorization means we have explicitly granted you access to data associated with a certain proposal. Access to data from each proposal is granted independently. Once you are authorized for a specific proposal, you can retrieve your proprietary data for that proposal with StarView just as you would public datasets.

In February, 1996, Starview v4.3 was installed, fixing a number of minor bugs. We have installed StarView v4.4 this May. Several new features and capabilities come with this newest version:

- Calibration files (with a choice of the "best" or "used") can be retrieved simultaneously with the raw data. The user only has to select this option on the retrieval screen when retrieving the science data.
- The Digitized Sky Survey overlay for the field of view now supports either the V3 or the U3 position angle orientation.
- The proposal abstracts are now easier to search. Previously each line was searched as a separate field. Now abstracts are saved in a single textfield. We expect to incorporate improved ways to search single textfields in the next version of StarView.
- User feedback will be requested upon exit.

Other changes that are less visible to most users were also incorporated into StarView v4.4. We welcome any and all suggestions for improving the scientific usefulness of StarView! Please send suggestions and comments to `archive@stsci.edu`.

We announce that the archive host computer can now be accessed as "`archive.stsci.edu`". Guest users can either use the name `archive.stsci.edu` or `stdatu.stsci.edu`. The most recent version of distributed StarView, as always, is available by anonymous ftp from `archive.stsci.edu` in `pub/starview`.

The Web HST Archive Survey and Data Media

We ran a web-based archive user survey from Nov 21, 1995 through March 7, 1996. We had 119 responses, of which 20 were General Observers or Guaranteed Time Observers. Of those 20, 90% desired electronic access to their data, and 60% of those 20 would still want a tape even if they had electronic access. The survey also revealed user interest in DAT tapes and CD-ROMS, two media not currently available for GO data distribution. We plan to make GO DAT tapes available as soon as next fall, and are investigating the use of CD-ROMs.

We are phasing out the use of 9-track tapes. After Cycle 5, 9-track tapes will no longer be a media option.

Archive Web Highlights

To use the Archive web pages most effectively, we recommend that browsers use Netscape v2.0.

- The HST Keyword Database can be accessed via the URL `http://archive.stsci.edu` keyword. The Keyword Database contains a glossary of the FITS header keywords for for all of the instruments, including STIS and NICMOS, and for data files from the Observatory Monitoring System (OMS). A user can also generate a schematic header and view the overall database structure.
- The second version of the Hubble Deep Field has been available since February.
- Many interactions with the archive can be initiated via Web forms (See the Archive home page at `http://www.stsic.edu archive.html` for links):

  Archive user registration: required for data retrieval

  Changes or extensions of proprietary rights: please submit at least two weeks before the data are due to be made public. We cannot retract data which are already public.

  Restriction of another proposal's proprietary rights

  Requests for Digitized Sky Survey data

Soon we expect to release Web forms that permit browsing and retrieval of public HST data. Since security is still an issue for Web usage, we feel StarView is still the only appropriate means to retrieve proprietary data. The platform-independent Web forms will allow users to do basic searches and retrievals.

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Public Outreach and Education

Finale of "Live from HST" Aired!

The third and final segment of "Live From HST" was broadcast live from the ST ScI auditorium on Tuesday, April 23rd. Two hundred middle and high school students from New York, New Jersey, Virginia and Maryland participated in the program, titled "Announcing Your Results."

The program was a highly interactive, student-oriented scientific symposium. In addition to the student audience at the Institute, students from all over the world joined in through e-mail and Cu-SeeMe video conferencing. Planet advocates Drs. Marc Buie and Heidi Hammel shared their preliminary findings of student-selected observations of Pluto and Neptune, and responded to comments based on parallel work done by participating students. The program provided give and take between the Planet Advocates and their student "Co-Investigators," as students witnessed the process of testing scientific hypotheses, verifying results and sharing new findings with peers to substantiate their significance.

"Live From HST" touched thousands of students from around the world. Live uplinks in the United States included the Buhl Planetarium at the Carnegie Science Center in Pittsburgh (where students helped make the original planet selections via interactive technology), and Los Angeles, California (a school district making a major push to integrate the Internet into their curriculum). Mr. Ron Hirosawa, the Assistant Principal of Lincoln High School in Los Angeles, had nothing but praise for the program and for the Institute for making it happen. His students, from a depressed area of the city, were "really excited and enthusiastic" about the program.

The Office of Public Outreach would like to thank everyone at the Institute who made the "Live From HST" program such a success, including the on-line journal writers and question/answer volunteers, the Director's Office, Data Systems Division, Observation Processing and User Support, Computer Operations, and Facilities departments.

