



SPACE TELESCOPE SCIENCE INSTITUTE

Newsletter

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An Update on NICMOS

As most of you know, NICMOS, which was installed in *HST* during the Second Servicing Mission in January, subsequently had an anomaly related to its dewar. As a result, it is

anticipated to have a useful lifetime of only about 1.6 years, roughly one third of the originally expected lifetime. In addition, expansion of the dewar led to motion of the cold-well, changing the focus of all three cameras from their nominal values, and pushing NIC3 beyond the usable range of the internal (PAM) focus mechanism. NIC1 and NIC2 are still well within the PAM range.

In early April the expansion stopped and the cold-well began moving back slowly towards its nominal position. Although the bench has moved back about half of the distance required to bring NIC3 into the range of the PAM, there is no guarantee that the motion will continue and allow NIC3 to be focused via the PAM. It is, however, possible to bring NIC3 into focus by moving the *HST* secondary mirror.

Despite these problems, many aspects of NICMOS performance are outstandingly good. Cameras 1 and 2 have excellent image quality and the thermal backgrounds are lower than expected, resulting in greater instrumental sensitivity than predicted and enhanced scientific capability.

In response to the NICMOS situation, and following recommendations developed by the Space Telescope Users Committee and by an Independent Science Review commit-

tee chaired by Malcolm Longair, which met at the STScI on 29-30 May 1997, the STScI is taking certain actions to optimize the science productivity of *HST*. Our intent is to implement a balanced *HST* observing program enabling the best possible science which requires NICMOS, while continuing to support other programs which use the unique capabilities of the new STIS and the existing WFPC2, FOC, and FGS instruments. We are also very aware of the need to facilitate the completion of prior cycle programs which were delayed by the servicing mission.

Based on the recommendations we received, we are:

- (1) Increasing the observing time allocated for NICMOS programs to between 40 and 50% of the total *HST* observing time between now and the end of its life, assuming that is approximately November 1998.
- (2) Issuing a special NICMOS Call for Proposals in early July, with a deadline for submission in early September 1997.
- (3) Planning for the possibility of a limited number of special observing campaigns to allow for focusing of NIC3 via secondary mirror movement.

The purpose of the new CP is to solicit only NICMOS observing programs. We will not accept proposals

for observing with other instruments, for archival research, or for parallel observations. NICMOS snapshot proposals will be accepted. The TAC for this solicitation, currently being recruited, will meet in early October, and the accepted proposals will start being carried out in January 1998. Since a substantial number of Cycle 5 and 6 observations remain to be implemented, and since NICMOS originally accounted for only about one quarter of the Cycle 7 time, execution of Cycle 7 WFPC2, FGS, FOC and STIS science observations will be stretched out over a lengthened period. Cycle 7 will now nominally run through February or March 1999.

Further information about the special solicitation and the status of the Observatory can be found in the CP and on our web-site. An updated NICMOS Instrument Handbook will be electronically available in mid-July. NICMOS calibration observations and non-proprietary parallel exposures are available. A web page,

http://archive.stsci.edu/pure_parallels.html

has been set up to quickly show users what observations have been done in these programs, with the most recently archived datasets listed first.

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Director's Perspective

Bob Williams

The second servicing mission is now behind us, and the observatory verification, i.e., re-commissioning, of *HST* is almost completed. In spite of initial concern over certain anomalies with the new instruments, we have now calibrated most of the important characteristics of both STIS and NICMOS, and it is clear that we have two functioning instruments that are capable of obtaining excellent data. Already the telescope scheduling is largely devoted to GO science programs, and excellent spectra have been obtained with the STIS MAMAs in the UV in the echelle mode, and in the optical with the CCD.

For NICMOS, the quality of the images from the NIC1 and NIC2 cameras is superb, and the detector noise is significantly lower than expected, making observations in the K-band viable. There remain two significant problems with NICMOS that are now being worked, viz., the thermal short that is causing increased cryogen depletion, leading to a shortened lifetime of approximately 18 months if conditions do not change, and the slight dewar deformation that has caused the wider field NIC3 camera to not be confocal with cameras NIC1 and NIC2.

The Independent Science Review (ISR) committee, chaired by Malcolm Longair, recently met at the Institute to consider the best action to be taken in this situation, and as is reported elsewhere in this issue they have recommended that we concentrate immediately on implementing approved Cycle 7 NICMOS GO and GTO programs, and that we augment the Cycle 7 science program with additional NICMOS programs in order to be able to schedule NICMOS observations on *HST* between 40 to 50% of the time, until the cryogen is depleted. A Call for Proposals for additional NICMOS programs has already been issued, with a due date for proposals in early September. The ISR also recommended that we undertake several special campaigns of NIC3 observing, which may require re-focusing the telescope to accommodate.

On other fronts, I am happy to report that (1) development of the Advanced Camera is proceeding, scheduled for installation on the third servicing mission (December 1999), (2) the near-term funding for GO data reduction remains healthy, at levels commensurate with those of previous Cycles, (3) as a result of *HST*'s scientific productivity and NASA's recent strategic planning exercise, the agency is giving serious consideration to extending operation of *HST* beyond 2005, and (4) funding of technology development for the Next Generation Space Telescope is proceeding, along with science studies aimed at identifying the important capabilities that NGST should have to address certain important scientific problems such as star formation and galaxy formation.

And finally, you the user community deserve a great deal of credit for your creativity in formulating the observing programs that have led to such interesting results from *HST* that we continue to read about in the journals.



*HST Recent Release:
M84's Black Hole*

Placing the STIS slit across the nucleus of galaxy M84 yielded this spectral signature of a supermassive black hole. The observation was made during STIS commissioning.

Credit: G. Bower, R. Green, STIS IDT

NICMOS update from page 1

This is a very ambitious schedule, which places demands on the user community, on the STScI and instrument teams, on NASA, and on the astronomers who are volunteering to serve on the special TAC, to whom we are very grateful. As the ISR stated: "It is important for the community and the STScI to appreciate that this is an exceptional situation and will require exceptional efforts..." We will continue to do everything possible to help the community make the best use of *HST*, and look forward to a scientifically productive Cycle 7.

Ethan J. Schreier

HST Science Headlines

Bursts of Knowledge

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Although Gamma-Ray Bursts (GRBs) have now been observed for a quarter of a century, until this year their nature and distance were only poorly constrained by observations. Data from one of *HST*'s sister Great Observatories, the Compton Gamma-Ray Observatory, have shown that GRBs are distributed uniformly on the sky (see Figure 1), and that there is a relative dearth of faint bursts, indicating that the observed bursts are falling-off in density after some characteristic distance. Yet the data do not allow one to distinguish empirically between models that place the characteristic distance at the Oort cloud, in the halo of our galaxy or at $z \sim 1$. This disappointing situation has changed dramatically, however, with the recent discovery of optical counterparts to two GRBs.

The credit for this development goes largely to an innovative search for an x-ray afterglow from GRBs undertaken by a team of astronomers, led by Enrico Costa, using the Italian Beppo-SAX spacecraft. The Wide Field Cameras (WFCs) on SAX survey approximately 5% of the sky at any one time, while the Gamma-Ray Burst Monitors (GRBMs) aboard the spacecraft are sensitive to bursts over the whole sky. When the Gamma-Ray Burst Monitors on SAX show evidence of a GRB, the contemporaneous WFC exposures are now examined for evidence of a simultaneous x-ray flare. Should such a flare be detected in one of the WFCs (which can provide a crude position), SAX slews so that within a matter of hours the satellites Narrow Field Instruments (NFIs) are pointed to search for and localize an x-ray afterglow. In three cases this year, the NFIs have detected x-ray afterglows, and have provided coordinates accurate to better than one arcmin, and in two of these instances the x-ray detection has been followed by the discovery of an optical counterpart.

The first of these optical detections occurred in late February, when SAX detected and localized the burst GRB 970228 (a burst's name is its UT date) to a region 50 arcsec in radius. Within 24 hours, a group headed by Jan van Paradijs had a WHT image of the field that showed a faint point source that was undetected when the group looked again on the 8 March.

Because of the unique scientific opportunity afforded by this detection, the Director of STScI, Bob Williams, authorized a group led by Kailash Sahu (STScI) to observe the source with *HST* (Figure 2). Images of the field were taken in *V* and *I* using the WFPC2 Planetary Camera on the 26 March and 7 April. The images reveal a faint nebulosity adjacent to the point source, which is identified as the GRB optical counterpart. Unfortunately, the source is in the ecliptic and was relatively near the sun at the time of these exposures. Thus the background is high, and the signal-to-noise ratio of the images is correspondingly low. Sahu and collaborators were therefore not able to unambiguously identify the nebulosity as a galaxy — a discovery that would have strongly supported the view that the sources are at cosmological distances. Similarly, Keck spectra of the optical transient displayed only a featureless continuum, and thus provided no indication of the distance to the source.