Copyright of Electronically Available Material

by C.A. Christian

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Regarding digital renditions of data (most commonly images), ST ScI personnel create "added value" digital products, as well as transparencies, lithographs and photographs, in collaboration with the research scientists whose work is being showcased. As a policy, ST ScI offers the full resolution digital renditions of those images *royalty free* through electronic means, again, in harmony with the NASA policy to offer such products freely to the public. These products are available through the HST Archive, as are non-proprietary Hubble Space Telescope data. The Office of Public Outreach is taking a pro-active role to inform the public that these value-added materials are available on the World Wide Web and through ftp. The huge demand for these products precludes any custom production offerings of the materials, and therefore the data and images are made electronically available.

The copyright notice discusses commercial use of materials. It may come as a surprise the type of requests that ST ScI has received, therefore commercial usage is lightly screened, with the intent to promote appropriate use of the materials. It is clear in the copyright notice that AURA/ST ScI cannot endorse any product, philosophy, organization or group, even if permission to use the material is granted.

Usage of graphics, video, audio, animation and other products is described in detail in the copyright notice, which is available in full at our Web address: `http://www.stsci.edu`.

Institute News

The ST ScI May Symposium: The Extragalactic Distance Scale

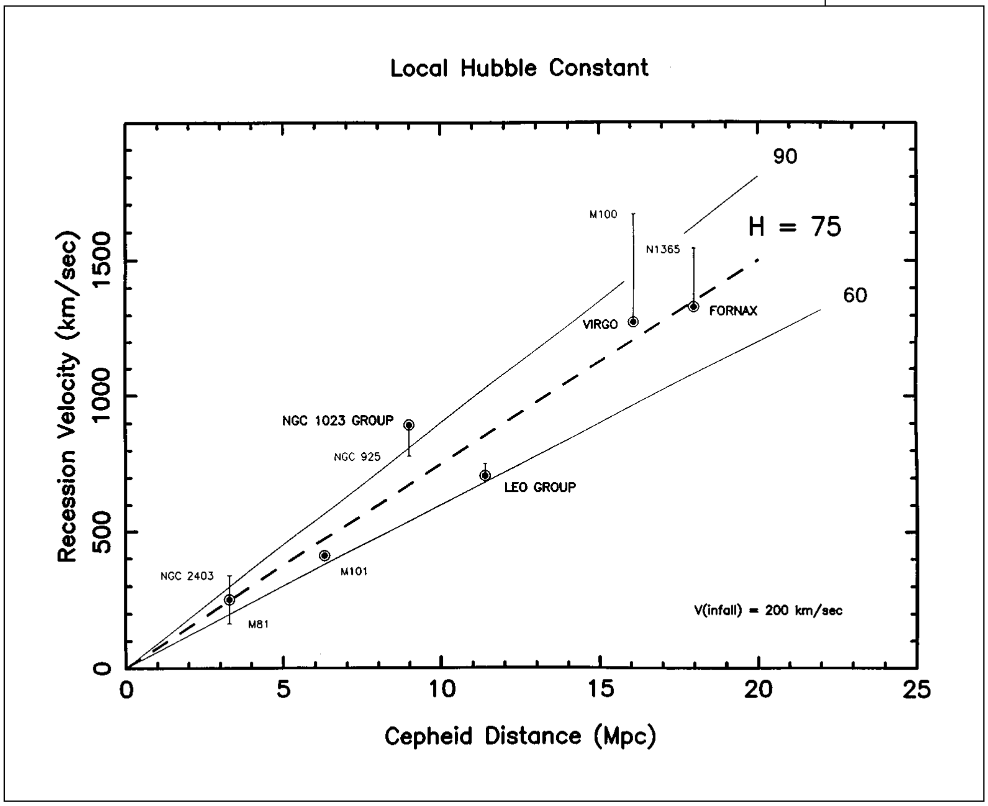
M. Livio

The ST ScI May Syposium took place in Baltimore on May 7-10, 1996. The topic this year was The Extragalactic Distance Scale. The 120 participants could agree on the questions, but not always on the answers. There were 24 invited talks, a poster session, and plenty of time for (sometimes heated) discussion.

Some background of the distance scale debate was first presented, both from a historical perspective and in terms of the science that is involved and the relations between the different cosmological parameters (H_0, q_0, the cosmological constant and the age of the universe). Limits on the age of the universe were presented from nucleocosmochronology and from the ages of globular clusters. For instance, recent calculations using isotopes of Th, U, and Eu seem to indicate a Galactic age of 13.8±3 Gyr. Progress in opacity and equation-of-state calculations results in an age for the globular clusters of about 14.5 Gyr, with a lower limit of about 12 Gyr. These limits place meaningful constraints on cosmological models.

The linearity of the Hubble flow must be established before any determination of the Hubble constant is discussed. Using the brightest cluster members, and supernovae Type Ia, it has now been established that variations in the Hubble constant are less than about 7% over a range of distances of 50 to 150Mpc. This effectively excludes the possibility that the Hubble constant has a relatively high value (e.g., 85 km/s/Mpc) locally, but a low value (e.g., 55 km/s/Mpc) globally.

Many methods of determining distances, or the Hubble constant, have been described. These methods typically rely on knowledge of the luminosity of some objects ("standard candles"), intrinsic physical sizes (geometric methods), velocities, or other relations between some of the properties of the objects (e.g., the luminosity and the velocity). Some of the methods are already producing results with relatively small (~10%) formal errors, but some are only in their early stages in terms of applications.



The classic Hubble diagram for Cepheids in nearby galaxies, courtesy of W. Freedman and the Key Project Team.

The basic goals of the HST Distance Scale Key Project have been to determine Cepheid distances to about two dozen galaxies, in order to calibrate a variety of other methods (e.g., The Tully-Fisher relation, the planetary nebulae luminosity function, supernovae Type I and II), and to test for systematic errors. A number of galaxies in the Virgo and Fornax clusters now have Cepheid-determined distances, and based on that, the Key Project now reports a Hubble constant of about 73±10 km/s/Mpc. A few other methods give similar results. For example Type II supernovae (the expanding photosphere method) give 73±7, the luminosity function of globular clusters gives (for M87 and Fornax): 75±10, and the luminosity function of planetary nebulae, now applied to 34 galaxies, gives 75±7. When the brightness vs. rate-of-decline relation is used for Type Ia supernovae, to reduce the scatter, this method yields a Hubble constant of about 65±5 km/s/Mpc. The Tully-Fisher relation, when applied to galaxies with calibrators gives 70±5.

However, Type Ia supernovae appear to yield a different result if one uses only supernovae which are essentially identical in terms of their spectral properties ("Branch normals").

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The 1997 Servicing Mission to HST: Checking Out the New Instruments

by Carl Biagetti

As you probably know, that a second Servicing Mission (SM2) to HST is scheduled for launch on February 13, 1997. At that time STIS and NICMOS will replace GHRS and FOS, a replacement FGS will be installed, and other parts of the telescope will be replaced or upgraded. This is all part of the plan for servicing HST every three years.

These new items must be carefully configured and tested after they are installed, in order to fully understand and confirm their operating characteristics, and to avoid any harm to them or other components on HST, and to commission them for normal science operations. The plan for that testing is called Servicing Mission Observatory Verification, or SMOV.

HST gets released from the Orbiter about seven days after the Shuttle launch, on February 20; this is when SMOV begins. SMOV has four parts:

1) the commissioning of the newly installed Science Instruments (SIs), which are NICMOS and STIS;

2) the recommissioning of the existing SIs (WFPC2, FOC, and two FGSs);

3) the recommissioning of other Observatory subsystems (e.g., the integration of the new FGS into the Pointing Control System); and

4) the execution of Early Release Observations (EROs).

SMOV is based on three fundamental policies: 1) Minimizing the downtime of the SIs and the entire Observatory, so that normal science observations may proceed as soon as possible after the Servicing Mission; 2) Maintaining the observing efficiency of HST at as high a level as possible during SMOV; and 3) Basing SMOV activities as much as possible on normal scheduling and on-board command and control systems. These goals and policies result in relatively quick resumption of Cycle 6 WFPC2 and FOC observations, while NICMOS, STIS, and the new FGS undergo more elaborate and deliberate commissionings. NICMOS and STIS observations (as part of Cycle 7) will be phased in as their operating modes become enabled.

The design of SMOV follows from several constraints. One of the most important of these is the potential for molecular contaminants introduced by new instruments and mechanisms. The Shuttle environment could also introduce such contaminants. Prevention measures include a WFPC2 cool-down procedure that occurs in steps and which is coordinated with UV sensitivity monitoring and decontamination procedures. For the same reason, the redeployment of the COSTAR arms that hold the FOC correcting mirrors will wait for at least 16 days after SMOV starts, just as was done when COSTAR was installed in 1993. Additional anti-contamination measures will be taken to prevent any possible polymerization of these outgassing molecules by ultraviolet photons. The only UV source strong enough to do this and to which HST is normally subject is the sunlit portion of the Earth’s surface. Therefore special operational constraints will prevent the exposure of HST’s focal plane to the “bright Earth” during the first 12 days of SMOV. This means, in effect, that HST must remain pointed in the Continuous Viewing Zone (CVZ) during these first 12 days.