A second localized burst, GRB 970402, passed without an optical detection, but fortunately, the third time was a charm. An optical transient associated with GRB 970508 was independently discovered by Howard Bond (STScI) and George Djorgovski (Caltech) within hours of the gamma-ray outburst, and has been frequently observed by telescopes across the globe thereafter. The combined photometry from many IAU circulars shows a source which rose from its discovery *R* band magnitude of 21 to

R~20 two days after the initial burst, and which has declined on a power-law with exponent $\alpha \sim -1.1$ thereafter. A number of authors have pointed out that this behavior can be explained by

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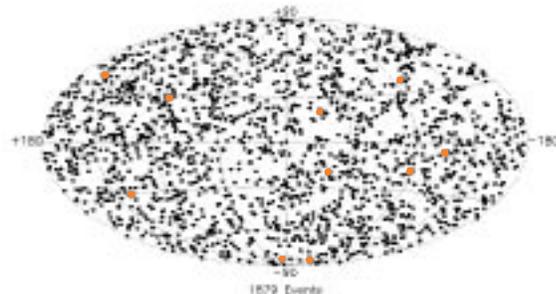


Figure 1: The distribution of over 1800 GRBs detected by the BATSE instrument aboard the Compton Observatory. The ten most recent bursts (as of June 18) are shown in orange. Credit: R. Mallozzi, the BATSE team and NASA.

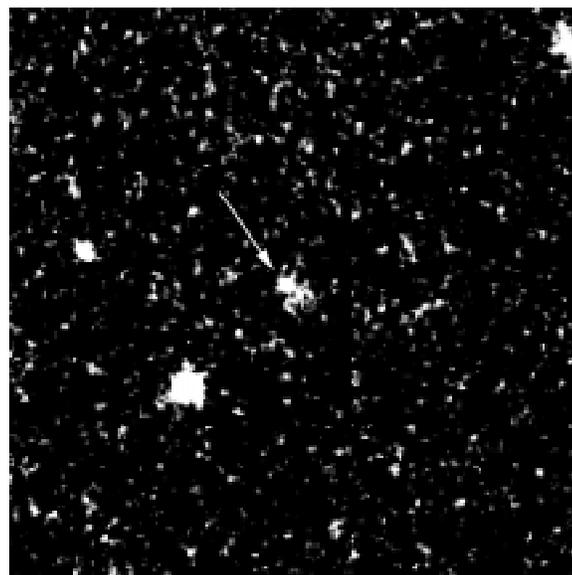


Figure 2: An *HST* Planetary Camera image of GRB 970228. An arrow points toward the optical transient. The nebulosity is visible immediately below and to the right of the optical transient. Credit: K. Sahu and NASA

Gamma-Ray Bursts from page 3

the expansion of a relativistic fireball into an inhomogeneous medium. However, the proof that this is an extragalactic phenomenon has come from Keck, where Mark Metzger and colleagues have obtained spectra showing intervening absorption systems at $z=0.768$ and $z=0.835$. The

latter system displays not only Mg I absorption but also [O II] emission, suggesting that the optical transient is coincident with a dense region of interstellar matter likely belonging to the host galaxy.

A group led by Elena Pian and myself was given 3 orbits of Directors Discretionary time to attempt to image the possible host. Two of these orbits were used to image in the clear filter mode of the STIS CCD, and one orbit was employed to observe in the NICMOS *H* band. The reduced STIS image is shown in Figure 3. The optical transient is clearly visible in the center of the image, as an $R=23$ mag point source. However, one can conservatively state that there is no evidence for nebulosity around the source brighter than $R \sim 25$. Similarly, the NICMOS image show only an $H \sim 20.8$ source at the position of the transient. It appears implausible that the two faint ($R \sim 25$ mag) galaxies visible a few arcsec from the optical transient could be responsible for the Mg I absorption or [O II] emission (at $z \sim 0.8$ the line of sight passes ~ 30 kpc from the center of these objects).

Therefore, the host galaxy of the GRB

is likely hidden by the glow of the transient. If the host is the $z=0.8$ absorption system, then it has a luminosity less than one-tenth L_* . The Hubble Deep Field, among other studies, has shown that sub- L_* galaxies at $z \sim 1$ are responsible for a substantial amount of the star-formation that has occurred in the history of the universe, and thus this observation may provide some encouragement to models, such as merging binary neutron stars, which associate GRBs with star formation. However, it will require further observations to be sure that there truly is a dwarf beneath this giant outburst.

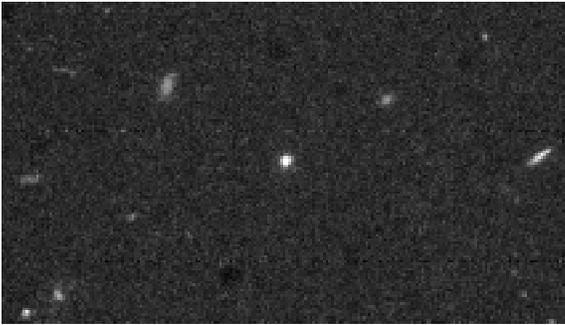
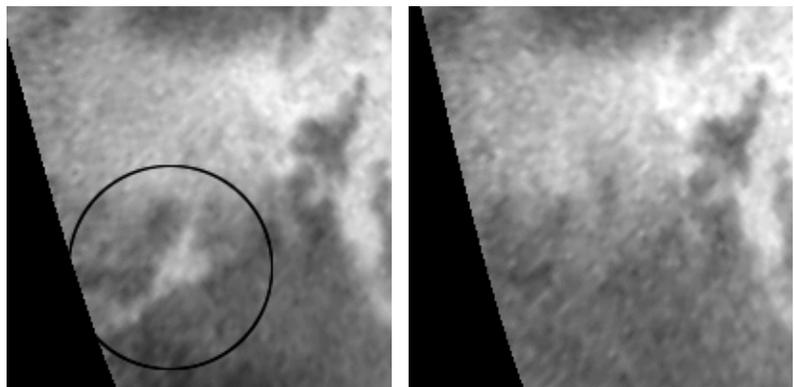


Figure 3: A STIS CCD image of the field surround GRB 970508. The optical transient is the point source at the center of the image. Two faint galaxies, each about four arcsec from the transient, can also be seen. Although this exposure represents only two orbits of integration, due to the remarkable efficiency of the open STIS CCD, it is within one magnitude as deep as the deepest single filter image of the HDF. Credit: E. Pian, A. Fruchter and NASA.

HST Recent Release: Mars

These Hubble images, taken to monitor weather conditions near the Pathfinder landing site, show that a large dust storm dissipated during the twelve days separating the two observations.

Credit: S. Lee, P. James, M. Wolff



News for Proposers and Observers

Non-proprietary STIS and NICMOS Parallel Observations

Ron Gilliland, STScI gillil@stsci.edu

The capability of *HST* to obtain parallel observations has been vastly expanded with the addition of NICMOS, STIS and the Solid State Recorder. Likewise the value of pure parallels is very high given three imaging instruments, all of which can operate in parallel with each other, and each of which provides unique capabilities for parallel science studies. The Cycle 7 Telescope Allocation Committee recognized the expanded capability of *HST* for pure-parallel science, and recommended that STScI take on the task of managing large, archival pure-parallel programs as a community service. Data to be obtained in such programs will be made available immediately to the full community via the *HST* archive.

Pure-parallel, archival observations with STIS and NICMOS have commenced as of 2 June 1997. These initial parallels are implemented with very simple single orbit exposure sets that are simply replicated onto as many opportunities as possible in a given week. As the ground system is developed further this summer, we anticipate that a new set of pure parallels will be implemented that more fully utilize the existing capability by using information on sky position and characteristics of the primary observing window to craft the individual parallel observations. A Working Group including Telescope Allocation and ST User Committee members and astronomers with interests in parallel science opportunities will provide recommendations on the appropriate science to address and the parallel observations needed to carry this out.

The current parallel observation units are these:

- For STIS, a short image with the CCD followed by a long G750L slitless spectroscopy exposure at the

longest wavelength setting (coverage from 6460-11490Å).

- For NICMOS, Camera 2 is in focus and the F110W, F160W and F222M filters (roughly J, H, K) are cycled through with the SPARS256 MULTIACCUM sequence. Simultaneously the F110W and F160W filters are used with NIC1 slightly out of focus, and F160W and grism, G141 are used with NIC3 significantly out of focus. Given the lack of parfocality of NIC3 with the other two cameras operated simultaneously, the grism observations are not expected to be scientifically useful. They will give useful technical data on the NICMOS background characteristics, however.