This mitigation of any contamination means, of course, that science observations with FOC or WFPC2 cannot resume for 12 to 16 days.

WFPC2 Cycle 6 observations should resume about two weeks following release, and for FOC (f/96) they start in about three weeks. While WFPC2 and FOC are being readied for more Cycle 6 observations, NICMOS, STIS, and the new FGS all undergo a more elaborate SMOV commissioning plan. Both STIS and NICMOS go through engineering activation, followed by optical alignments, checking target acquisitions and locations of apertures in the HST focal plane, and initial calibrations. This means demonstrating and verifying that the instruments work, showing that the SIs can perform science observations, and then starting the Early Release Observations (EROs).

For NICMOS, the HST environment is critical, and so that environment must be characterized and its effects on NICMOS operations assessed. This includes plans to determine the thermal background flux of HST; this could result in adjustments to Cycle 7 long-wavelength science programs (e.g., exposure times). We will also determine appropriate avoidance contours for the South Atlantic Anomaly (SAA) and Earth-limb avoidance angles. The NICMOS plan uses about 80 orbits of prime pointing (this does not include the ERO program), as well as parallel operations and internal calibrations. The pace for these activities is partially constrained by the need for the cryogenically cooled instrument to reach thermal equilibrium. This period is estimated to be several weeks, but it will not be known with certainty until NICMOS is actually in HST. We anticipate that NICMOS will be ready for Cycle 7 observations in late April or early May of 1997, and ERO observations will occur as early as is technically possible.

The STIS plan is similar, with upwards of three dozen activities that provide separate check-outs for the CCD and the two MAMAs. Some internal measurements are done in parallel with tests requiring external targeting (such as various kinds of CCD target acquisitions, target/slit centerings and peak-ups, camera mode image quality, sensitivities, throughputs, etc.). Because STIS now has an external shutter, it is less sensitive to the HST environment. As a result, the SMOV schedule for STIS is determined by the many modes, slits, and apertures that need to be tested and analyzed even for a minimal enabling

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The Next-Generation Space Telescope

John Mather and Peter Stockman

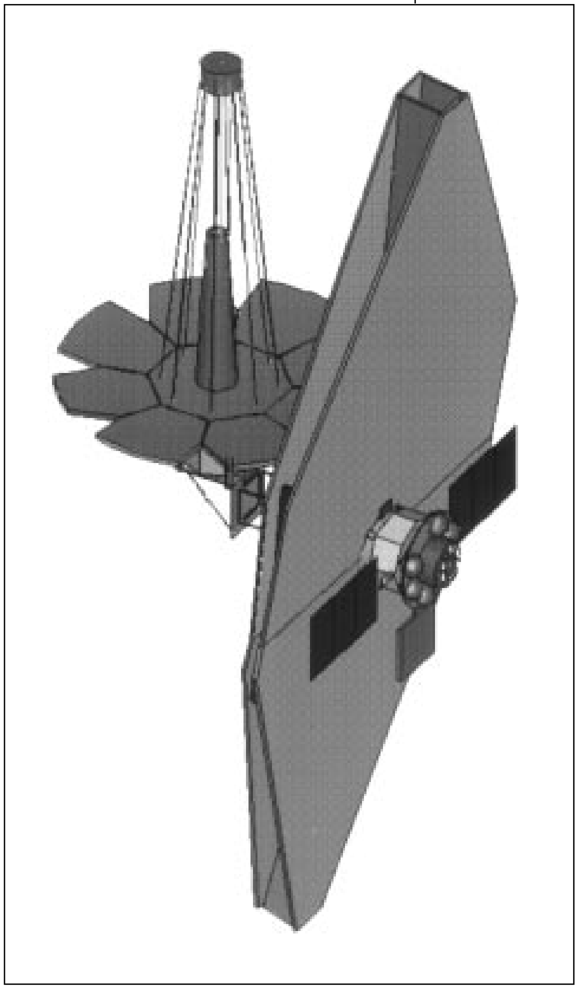
AURA's HST and Beyond Committee recognized the enormous scientific capabilities of a large-aperture, infrared-optimized space telescope and recommended strongly that such a mission be developed to follow the HST and SIRTF programs. The Committee, chaired by Alan Dressler, recommended a passively cooled telescope with the core mission of studying the early formation of stars and galaxies at high redshift. For these studies, a diameter of 4 m or more provides resolution comparable to HST (corresponding to scales lengths of about 1 kpc at high redshift) and the sensitivity to detect the compact, essentially unresolved star forming regions in early galaxies ($3 < z < 10$). The HST&B report also lists a wide range of scientific research which would be enabled by such a facility in both the optical and FIR (far infrared), but cautions that the mission should be driven by its performance in the NIR (near infrared).

NASA HQ has chartered Goddard and the ST ScI to lead the study of such an instrument, with the guidance that it should cost no more than $500M to construct, and should fit within an Atlas IIAS launch vehicle. There are now three teams doing studies. The Government-led team is managed by John Campbell, John Mather is the Study Scientist, and Peter Stockman leads the ST ScI effort and co-chairs the Science Working Group. Bernie Seery is the Systems Engineer and leads the spacecraft team. Pierre Bely (ST ScI) leads the science module team, and John Humphreys (MSFC) leads the telescope team. Keith Kalinowski leads the operations team, and Richard Capps leads the JPL effort. Rob Kennicutt chairs the Science Advisory Committee, which reports to Ed Weiler, the head of the Origins Program at NASA Headquarters. Frank Martin of Lockheed chairs the Industry Advisory Board. Collaboration with European and Japanese colleagues and institutions is certainly of interest but discussions have just begun. There are also two industrial consortia, recently selected to do completely independent studies, that will be reported Aug. 15. The TRW team is led by Dr. Chuck Lillie, and the Lockheed team by Domenick Tenerelli. The results will be merged for a combined Interim Report in November.

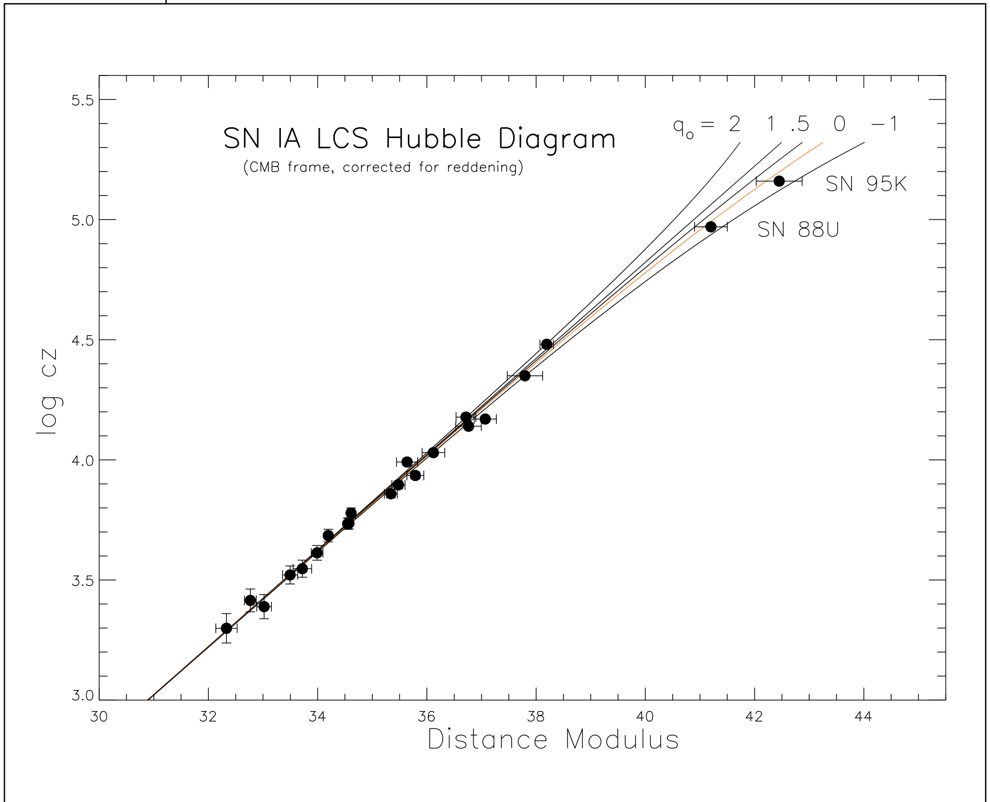
It appears possible to build a deployable telescope of the order of 8 m in diameter. It would be placed in an orbit far from Earth, like the Lagrange point L2, or a solar drift orbit like SIRTF, so that it could cool to around 30 K by radiation. At that temperature, InSb detector arrays could cover the 0.5 to 5 micron wavelength range without additional cooling. With some additional effort, hydrogen and helium coolers could enable the use of silicon BIB detectors, working to wavelengths around 40 microns.