The proposal numbers for these community-support programs are 7675 and 7676 for STIS and NICMOS respectively, and 7700 and 7701 for shorter visit versions of the same that can fit in smaller opportunities. In the first two weeks, the ~40 minute parallel units for both STIS and NICMOS schedule about 15 times for one-orbit pointings of the prime, 6 times for 2 orbits, 6 for 3 to 4 orbits, and 6 for 5 to 10 orbits. The shorter ~20 minute parallel units receive a comparable number of "hits." As the fraction of time devoted to NICMOS prime observations ramps up to near 50%, the number of parallel opportunities will decline somewhat. As an illustration, a 6-orbit prime window results in total exposure times of 1800 s STIS/CCD clear image, 10,800 s for the G750L slitless spectroscopy, and 4608 s (F110W), 6144 s (F160W), and 4608 s (F222M) on NIC2. The STIS and NICMOS exposure time calculators may be used to determine how deep such exposures will go for your favorite objects — the limiting magnitudes are impressive for multi-orbit cases. For NICMOS the high

quality diffraction limited infra-red imaging, coupled with a lower than anticipated thermal background allow exceedingly faint limiting magnitudes particularly in the H band.

A web page,

http://archive.stsci.edu/pure_parallels.html

has been set up to quickly show users what observations have been done in these programs, with the most recently-archived datasets listed first. As of 20 June 1997 (from the first 2.5 weeks) there were for STIS 48 pairs of 300 s direct image and 1800s G750L slitless spectroscopy and 100 pairs of shorter exposure sets, and for NICMOS a total of 145 exposure sets (7 exposures per set over the 3 cameras) of which 85 make use of the long visibility period. Extensions of these programs, which may entail additional proposal IDs, will be incorporated in this web page in a transparent fashion. Registered archive users will then be able to retrieve the data through this page. Efforts are underway at the ST-ECF and STScI to provide data reduction and analysis software that will facilitate interpretation of these unique data.

The priorities for WFPC2 are to finish the approved Cycle 6 GO parallels before phasing in an appropriate archival, pure-parallel program. The Cycle 7 approved GO parallel programs will have high priority for execution beginning this fall when the more robust ground system implementation for parallels becomes available.

There is no proprietary period for the community service pure parallels, so these data will be the first STIS and NICMOS observations broadly available to *HST* users and may be used not only for science, but also to obtain a measure of how well the new instruments perform.

Space Telescope Users Committee May 1997 Meeting

Fred Walter, STUC Chair

The Space Telescope Users Committee (STUC) is an advisory body to STScI. It is composed of 12 users of *HST* who serve 3 year terms. The STUC has a dual role: to provide input and advice to the STScI and the *HST* project from the user community, and to inform the user community of issues being raised by the STScI and by the *HST* project. The STUC meets semi-annually, in May and November.

The STUC met on May 12 and 13, 1997. The primary topic was the expected short cryogen life of NICMOS, and how to maximize the scientific return from NICMOS while not neglecting the excellent science accepted for the other instruments. The STUC also discussed other issues relevant to users. The STUC made a number of recommendations to the project:

1. NICMOS observations should be given high priority, and a "delta" call for proposals should be issued

as soon as possible for NICMOS observations in 1998, prior to the loss of cryogen.

2. There should be at least one NIC-3 campaign, conducted by moving *HST*'s secondary mirror.
3. Development of a cryogenic cooler for NICMOS should be studied further, but development costs should not be taken from UPN 459 funds (GO and GTO support), or from funds for the 2002 instruments.
4. A major effort should be undertaken to ensure parallel observing capabilities with NICMOS and STIS.
5. Any plans to decommission WFPC2 or FGS for scientific use should be undertaken only after full consultations with the community.
6. STScI should provide additional support for new users.
7. The Sabbatical Visitor Program should be restored.

8. Archival data analysis funding should be available on an annual basis, and not be tied to the irregular GO cycle.

9. Plans should be undertaken for a servicing mission in the year 2005, and a new instrument should be placed in the *HST* at that time.

The full recommendations of the STUC, as well as the minutes of the meeting, are available on the STUC web page:

<http://www.stsci.edu/stsci/STUC/>

The next meeting of the STUC is planned for November 17 and 18, 1997. Users are encouraged to bring to the attention of the STUC any issues or concerns which affect their present or future use of the *HST* and its data products.

IRAF 2.11 and STSDAS

Perry Greenfield, STScI greenfield@stsci.edu

The Science Software Group will be releasing STSDAS v2.0 and TABLES v2.0 shortly after NOAO releases IRAF 2.11. Included as part of this release will be the new calibration pipeline software for both STIS and NICMOS, the software that produces the paper products delivered for all GO observations, and new analysis tools and utilities for dealing with the new data formats for STIS and NICMOS datasets. Also part of the release is an update to TABLES to handle FITS tables and some added capabilities to access arrays stored in table cells, the data format that will be used for STIS and NICMOS extracted spectra. Much of the new software written for this

release has been written in C using a C interface for IRAF developed at STScI.

This release *requires* IRAF 2.11 to work properly. IRAF 2.11 incorporates a new FITS image kernel which allows direct access to the data files produced for STIS and NICMOS, and many of the programs dealing with such data depend on this new image kernel.

Initially, IRAF 2.11 will only be available for Sun computers, with support for other platforms coming soon after. Currently a final release of IRAF 2.11 is planned for the second half of July. In order to provide GOs with a means of analyzing their data, both NOAO and STScI are providing the beta versions of IRAF 2.11 and STSDAS/TABLES v2.0 to the

community. The final beta for IRAF 2.11 should be available by the end of June. The beta for STSDAS/TABLES v2.0 should be available by July 17. Please refer to the STSDAS web page for the latest information:

<http://ra.stsci.edu/STSDAS.html>

Public Outreach and Education

Time for New IDEAS!

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The Initiative to Develop Education through Astronomy and Space Science (IDEAS) is a grant program that funds start-up educational outreach projects which team educators with astronomers and space scientists. The purpose of the program is to provide grants to enhance science education through astronomy and space science. IDEAS was developed in 1991 by the NASA Astrophysics Division to create more opportunities for scientists to share their knowledge and excitement about astronomy and space science with students, educators, and the general public. Today the program is administered by STScI and coordinated by the Office of Public Outreach on behalf of NASA.

The IDEAS grants program encourages scientists to use their talents and enthusiasm to undertake projects that promote greater mathematical, technological, and scientific literacy. The primary target of IDEAS

projects is the K-12 community of teachers, pre-service teachers, and students, as well as the general public.

In 1996, 35 proposals received grants out of 53 requests. What makes a successful IDEAS proposal?

- An astronomer or space scientist as Principal Investigator (PI) teams up with an education professional in a project where both will have an active role.
- The proposal contains well-defined and well-presented project goals.
- The proposal includes a plan to disseminate the results of the project.
- The proposal explains effectiveness of the proposed project on the target audience.
- The project is within the guidelines for IDEAS, e.g., educational basis, activities vs. products, etc.
- The budget is well-justified and within the NASA guidelines for IDEAS.

- The proposal shows a relationship to NASA's astronomy research, education outreach or data usage.
- The proposal has an evaluation plan.

The 1997 "Request for Proposals" will be going out in mid-July. The due date is October 15, 1997.

Funding for IDEAS grants is available in two grants sizes: small (up to \$10,000 maximum) and large up to (\$40,000). Preference will be given to requests for small grants with high leverage and impact. Funds may be used to support local travel, materials, stipends, etc. Funding for equipment is discouraged but allowed in exceptional circumstances.

For more information about IDEAS and to see the abstracts of awarded projects, visit our Web site at:

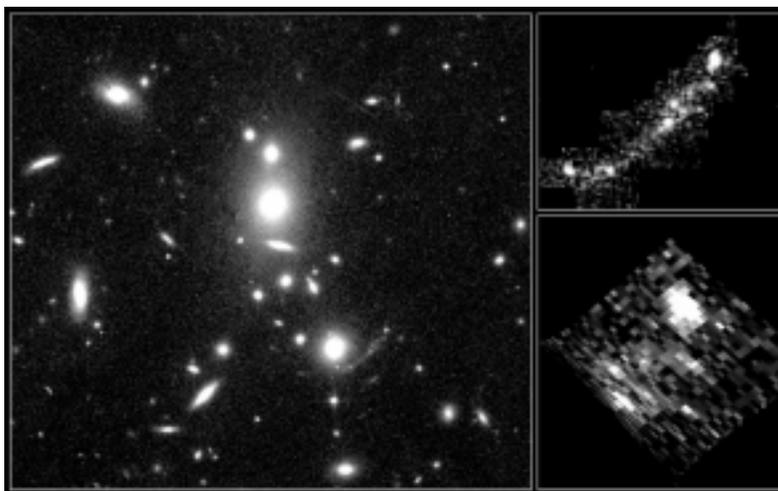
<http://www.stsci.edu/pubinfo/edugroup/ideas.html>

or send e-mail to ideas@stsci.edu.

Recent Release: Most Distant Galaxy

This WFPC2 observation of galaxy cluster CL 1358+62 revealed a gravitationally-lensed image of a more distant galaxy located far beyond the cluster. Spectroscopic observations using one of the W. M. Keck telescopes established a redshift of 4.92, making this the farthest galaxy ever seen.

Credit: M. Franx, G. Illingworth



Servicing Mission Status

Servicing Mission Orbital Verification News

Carl Biagetti, STScI biagetti@stsci.edu

We are now entering the final stages of the Servicing Mission Observatory Verification (SMOV) program. Most of the operational modes for both instruments have been tested and calibrated, and many scientific observations have been made. Here are some details.