The NGST demands careful use of new technology. The deployment of a large mechanical structure to hold up the mirrors requires great care in design. The mirrors will have to be adjusted after launch, and to achieve a low enough weight they will have to be very thin. New materials and processes make this possible, and there is a wide range of choices. The traditional silica, aluminum, or beryllium mirror elements could be used with suitable supports and adjusters, but silicon carbide or replicated optics on graphite fiber reinforced composites may be superior.

Public participation is invited. Volunteers for the Science Working Group are welcome; contact John Mather or Peter Stockman (`mather@achamp.gsfc.nasa.gov; stockman@stsci.edu`). Volunteers for engineering work should contact the lead engineers of the NGST study. Some details are available on our Web site: `http://saturn1.gsfc.nasa.gov/ngst/`



A design concept for the Next Generation Space Telescope. Shown is the deployed primary and secondary mirrors, the large sunshield with solar arrays and phased array antenna, and a module containing the warm spacecraft electronics and pointing system. The radiatively cooled instrument module is behind the sunshield and below the deployed primary mirror. (GSFC)



The Hubble Diagram for Type-Ia supernovae. The lines show the distance-redshift relation for five possible values of the deacceleration parameter, q_0. The distance estimates to the supernovae have been corrected for variations in intrinsic luminosity and interstellar dust absorption based on properties of their light curves. The light curves of the low-redshift supernovae are from the Calan-Tololo sample combined with data from a continuing program at the Center for Astrophysics. SN1995K, at z=0.48, was the first of many high redshift supernovae to be discovered and studied by the High-Z SN Search Team. A consistent comparison between local SNe-Ia and those at z>0.3 will provide a direct estimate of the deacceleration parameter. The High-Z SN Search, an international effort made up of astronomers at MSSSO, CTIO, Cfa, U. Washington, ESO, UC Berkeley, U. Michigan, and U. Arizona.

Where are the Preprints?

To save space we have dropped the ST ScI Preprint list, but you can easily find it yourself on the Web. Start at:

`http://www.stsci.edu`

then look under "`STScI`," "`Library and Publications`," "`Preprint Services`,"
and "`STScI Stepsheet`." If you search on "`STScI 96`" you'll get (mostly) current Institute preprints.

May Symposium *from page 13*

For such a homogeneous group, the claim is that there is no need to correct for the brightness vs. rate-of-decline relation. When the Type Ia supernovae are calibrated with Cepheids and used as standard candles in galaxies in Virgo and Virgo south, a value of about 55±5 km/s/Mpc is obtained. This makes it appear that the differences between the "high" and "low" values of the Hubble constant have now been reduced to about 20%. This represents the enormous progress achieved in recent years.

A few other methods described in the Symposium are extremely interesting, either because of their potential to lead to independent determinations, or because of the physics involved and the potential to learn other properties, or both. These methods include gravitational lensing, the Sunyaev-Zeldovich Effect, surface brightness fluctuations, light echoes, and a variety of distance indicators such as: novae, Tip of the Red Giant Branch (TRGB) stars, Post-Asymptotic Giant Branch (PAGB) stars, and detached, eclipsing, spectroscopic binaries (the latter, using the EROS, OGLE and MACHO microlensing databases).

In addition to the determination of H0, we can hope that some of the methods, like Type Ia supernovae, will lead to a determination of q_0, and possibly the cosmological constant. For instance, the illustration at the left shows that supernovae may be able to yield distances accurate enough to discriminate among different values of q_0.

Sabbatical Visitors at ST ScI

With the goal of promoting the exchange of ideas and collaborations in HST-related science, ST ScI can support scientists who wish to visit here. Terms are typically three to six months, as an adjunct to a sabbatical leave from a home institution. In general, visitors have the status of ST ScI employees, and have access to the facilities available to staff members, including the National Center for Supercomputing Applications.

Established scientists who are interested in such a visit should send a letter specifying the suggested period for the visit, and any other relevant details, to the Visiting Scientist Program, c/o Nino Panagia (panagia@stsci.edu) at ST ScI. Applicants should also include a statement of research plans and a copy of their curriculum vitae. Applications can be submitted at any time of the year, but full consideration for visits planned during the summer of 1997 or during the academic year commencing in September 1997 will be given to applications received by February 1, 1997.

Sabbatical visitors for the academic year 1996-97 include Stanislaw Bajtlik (Copernicus Center, Warsaw), Russell Cannon (Anglo-Australian Telescope), Hilmar Duerbeck (University of Muenster), Juhan Frank (Lousiana State University), Vahe Petrosian (Stanford University), and Letizia Stanghellini (Bologna Observatory).