NICMOS

Since the last newsletter, NICMOS SMOV has enabled all science, except coronagraphy, using cameras 1 and 2. On March 4, the same day that we were beginning the month-long process of NICMOS optical alignment and focus, the instrument experienced a thermal “short” which, as reported in the last Newsletter and elsewhere, has resulted in a Camera 3 that is — at least for now — beyond the range of mechanical focusing. This thermal short also means a reduced instrument lifetime. The dewar is contracting as a result and the detector and filter temperatures have not been stable, but that has not prevented the planned scheduling of the iterative SMOV alignment and focus activities during the month of March. These activities, combined with a greatly expanded SMOV focus-monitoring program, allowed us to track the optimum focus positions for each of the 3 cameras and enabled us to proceed with a SMOV program modified to use cameras 1 and 2. (For details on the current status of the thermal short, and its effects on dewar motion, focus, temperatures, and lifetime, see the NICMOS instrument report elsewhere in this issue.)

With the focus and alignment activities complete by the first week of April, except for continuous focus monitoring, NICMOS SMOV activities shifted to execution of the Early Release Observations (EROs) and the series of basic science calibration programs needed to enable regular GO science.

The ERO program, also modified to use only cameras 1 and 2, resulted in several fine images, two of which, an image of the Orion Molecular Cloud 1 (OMC1) and an IR image of the Egg Nebula, were presented at the May 12 Press conference to demonstrate HST’s new capabilities. Since then, several more EROs have been carried out for presentation at the June AAS and elsewhere.

Meanwhile, NICMOS instrument scientists have been analyzing the results of the many SMOV calibration observations that were taken during April and May. Analysis is still continuing, but by the end of April the instrument was commissioned for all science modes except Camera3/Grism and Camera 2 coronagraphy. This allowed Cycle 7 NICMOS science observations to begin the week of June 2, and they are continuing at a progressively higher rate each week. Aside from Camera3/Grism science, the one remaining science mode yet to be enabled by SMOV is that of coronagraphy. Plans for this mode include target acquisition testing which is underway at the time of this writing, to be followed by coronagraph verification in July.

The instrument’s electronic sensitivity to SAA passages, reported in the last issue and elsewhere, has been addressed by a Flight Software (FSW) upgrade which turns the detectors off during NICMOS’ passage through the most intense region of the South Atlantic Anomaly. This upgrade was made in mid-April and the instrument has been operating nominally ever since.

STIS SMOV

STIS SMOV was designed to commission the CCD separately from Near-Ultraviolet (NUV) and Far-Ultraviolet (FUV) MAMAs. As of this writing, we have enabled STIS Cycle 7 science that involves CCD imaging

and CCD long-slit spectroscopy, using point source acquisitions or certain types of diffuse source acquisitions, and slits at least 0.2 arcsec wide. CCD coronagraphic verification has proceeded nominally and CCD coronagraphy is expected to be enabled by mid-July.

Getting to this point in CCD SMOV involved an iterative series of target acquisition tests, acquisition “peak-up” tests, and STIS fine optical alignment and focus using the CCD and MAMAs. All of these tests suffered from various unforeseen detector anomalies and FSW deficiencies. The point-source acquisition testing suffered from an elevated bias pattern in the CCD, causing some acquisitions to fail. Meanwhile certain types of peak-up maneuvers were corrupted by a subtle “truncation” effect in the on-board flight software processing. In addition to these problems, the CCD was found early on to be subject to “partial resets,” resulting from electronics with the same SAA sensitivity as that of NICMOS. All of these problems have been addressed with actual or near-term FSW upgrades or ground system work-arounds and, as a result, the commissioning of CCD science using narrow-slit spectroscopy, target acquisition peak-ups, and diffuse source acquisitions, will occur in late August, with the first such science observations occurring by the first week of October.

A set of CCD spectroscopic ERO observations were carried out for the May 12 press conference (SN1987A, and M84) and, like NICMOS, several more have been performed since then for presentation at the AAS and elsewhere.

Starting the week of June 2, a non-proprietary parallel program has been routinely executed for STIS. Typically 40 to 50 new data sets are expected to be generated each week.

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In the case of the MAMAs, the electronics' SAA susceptibilities, similar to those of the CCD, presented a potential health and safety problem, and therefore the initiation of MAMA SMOV was delayed by over five weeks, from March 23 to April 28, while the problems were studied and operational and flight software protections were devised.

By the week of May 19, the MAMAs were being used extensively to carry out their planned SMOV calibrations and EROs. FUV MAMA imaging along with FUV and NUV MAMA coronagraphy are expected to be enabled in July. NUV imaging and first-order spectroscopy in both bands is expected to start in August. Flight software upgrades, currently planned for August, will correct a doppler processing deficiency and the NSSC1 truncation problem which currently prevent echelle spectroscopy and CCD

acquisition peak-ups for narrow-slit (<0.2 arcsecond) spectroscopy. Such science is expected to be enabled in late August with the first observations scheduled in the first week of October.

The remaining STIS SMOV activities are a fine alignment operation using the MAMAs, which, as of this writing, is due to occur in the last full week of June, as well as various detector calibrations characterizations. These calibrations include a MAMA time-tag test in late July and a doppler processing check-out, along with a few doppler-dependent calibrations, following the flight software correction in mid-August.

FGS SMOV

The SMOV tests for commissioning the FGS, and the associated alignments and re-calibrations of the two old FGSs, went very smoothly with no deviation from the original plan. As a

result, the routine operational use of the new FGS as an integral part of *HST*'s Pointing and Control System (PCS) started in the week of May 19.

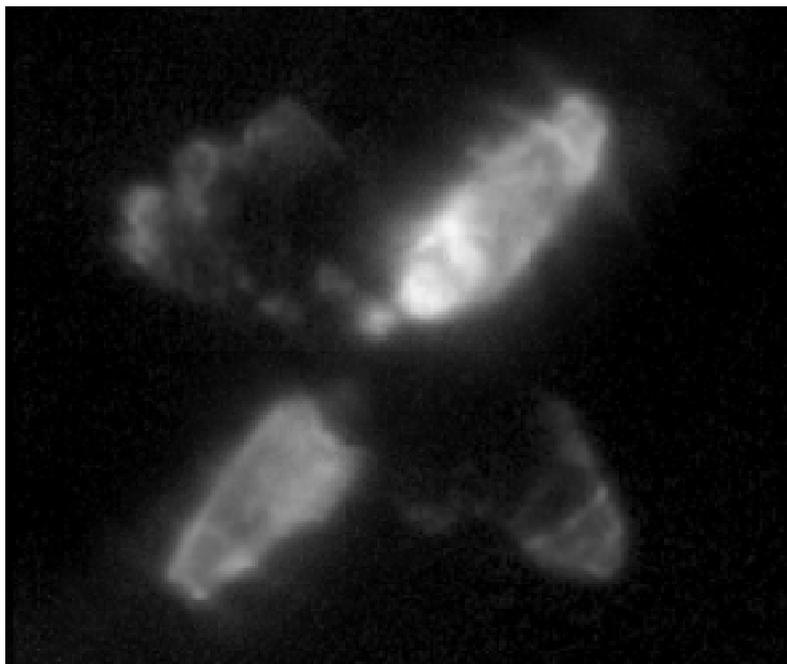
Remaining Work in SMOV

The remaining SMOV activities in July and August are reduced to typically a few (<10) orbits per week. The last SMOV activities requiring external targets are now planned for the week ending August 24, about 60 days beyond the original pre-launch plan. Given the unforeseen, serious problems experienced by both new science instruments, this is a rather modest delay, especially considering that most science for NICMOS and a large fraction for STIS is already underway. A great deal of credit goes to a large number of people, spanning STIS, NICMOS, and FGS IDTs, all divisions of the Institute, and many groups at GSFC, for the SMOV progress to date. My personal thanks and congratulations to all.

HST Recent Release: Egg Nebula

This infrared image of the Egg Nebula (CRL 2688) was taken as part of the new science instrument commissioning.

Credit: R. Thompson, M. Rieke, G. Schneider, D. Hines, R. Sahai, NICMOS IDT.




ST-ECF Newsletter

*The Space Telescope — European Coordinating Facility publishes a quarterly newsletter which, although aimed principally at European Space Telescope users, contains articles of general interest to the *HST* community. If you wish to be included in the mailing list, please contact the editor and state your affiliation and specific involvement in the Space Telescope Project.*

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Instrument News

Fine Guidance Sensors

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FGS1R

On May 18, 1997, the newly-inserted Fine Guidance Sensor (FGS1R) was commissioned for routine operations. It has since served as a reliable instrument used for pointing and guiding *HST*. This brings *HST* up to its full complement of three operational FGSs (the original FGS1 was returned to Earth for mechanical and optical repairs). As part of the FGS1R commissioning process, its optical performance was optimized by adjustment of the articulating fold-flat #3 mirror (FF3), its position in the *HST* focal plane relative to the other FGSs and science apertures was determined, and its internal optical field angle distortion (OFAD) was measured (as was also done for FGS2 and FGS3).

The FGS's full field of view is a quarter annulus subtending an arc on the sky of approximately 22 arcmin by 4 arcmin wide. Any star in this "pickle" can be observed by the FGS with its 5x5 arcsec instantaneous field of view. The FF3 adjustment mechanism, which is not part of the original design of the FGS (and therefore not present in FGS2 and FGS3), makes it possible to compensate for internal misalignments of the FGS's optical elements at any one place in the pickle. However, if the optical performance is variable across the pickle (i.e., has field dependence), then the FGS can be optimized at only one position and will be somewhat degraded elsewhere in the pickle. On-orbit testing of FGS1R has demonstrated that its optical response is, in fact, field-dependent, being nearly perfect at pickle center but degraded at the pickle's extreme azimuthal edges. Nevertheless, it is by almost any measure the best FGS onboard *HST*.

With its near-perfect optical performance at pickle center, FGS1R promises to be the best orbiting interferometer available for use as a science instrument. Simulations suggest that it will be able to resolve binary systems when the components are separated by angular distances as small as 6 milliarcsec provided the magnitude differences are not larger than about 1.5 (this will be tested by on-orbit measurements). By comparison, FGS3, *HST*'s current astrometer, has difficulty along one of its interferometric axes when the separations are less than 20 mas. But before FGS1R can be commissioned as a science instrument it must be stable and calibrated. Early assessments have indicated that it is not yet sufficiently stable (due to outgassing) and thereby not ready for calibration. STScI will be monitoring this instrument in both POSITION and TRANSFER modes to determine when temporal stability has occurred. At such time calibrations can be initiated and FGS1R can be commissioned as a science instrument.

FGS3

FGS3 continues to perform well as a science instrument. Comparison of its pre- and post-SMOV2 characteristics has shown it to be unaffected by the activities of SMOV2. Cycle 7 calibration plans include routine monitoring of the S-curves at pickle center (for TRANSFER mode stability), and a continuation of the POSITION mode Long Term Stability observations of an astrometric field in the M35 cluster. New to Cycle 7 calibrations is the quantification of an effect whereby the measured separation of the components of a binary system is seen to be slightly *HST* roll dependent. As before in previous calibration cycles, TRANSFER mode observations will be made of single stars of various *B - V* colors to support the analysis of GO science data. In support of POSITION mode science data, the plate scale of the central region of the pickle will be measured by observations of several Hipparcos stars.

Faint Object Camera

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As reported in the previous Newsletter, the FOC SMOV program was completed quickly and smoothly, and the first post-SM2 science images were taken on April 21. The main theme of the FOC SMOV program was ensuring that the performance of the FOC was returned to its pre-SM2 level. This was accomplished by first taking internal flatfield and dark images (to ensure that the FOC still works, and to exercise filter wheels and internal LED sources); taking images without the COSTAR/FOC arms deployed (to make sure that the shutter still works, and that the FOC is still sensitive to UV and visible light and delivers a faithful image); an aperture location test (to ensure that the FOC+COSTAR is still pointing in the same place relative to the FGSs, and to give an initial assessment of the COSTAR-corrected image quality); a program to re-align the COSTAR/FOC mirrors by optimizing the FOC PSF quality; and a program to check the absolute sensitivity by imaging a standard star with a large number of UV and visible filters.

The FOC SMOV tests all worked perfectly, and indicated that the performance of the COSTAR-corrected FOC was not affected by the second servicing mission. A drop in sensitivity of approximately 10%, relative to 1994 measurements, was noticed, but this was a confirmation of an effect that had been seen before the Servicing Mission. Work is underway to try and tweak the sensitivity back up to its peak levels.

The Cycle 7 calibration plan has been devised and submitted. Since the GO use of the FOC during Cycle 7 is very low, only a PSF monitoring and UV throughput monitoring program were submitted.

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Instrument News

FOC from page 10

Calibration of the FOC F/48 longslit spectrograph is reaching its final stages; two recent Instrument Science Reports (FOC-097 and FOC-098) describe the wavelength calibration and spectrophotometric calibration respectively. Calibration reference files will be installed in CDBS as soon as we have finished testing the implementation of the spectroscopy pipeline.

Instrument Science Reports, news, and other items of interest to FOC users can be found by referencing the FOC WWW pages at:

http://www.stsci.edu/ftp/instrument_news/FOC/topfoc.html

Goddard High Resolution Spectrograph

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Who are these people in the photo? On April 18, through the cooperation of the *HST* Project at Goddard Space Flight Center, some STScI staff who have worked with the GHRS had a chance to visit the instrument first-hand, following its return to Earth after the recent servicing mission. We're wearing "bunny suits" because the GHRS (and also the FOS) are in a clean room at Goddard for inspection and test. The GHRS is due to return to Ball Aerospace for further tests.

In the past few months the GHRS Group at STScI has completed several analyses of calibration observations. These Instrument Science Reports, available from our web page, have been issued:

- ISR081, "An Analysis of Pipeline Wavelength Calibrations for the First-Order Gratings of the GHRS in Cycles 4 Through 6."
- ISR082, "Analysis of Detector Calibrations for the GHRS in Cycles 4, 5, and 6."

- ISR084, "Implementation of a Background Count Rate Model for the GHRS."

- ISR085, "Redetermination of Sensitivity and Vignetting for Grating G140L."

If you cannot access them on the web, contact help@stsci.edu.



STScI staff inspect GHRS in a clean room at Goddard.

Near-Infrared Camera and Multi-Object Spectrometer

Keith Noll, STScI noll@stsci.edu

The NICMOS science program began in June with early execution of a number of observations using the in-focus NIC1 and NIC2 cameras. The instrument is returning excellent quality data with diffraction-limited performance in both cameras. Results of one of the first science observations, measurement of the gamma-ray-burst source GRB 970508 (described elsewhere in this Newsletter by A. Fruchter), are publically available from the *HST* archive.

In addition to GO and GTO science data which are, in general, proprietary, a large program of publically available parallel observations has been implemented. In the first week of this program 67 orbits of NIC1 and NIC2 imaging were completed and placed in the *HST* archive. NIC3 images were obtained at the same time but are far from focus because the PAM mirror was set for the NIC2 parallels. A comparably high rate of scheduling has continued in the following weeks. Available NICMOS parallel data can be identified and retrieved by using the Starview software tool accessible on STScI's web pages.

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Instrument News

NICMOS from page 11

Improved versions of the NICMOS pipeline were implemented in mid-June with better handling of cosmic ray rejection. A more sophisticated mosaicing module (CALNICB build 2) is expected in late June. Observer's with observations taken early in June may benefit from recalibrating their data with the new versions of CALNICA and CALNICB.

Darks and flats continue to be measured on-orbit. On-orbit flats have been measured for approximately half of the filters. For the remaining filters, flats measured during thermal vacuum testing are being used. However, the unexpected higher temperature of the detector on-orbit causes small flat-field residuals when the ground-based flats are used. The measurement of on-orbit darks for all 16 available MULTIACCUM sequences is ongoing. The current status of pipeline calibration files is maintained on a page under the NICMOS www page. Still incompletely understood effects in the detector cause anomalous, time-dependent dark currents that appear to be correlated with cycling the amplifiers between idle and active states. Several possible solutions to this problem are being actively investigated at the time of this writing. Meanwhile, good progress has been made in developing an empirical model of the various components contributing to NICMOS dark current and it is now possible to produce acceptable synthetic darks with this model.

Cosmic ray rates in NICMOS have been measured on-orbit and are close to predictions made before launch. Approximately 2 pixels per second are affected by cosmic rays outside of the South Atlantic Anomaly (SAA). An ISR describing these measurements is available on the NICMOS www page (D. Calzetti).

During SMOV a population of pixels with low throughput was identified. Contaminant inside NICMOS, possibly flecks of paint from a baffle that was compressed by the expansion of the dewar, has been identified as the likely source. Approximately 100 pixels in each camera are affected, some single pixels, and a few larger groups of pixels. Some of these bits of contaminant or "grot" have moved by small amounts while others have remained fixed. This small population of bad pixels currently poses only a minor threat to science observations and will continue to be closely monitored.

The first measurements of throughput and quantum efficiency (QE) have been made on orbit. Measurements of a G standard star revealed the throughputs to be lower than expected by 10-30%. Analysis of existing flats made with the calibration lamp show no evidence of time dependence in the throughput or QE. Synphot and the NICMOS exposure time calculator are in the process of being modified to reproduce NICMOS's observed photometric performance.