1997 Servicing Mission *from page 14*

of basic science capabilities. The STIS SMOV is currently expected to require over 120 orbits — not including EROs — of prime external targeting, and several days' worth of internal calibrations. At present, we expect to perform relatively simple CCD EROs (e.g., slitless spectroscopy) by late March 1997, with the rest of the EROs being performed several weeks later.

The SMOV plan will also commission the new FGS (called FGS-2R, the "R" being for "refurbished") so that it may be incorporated into the Observatory's pointing and control system (PCS). (Note that at least for Cycle 7 FGS-3 will remain the science astrometer.) FGS-2R is expected to be commissioned for fine guidance by early April, and that means, of course, that before then only FGS-1 and FGS-3 can be used for guiding during observations.

The SMOV plan consists of roughly 300 prime orbits, and over 100 additional orbits that can be scheduled as pure parallels with the primes. The observations span the interval from release in late February 1997 to late June. As mentioned above, we intend that the remaining orbits that are available during SMOV will be used for WFPC2 and FOC Cycle 6 observations, along with any Cycle 7 programs that are technically feasible before the nominal July 1 start date.

The ST ScI has formed a SMOV Team which is a major component of a GSFC-led SMOV Program. The team consists of several Instrument Scientists from the Servicing Mission Office of ST ScI, members of the NICMOS and STIS Investigation Definition Teams, and other ST ScI engineers and schedulers. This team has now defined SMOV requirements and documented a plan of coordinated SMOV activities. Our next major effort is the generation of the formal proposals that get converted into detailed commands for HST for next spring's commissioning activities.

Symposia and Announcements

Planets Beyond the Solar System and the Next Generation of Space Missions

16-18 October 1996
Space Telescope Science Institute
Baltimore, MD

This is a workshop to bring together scientists searching for extrasolar planets with those planning a new generation of space instrumentation. The program will include:

- New programs for the detection and study of planets (interferometry, photometry, microlensing)
- Recent progress in the search for extrasolar planets (radial velocity and astrometric programs, direct imaging)
- The astrophysical context of planet detection (proto-planetary disks, low-mass companions to stars, models of planet formation, astrophysical limits to the techniques)
- Spinoffs and benefits of planet detection programs (astrophysics using small-field interferometry, NGST)

For more information contact `soderblom@stsci.edu`, or check the ST ScI Web pages.

The Scientific Impact of the Goddard High Resolution Spectrograph

11 - 12 September 1996,
Goddard Space Flight Center,
Greenbelt, MD USA

In February, 1997 the Goddard High Resolution Spectrograph (GHRS) is scheduled to be removed from the Hubble Space Telescope. This will mark the end of nearly 7 years of outstanding service in ultraviolet spectroscopy involving all branches of astronomy. To commemorate the accomplishments of the GHRS, the Science Team is sponsoring a two-day scientific symposium, which will include about 20 invited review papers as well as contributed posters. The presentations will deal with GHRS observations and will cover a wide range of topics, including cosmology, galaxies, stellar physics, the interstellar medium, planets and atomic physics. A proceedings of the conference will be published and distributed to all participants.

Further information may be obtained from: `hrssymp@hrs.gsfc.nasa.gov`. If you have any questions please contact:

Tom Ake
Co-Chair, LOC, Code 681/CSC
Goddard Space Flight Center
Greenbelt, MD 20771
`hrssymp@hrs.gsfc.nasa.gov`

ESA Fellowships at ST ScI

We remind astronomers of ESA member countries that they may come to do research at ST ScI as an ESA Fellow. ESA Fellowship candidates should aim to work with a particular member or members of the staff at ST ScI, and, for this reason, applications must be accompanied by a supporting letter from ST ScI.

Information on the scientific interests of staff members at ST ScI can be obtained from Dr. N. Panagia (`panagia@stsci.edu`). Applicants can also learn this by reading the Annual Report of ST ScI, the most recent of which is in the Bulletin of the American Astronomical Society, 1996, vol. 28, p. 588.

Details of the ESA Fellowships and application procedures can be obtained from the Education Office, ESA, 8-10 rue Mario Nikis, 75738 PARIS 15, FRANCE. Completed application forms must be submitted through the appropriate national authority, and should reach ESA no later than 31 March for consideration in May, and no later than 30 September for consideration in November. A copy of the completed application should be send to the Chairman of the Postdoc Selection Committee (currently Dr. M. Fall) at ST ScI, 3700 San Martin Drive, Baltimore, MD 21218, USA.

The starting date for an ESA Fellowship must be negotiated with the Research Programs Office at ST ScI at least 2 months before that date.

We now have one ESA Fellow at ST ScI, Nicola Caon, who is studying elliptical galaxies.