We have continued to monitor changes in focus in all three cameras and are closely monitoring temperature inside NICMOS. NIC3 is continuing to move back towards the focusable range of the Pupil Alignment Mechanism (PAM) mirror. However, after an initially rapid motion, the movement of NIC3 has slowed in recent weeks. Updated information on the latest focus measurements and focus history is now posted on the NICMOS www pages. An adjustment to the PAM position for NIC1 and NIC2 was made in June to follow the evolving focus of these two cameras. NIC1 and NIC2 remain at separate foci, although the performance of either camera at the other's focus is good because of the relatively small difference in focus between these two cameras. Also in June, the location of the NIC1, NIC2, and NIC3 apertures were moved away from the geometric center of the detector arrays to nearby locations. The sites of the new aperture positions were chosen to be relatively flat regions with good detector QE that lie close to the center of the array and are well clear of contaminant. Users are reminded that the positions of these apertures may change with time as changes in the detector arrays demand. However, as always, the NICn-FIX apertures will remain fixed at the geometric center of the arrays.

The NICMOS observer community is reminded that we are continuing to characterize NICMOS as rapidly as possible. We will continue to post new results on our www site. This should be checked regularly by those who need the latest information of the status of NICMOS and our understanding of optimum observing and data analysis strategies.

Space Telescope Imaging Spectrograph

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As of July 1, STIS SMOV is ~80% complete. In addition to a wealth of calibration data, excellent STIS science data has been obtained from all three detectors across STIS's many modes, using the long slit with the first-order gratings, in echelle mode, and in imaging mode. STIS has clearly demonstrated its promise. A STIS Pure Parallel Archival Program — providing 50CCD clear imaging and G750L slitless spectroscopic observations when WFPC2 or NICMOS are prime — has been initiated, with excellent early results (see the STIS Instrument web page for examples and details). The STIS Cycle 7 program begins in earnest on July 1, ramping up through the summer as flight software and ground system fixes to problems identified in early SMOV activities are brought on-line, with all basic advertised modes in use for science by early fall. The bulk of the ~200

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Instrument News

STIS from page 12

Cycle 7 STIS science proposals were received in house from the GOs and GTOs in late May and are processing through the system.

Along with the frenzied activity at STScI to carry out SMOV and commission STIS's many operational modes, we have also been finalizing the STIS calibration pipeline software (see also Hulbert et al. 1997) and developing an early set of tools to work with STIS data within STSDAS. The STSDAS release to users is planned to coincide with the release of IRAF 2.11 this July. The basic STIS pipeline will deliver calibrated to users, performing basic two dimensional image reduction (e.g., dark and bias removal, flat fielding, bad pixel identification) with photometric calibration for imaging data, basic two dimensional image reduction plus two dimensional spectral extraction (producing a rectified flux calibrated and wavelength calibrated two dimensional image) for long slit first order grating data, and basic two dimensional image reduction plus one dimensional spectral extraction (producing a background subtracted, flux and wavelength and calibrated spectrum) for echelle data. For spectroscopic data the accompanying automatic wavecalcs are processed along with the science data, so that an accurate zero-point for the wavelength scale can be affixed to the data. For crsplit (or num_exposure=many) data, cosmic rays are rejected as part of the basic two-dimensional image reduction step. An extensive set of paper products has been developed for STIS data, to help give GOs a quick overview of their data when it is received, and to help them identify any unexpected anomalies should they occur. An early "Guide to Working with STIS Data" will be published in mid-summer to assist GO and GTOs working with their new STIS data. This will evolve into a full STIS chapter in the new HST Data Handbook, which is expected out in November. The full initial version of the pipeline is expected to be implemented before the publication of this newsletter. Refinements are, of course expected to be needed as we gain on orbit experience with a range of science data, and we welcome your comments and suggestions (send to help@stsci.edu). Results from SMOV have been routinely described in the STIS STANS and we will continue to provide technical updates as SMOV transits into Cycle 7 Calibration, with information in STANS, postings to the WWW, and Instrument Science Reports, as results are finalized. The Cycle 7 Calibration plan for STIS has been developed, encompassing over 50 proposals to calibrate the diverse set of STIS modes. This plan has been posted to our STIS Instrument WWW Page and we welcome input on its design and any omissions you might identify.

To summarize the STIS SMOV results to date, all three detectors on STIS are working extremely well. Flight software modifications were successfully installed to protect the MAMA detectors from damage due to uncontrolled resets of the MAMA control electronics following cosmic ray impact to the opto-isolators. Modifications to the operating procedures for the MAMAs were also required and the MAMAs high voltage is now only turned on for science during the ~6 contiguous SAA-free orbits of each day. Since turn on the MAMAs have been performing extremely well and appear to be quite robust.

The CCD dark current and the FUV-MAMA dark current are almost a factor of 10 lower than advertised in the STIS Handbook. On the other hand, NUV-MAMA dark rate is roughly a factor of 3-10 higher than advertised, due to unexpected impurities in the MgFl window which lead to cosmic-ray induced phosphorescence. The NUV-MAMA dark current has been evolving with time as the phosphorescence rate (which appears to be highly temperature dependent) comes into equilibrium with the excitation rate, and by the time of the publication of this newsletter more information should be available and will be announced in STANS and posted to the STIS WWW page.

The CCD has realized its read-noise expectations. However, the growth rate of CCD hot pixels is roughly a factor of 4 higher than expected; these can be removed via post observation processing using weekly darks or dithering strategies can be employed when observing if desired to facilitate hot pixel removal.

The throughputs measured on orbit appear to be within, typically, 20% of expectations across the board, with a few exceptions, predominantly at the extremes of the wavelength settings for the scanned modes. By the time of the publication of this Newsletter we expect to have updated sensitivities for all the basic STIS modes based on on orbit calibrations, with accuracies of around 5-10%.

SMOV target acquisition and acquisition pickup testing identified several problems with the flight software all of which are expected to be fixed by September. The early testing also showed that when fixed, the acquisition accuracies will be considerably better than advertised in the handbook - with 0.025 arcsecond centering accuracy expected from point source acquisitions and accuracies of ~5% of the slit width expected for pickups.

The STIS corrector mechanism has been adjusted to optimize the throughput at the slit plane - realized throughputs look to be at or above the specifications from the NIR to the UV. Encircled

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Instrument News

STIS from page 13

energies and line spread functions show that STIS has realized its optical performance expectations.

As always with a brand new instrument, there is much still to be learned, and there have indeed been surprises around most corners to date, with no doubt more lurking. All in all, however, it is clear that STIS is performing extremely well. STIS science is just starting in earnest as of this writing. The early Cycle 7, ERO, and pure parallel results show just how powerful STIS is as a science instrument and leave us looking eagerly forward to the spate of new astronomical discoveries awaiting us all.

WFPC2

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Based on the successful completion of our servicing mission observations, WFPC2 was formally recommissioned for routine operations on March 3, and parallel observations were recommissioned on April 1. Since then, many *HST* observations have used WFPC2, including observations of Mars in support of the Mars Pathfinder Mission. The rate of WFPC2 observations will decrease as the summer progresses, however, due to the increase in the fractions of NICMOS and STIS observations. See the Director's Perspective for more details about the relative fractions.

In June we updated the SYNPHOT files used to generate the photometric keywords which are placed in the header of WFPC2 images (e.g., photflam, pivwav). Details concerning the changes are documented in a new Instrument Science Report (ISR) by Baggett, Casertano, Gonzaga, and Ritchie, which is available from the WFPC2 homepage. All UV filters shortward of F439W were updated, as well as some of the more frequently-used broadband filters redward of F439W (i.e., F450W, F555W, F606W, F675W, F702W, F785LP, F791W, F814W, F850LP, and F1042M). Changes were installed in the calibration pipeline slightly earlier (i.e., May 16, 1997). With a few exceptions, changes to non-UV filter modes were relatively minor: generally ~1 to 2% or less. F785LP, F850LP, and F1042M were more: ~1 to 4%, ~1 to 6%, and ~2 to 15%, respectively, depending on the chip. The UV filters required somewhat larger changes to bring synphot into agreement with our monitoring observations, ranging from ~2% (e.g., F255W and F300W) to ~5% (F170W, F218W) to 10% or more (F160BW, F375N).

The Cycle 7 WFPC2 calibration plan was developed this past spring and is currently being implemented. The plan is similar to past calibration plans, but with modest declines in both routine and special calibrations due to the long baseline of existing observations. One highlight is a concerted effort to understand

better the apparent difference in the photometric zeropoints when using long vs. short exposure times. For more details, see the Cycle 7 calibration plan page on our WWW site. We remind users that all calibration data are non-proprietary and can be easily obtained from the *HST* archives.

During the past year, we have made progress toward understanding the Charge Transfer Efficiency (CTE) problem (see the CTE/Long vs. Short page on the web), especially over the last few months. In particular, a new ISR by Biretta and Mutchler shows that residual images apparently left by poor CTE have a half life of about 11 minutes. An empirical approach designed to correct for CTE has been taken in an ISR by Whitmore and Heyer. The main results are that CTE can range from about 2% to 15%, depending on the how bright a star is and whether the background is faint or bright. There also appears to be a weak CTE problem along the X axis (1 to 5%), with stars on the right side of the chip being fainter than stars on the left side. This is probably due to CTE loss in the shift register. A set of formulae has been developed to correct for these effects to a level of about 2%.

WFPC2 has now been operating for over three years, and in this time a great deal has been learned about the characteristics and calibration of the instrument. The WFPC2 CLEARINGHOUSE has been developed in an effort to make this material more readily available. The Clearinghouse contains references to: **1)** STScI documentation, **2)** publications from the astronomical literature, and **3)** user-submitted documentation. The tool also provides a handy set of search engines to access the various articles and software tools once they have been identified. At present (end of June) the WFPC2 Clearinghouse is only about 50% populated, but will eventually contain any articles using WFPC2 data that we are aware of. If you have an item you would like to contribute to the Clearinghouse please send it to wiggs@stsci.edu. One important point to note, however, is that inclusion in the WFPC2 Clearinghouse does not necessarily mean that the WFPC2 group at STScI endorse the results of a given reference, since there are simply too many items for detailed review.

The DRIZZLE software, developed by Andy Fruchter and Richard Hook to support subpixel dithered images, will be distributed to the community as part of the next STSDAS release scheduled for later this summer. In addition, a new web page has been developed to provide general advice on dithering *HST* Observations.

For reference to these and other WFPC2 materials please access the WFPC2 homepage via:

http://www.stsci.edu/ftp/instrument_news/WFPC2/wfpc2_top.html

News from the HST Project

New Instruments for HST

The Advanced camera for Surveys (ACS) is now being built and will be installed into *HST* during Servicing Mission 3 in 1999. The fourth, and last, servicing mission is planned for 2002. NASA recently received proposals for Scientific Instruments (SIs) for the 2002 servicing mission. *HST* Project Scientist David Leckrone said a "substantial number" of proposals were received and that the selection process is at an advanced stage. The results should be announced in mid-summer.

A Permanent Cooler for NICMOS?

Engineers at NASA have proposed an electrically-driven device that could be added to NICMOS in the 1999 servicing mission. This "cryo-cooler" has recently gone through a Preliminary Design Review, and is scheduled for a Critical Design Review and Science Peer Review in mid-August. *HST* Project Scientist David Leckrone says the cooler looks promising at this point and that it could cool NICMOS to its operating temperature within about 24 hours. Its power consumption is about 300 watts, a little more than a typical SI. Because new Solar Arrays will be installed in 1999, there will be sufficient power for all of *HST*, the cooler included, until about 2002. After that time some sort of power management will be needed to keep overall consumption within limits.

The NASA-STScI Contract

*David Leckrone,
HST Project Scientist*

NASA/GSFC recently awarded AURA a 5-year extension to the STScI contract. The contract requires the STScI to continue with the responsibility to plan and conduct the *HST* Science Program.

Just like the previous 5-year extension, the contract was negotiated at a cost lower than the AURA/STScI proposed cost. The new contract value places a limit on the total cost of the entire 5-year contract period; however, the contract Statement of Work is the same as for the previous 5-year period.

As negotiated, the contract falls short of the STScI estimated resources needed to complete all tasks. The significant budget shortfall begins in FY99, and so, the Project still has time to work these issues. We have several tools at our disposal to ensure the necessary work gets done:

1) Prioritize the Work

A dynamic organization always wants to do more than it can afford. Over the course of the 5-year contract period, work priorities at the STScI will change. These will not only be budget driven, but other factors can apply. Performance of the *HST* spacecraft and subsystems, for example, can have a large influence over the workload at the STScI. As the priorities change, the workload at the STScI will be carefully reviewed.

2) Implement Process

Improvements The STScI has a history of developing new ideas and implementing these to improve user services while producing cost savings. The STScI has in-work a project to improve Hubble Data Archive services. In addition, several proposals for new process improvement projects are in hand. The Project has encouraged the STScI to continue along this line to reduce long-term contract costs.

3) Add Resources

In cases where there are impending unacceptable science impacts that can be avoided no other way, the Project has the option to add resources to the STScI contract.

The Project is currently working several science priority issues that could affect the STScI workplan. We must continually question the cost/benefit of our work. A study is underway, for example, to determine the WF/PC-2 science and operational requirements relative to the on-orbit operation of the ACS. The results of this study will be used by the Project to help determine the planned longevity of WF/PC-2 operations and the corresponding work priorities at the STScI.

In summary, the Project has the full intent of minimizing any impacts to the *HST* Science Program. Although the negotiated STScI contract is short of the estimated effort to perform all currently defined tasks, the combination of the alternatives listed above will help solve problems where shortfalls occur. The overall goal is to provide first-rate services to the *HST* User Community to produce first-rate science.

HST Data Archive

Hubble Data Archive News

Megan Donahue archive@stsci.edu

Archive Status

Archive retrieval and ingest activity in the last couple of months has been at an all-time high since the new instruments were installed. We are seeing ingest rates of 4 GB/day, and retrieval rates of twice that, with some days when over 20 GB were retrieved. The ST-DADS system has handled this load with aplomb. Occasionally we are experiencing some staging disk overloads, so if you use the "HOST" option (which stages data on archive.stsci.edu for subsequent FTP), we would appreciate it if you let us know when your FTP session has completed successfully so we can free disk space.

How Do I Get My Proprietary Data?

About 40% of the General Observers (GOs) have requested purely electronic access to their proprietary data in Cycle 7. These GOs will be notified by email when any of their science data has arrived in the archive. They will also be sent the paper products for their program when all of the companion files are available (usually within a week or so after the science data arrives).

Proprietary data can only be delivered directly to your machine (either your account or your anonymous ftp area) or by tape. You cannot request proprietary data via the "HOST" option in StarView (which delivers data to archive.stsci.edu's staging disk) or via our Web interface. We do plan to upgrade our Web server for secure transmissions of account passwords so that eventually, you will be able to retrieve proprietary data across the Web.

We must remind GOs, including PIs, that they are not automatically authorized by any means to retrieve their proprietary data. They must specifically request access from the archive by sending email to that effect to archive@stsci.edu. If you are a collaborator on an *HST* program, you

must ask the Principal Investigator (PI) of the program to send us email to authorize your access.

NICMOS GOs should note that to get all of the individual exposures associated with their program, they should request not only the calibrated files but also the uncalibrated files. NICMOS retrievals of calibrated-only data will only contain the final products, not the individual exposures.

Dataset Limits and Retrieving NICMOS Data

NICMOS GOs may find that their data requests are rejected because of dataset limits for a single request of no more than 300. NICMOS proposals pose a problem because they tend to have large numbers of datasets. By July this limit may be raised, but in case you have trouble, the prescription, then, to retrieve large numbers of datasets is the following:

Select all of the datasets desired in StarView. The number of datasets reported by StarView is the number of datasets counted by DADS *if and only if* you only ask for calibrated and raw data (that is, the "CAL" archive class). If you also ask for PDQ and OMS data, this multiplies the number of datasets (as counted by DADS) by a factor of up to 3. Therefore, if the number of datasets as selected by StarView is, say, 286, you can safely retrieve all of that data in a single request if you **ONLY** ask for raw and uncalibrated data. Larger requests should be broken up into separate requests. If you want the OMS and PDQ files, you should submit separate requests for these files, since each archive class counts as a new category of datasets in DADS.

Note that requesting the calibration reference files for NICMOS will also increase your total request. Therefore, requests for calibration reference files should be separated from the request for the science data. We apologize for this inconvenience, and as we mentioned above, we hope to produce a workaround either via a StarView or DADS modification by mid-July.

Quick Access to the Pure Parallel Programs and Gamma-Ray Burster Data

Data for the pure parallel programs for STIS, NICMOS, and WFPC2 are made public within 24 hours of their arrival in the archive. (The slight delay is caused because our automated release program only runs at midnight.) Tim Kimball, our Web wizard, has knocked off a handy Web page for easy access and searching of the pure parallel programs. Check it out at

<http://archive.stsci.edu/>

(You'll find a lot of other interesting stuff there too.) Select the instrument desired and then "Form" to get a pre-qualified form to specify specific search parameters such as coordinates or filter. The parallel programs are now large enough that retrieving the entire list (~500 kbytes as of June 12) by Web browser may take awhile, so be forewarned if you request the entire list!

STIS and NICMOS observations of the gamma-ray burster, GRB970508, as well as WFPC2 observations of GRB970228, all obtained through the Director's Discretionary time, are now available by FTP from the same page.

StarView and DADS Software Updates

The current version of StarView is 5.1. This version is now compatible with Sun Solaris 2.5 and Digital UNIX V4.0.

For NET transfers of data directly to your desk machine, you can now enter a password with the "@" character, allowing data transfers into anonymous ftp sites with incoming access.

We are pleased to announce that DAT/4mm tapes will be added to the supported media options available to GOs beginning in July.

Proprietary Periods for Servicing Mission Data

The Early Release Observations for STIS and NICMOS now have a release date of October 1, 1997, to coincide with the publication of a special *Astrophysical Journal Letters* issue. However, all STIS and NICMOS calibration data are now public.