Tenure for Meg Urry

Dr. C. Megan Urry was promoted last year to Associate Astronomer with tenure at ST ScI. Meg came to the Institute in 1987 as a post-doc, and then joined the staff as Assistant Astronomer in 1990. She comes from a science-oriented family (father a chemistry professor, mother with degree in zoology, many relatives in related fields), and had science or math as a likely goal, but she did not come into astronomy until after her junior year in college. The turning point was a summer internship at NRAO, following a suggestion from her father. That lit the spark (and continuing strong friendships), and led to graduate school at JHU. At that time the JHU department was Physics, but within a few years JHU was designated as the host for ST ScI and Hopkins astronomy came to the fore.

In her first summer at JHU, Meg worked at Goddard Space Flight Center in the x-ray group. That led to a thesis with R. Mushotzky (GSFC) and A. Davidsen (JHU) titled "X-Ray and Ultraviolet Observations of BL Lacertae Objects." Meg's thesis went beyond just x-ray or ultraviolet astronomy to put more pieces together into a multi-wavelength study of AGNs, work she continues today. After completing her degree she spent three years at MIT as a post-doc with C. Canizares before joining us at ST ScI.

In addition to her key work on AGNs, Meg has been closely identified with a meeting held at STScI in 1992 titled "Women at Work: the Status of Women in Astronomy." An important product of that meeting was the "Baltimore Charter," a statement of principles, recommendations, and a call to action (see the ST ScI Newsletter for September, 1993). This Charter was written by the 200+ participants of the Workshop and has been utilized widely in the astronomical community.

Meg's husband, Andrew Szymkowiak, is an astronomer at GSFC, and they have two children, Sophia (2) and Amelia (5). Those children are their primary joy and challenge, but she is also an avid reader of current fiction, has a soft spot for opera, and lifts weights to concentrate on none of the above.

Archive News from page 11

Archive Documentation

A new version of the Archive Primer was released in March, 1996. This Primer supersedes the first 3 chapters of the Archive Manual. A new Manual is expected to be available by July, 1996. Since many aspects of the database structure and archive accessibility are expected to change rapidly in the next 6 months, we will post changes to our Web site as they occur, and publish them as they settle. The basic core capabilities of StarView will remain, but Web access will expand and evolve and the structure of the databases, relevant to advanced custom queries and to queries regarding associated datasets from NICMOS and STIS, will change. Stay posted!

Calendar

Cycle 7 Proposals

Call for Proposals mailed	1 June 1996
Update to CP information available on Web	15 Aug
Proposals due (see CP)	6 or 13 Sep
TAC panels meet	28 Oct to 6 Nov
TAC meets	18 to 20 Nov
Decisions mailed to proposers	31 Dec (tentative)
Phase II Proposals due	February 1997 (tentative)
Observations begin	July 1997

Cycle 8 (tentative):
same dates, advanced by one year

Second HST Servicing Mission Launch
13 Feb 97 (tentative)

The following workshops are being planned for the coming year:

Multi-Wavelength Digital Sky Surveys,
August 26-30 (this is IAU Symposium 179).
Local scientific contact is Marc Postman.

Planets Beyond the Solar System and the Next Generation of Space Missions
see previous page

The Sixth Annual Hubble Fellows Symposium
(date TBD)
Local scientific contact is Howard Bond.

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How to contact us:

First, we recommend trying our Web site: `http://www.stsci.edu` You will find there further information on many of the topics mentioned in this issue.

Second, if you need assistance on any matter send e-mail to `help@stsci.edu` or call 800-544-8125. International callers may use 1-410-338-1082.

Third, the following address is for the HST Data Archive:
`archive@stsci.edu`

Fourth, if you are a current HST user you may wish to address questions to your Program Coordinator or Contact Scientist; their names are given in the letter of notification you received from the Director, or they may be found on the Presto Web page (`http://presto.stsci.edu/public/propinfo.html`).

Finally, you may wish to communicate with members of the Space Telescope Users Committee (STUC). They are:

Ted Snow (Chair), U. Colorado, `tsnow@casa.colorado.edu`
John Bally, U. Colorado
John Clarke, U. Michigan
Alex Filippenko, U.C. Berkeley
Bob Fosbury, ESO
Marijn Franx, Kapteyn Astron. Inst.
Laura Kay, Barnard College
Regina Schulte-Ladbeck, U. Pittsburgh
Rodger Thompson, U. Arizona
John Trauger, JPL
Will van Breugel, Lawrence Livermore
Fred Walter, SUNY Stony Brook

The next meeting of STUC will probably occur in Nov., 1996.

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