Institute News

The Search for a New Director for STScI

David Soderblom, STScI
Harry Feinstejn, AURA Corporate Office

Bob Williams, current Director of STScI, has elected to step down at the end of his current five-year term, in September, 1998 (see April, 1997, Newsletter). AURA, which is responsible for naming a replacement, has now appointed a search committee:

Robert Kirshner, Chair, Harvard-Smithsonian Center for Astrophysics
Arthur Davidsen, Johns Hopkins University
Wendy Freedman, Observatories of the Carnegie Institution of Washington
Garth Illingworth, University of California at Santa Cruz
Michael Jura, University of California at Los Angeles
Rolf Kudritzki, Heidelberg
Knox Long, Space Telescope Science Institute
Harry Feinstejn, AURA (non-voting).

The committee's charge and the selection criteria generated by the AURA Board Chairman considered comments made by STScI staff. Advertisements have been published in *Physics Today*, *Nature*, and the AAS Job Register. Bob Kirshner visited the Institute on June 17 and talked with the staff about the search. The goal is to name a new Director by the end of the year. Those who wish to comment may contact the Chair:

kirshner@cfa.harvard.edu.

The STScI May Symposium: The Hubble Deep Field

H. Ferguson ferguson@stsci.edu

The STScI May Symposium took place in Baltimore on May 6 to 9, 1997. The topic this year was the Hubble Deep Field (HDF). The 150 participants shared results from followup observations and discussed implications of the observations on topics ranging from white dwarfs to the formation epoch of galaxies.

The HDF image, obtained in December 1995 during 10 days of nearly continuous observing, is the deepest optical image of the sky yet taken. The telescope was pointed at a carefully chosen "representative" patch of sky, and obtained what is in essence a very deep core sample of the universe from the Solar System to the very distant universe. The faintest sources detected in the image have fluxes equivalent to one photon per week hitting the human eye.

The rapid public release of this unique data set stimulated intense interest in a variety of fields, with over 30 papers now published or in press (most of the references can be found on the Hubble Deep Field web page under "Science Resources" at

<http://www.stsci.edu>).

All this rather anarchic activity made for a very timely and lively symposium.

While most of the 3000 or so sources detected in the HDF are galaxies, the images have provided important constraints on the stellar mass function in our own galaxy. The increasing numbers and small sizes of faint galaxies make it extremely difficult to count stars fainter than $I \sim 25$ mag. At fainter magnitudes, HST's depth and resolution provide a significant advantage, and the HDF and other deep fields provide the best counts down to $I = 28$. While the area covered is as yet too small to provide a clear detection of the end of the hydrogen-burning main sequence in

the Galactic halo, the observations clearly rule out low-mass hydrogen-burning stars as the dominant source of halo dark matter. The observations have also put the noose around, but not yet shooed the horse out from under, the idea that white dwarfs could be an important mass contributor to the halo.

Most of the meeting focused on the galaxies detected in the image.

Followup observations have provided near infrared colors of many of the sources, far-IR and radio detections of a handful of sources, and redshifts for over 250 sources in the HDF itself and its shallower flanking fields. There have been half a dozen independent attempts to assign "photometric redshifts" to HDF galaxies based on their apparent magnitudes at different wavelengths. Representatives from the different groups arrived armed with their latest estimates, ready to shoot it out against the latest spectroscopic redshifts from the Keck observatory. At the end of the ruckus all of the photometrists were left standing, but the spectroscopists left slightly wounded. To the extent that they have been tested (that is for galaxies typically brighter than $R \sim 24.5$ with redshifts $z < \sim 1.2$ or $z > \sim 2.5$), photometric redshifts from all the groups appear accurate to better than $\sigma(z) = 0.2$, sufficient for many statistical measures of galaxy evolution. In the case of some of the most severe outliers, a compelling case was made that the spectroscopic, not the photometric, redshifts were in error. Nevertheless, with the deep spectroscopic surveys it is now possible to study clustering at high redshift, and striking peaks in the redshift distribution are turning up out to redshifts $z \sim 3$.

Both photometric and spectroscopic redshifts are essential for deriving estimates of the global star-formation or metal-production rate of the universe as a function of redshift. Such estimates have become a useful tool for assessing the viability of galaxy

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evolution models, and have provided a context for discussing the results from the HDF and other surveys. Taken at face value, the statistics of HDF Lyman-break galaxies (galaxies at $z > 2.5$), coupled with the results from pre-HDF redshift surveys, suggest a peak in the metal-formation rate at $1 < z < 2$. If this is really true, then it is possible that the “epoch of galaxy formation” has been identified and it appears to coincide quite well with the expectations from Cold Dark Matter models. The debate mostly involves whether some of the star formation could be hidden from view, either because of dust or because of selection effects in finding galaxies. Corrections to the metal-production rate derived from the ultraviolet fluxes could be as low as a factor of 2 to higher than a factor of 10. Further multi-wavelength observations should settle the matter.

If the epoch of galaxy formation is at $z < 2$, there should be few massive or old galaxies at high redshift. The relatively large velocity widths of the interstellar lines of the Lyman-break galaxies are difficult to interpret because outflows may be involved. Kinematics from IR observations of [O II] emission are available for only a few objects, and favor rather low velocity dispersions (relative to present-day L_* galaxies). Searches for relatively old, passively-evolving, elliptical galaxies at high redshift have turned up very few candidates. This result is consistent with the formation epoch inferred from the studies of star-forming objects, and with models wherein ellipticals mostly formed in late-epoch mergers. However, it is not yet clear if the numbers are inconsistent with the alternative picture that the

most massive ellipticals formed at higher redshifts.

The HDF meeting provided a reasonably good snapshot of our understanding of galaxy evolution, both observationally and theoretically. It is clear that the HDF itself and the massive followup campaign are having a huge impact. During the meeting, Bob Williams reinforced his intent to carry out a southern HDF, this time with a QSO in it to provide a line of sight for absorption line studies. At present both the timing of the southern HDF campaign and the field selection are up in the air. Recent radio observations of the best candidate field have revealed a relatively strong radio source close to the QSO which would make it difficult to get extremely deep images of the surrounding field. Searches are underway for QSOs in the other candidate fields.

Michael Hauser, Deputy Director

Over the past year, we have profiled several STScI staff astronomers who have recently been granted tenure. So

far, that has meant promotions from junior levels, but one of these individuals given tenure is our recently-appointed Deputy Director, Mike Hauser.

In the past generation or two, astronomy has grown far beyond the bounds of the traditional optical regime, and the pioneers in new energy domains have often come from physics and engineering because of the

experimental technology needed to advance those frontiers. Mike is one of those pioneers. He received a BA in engineering physics at Cornell in 1962, then went to Caltech to get his Ph.D.,

in 1967, in elementary particle physics. His advisor was Robert Walker and he used the electron synchrotron there.

That led to an Assistant Professor position at Princeton working with their proton synchrotron, starting in early 1967. Princeton, of course, also had a very active gravitational physics group, which included Dicke, Peebles, and Wilkinson. Mike started working with this group on some aspects of galaxy statistics, which then led to work on hardware to measure the higher frequency spectrum of the microwave background radiation (following the discovery of the background a few years before by Penzias and Wilson, just down the road a piece).

Mike's transition into astrophysics was a natural outgrowth of his evolving interests at the time, but it also proved to be well-timed, given the leveling off in physics employment seen in the early 1970s. He went back to Caltech as a Senior Research Fellow, working with R. Leighton and G. Neugebauer on millimeter and sub-

millimeter detectors to augment the 10-meter dishes being built at the time. In 1974, after about two years on this effort, Len Fisk encouraged Mike to come to Goddard, where Len was then working in Frank McDonald's Laboratory for High Energy astrophysics, to work on space infrared instrumentation. This was shortly after Announcements of Opportunity for Scout- and Delta-class Explorer missions had come out and Goddard was building a presence in the IR. Mike and his colleagues submitted proposals which led to both the IRAS and COBE missions.

Goddard clearly agreed with Mike, for he spent 21 years there, working on instrumentation for space and balloons, and building up an IR group that grew into a sizable component of the Goddard research establishment. Mike was PI for the COBE Diffuse Infrared Background Experiment, and was part of the IRAS science team. He eventually rose to become Division Chief for astronomy and solar physics

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Hauser from page 18

at Goddard, which, among other things, had responsibility for the development of STIS. Mike came to STScI in 1995 to become our Deputy Director.

Mike grew up in the Washington D.C. area since the age of 10, going to elementary and junior high schools in the city. His father had studied chemistry and worked for the Food and Drug Administration on product regulation. Dad imparted a strong enough scientific influence to affect both Mike and his brother, who works in sociology at the University of Wisconsin (an uncle was in that field too). High school physics particularly intrigued him, enough so that he worked as a lab assistant for that teacher the next year.

Mike still frequents the tennis court when he can, and music is a continuing love he shares with his wife, who is a piano accompanist for vocal soloists. Their children, now grown, include a zookeeper, pre-school teacher, artist, and attorney. Mike was a single parent for about 5 years before he married his current wife, during the years when he started at Goddard. The satisfaction of seeing his children mature has been marred by the tragedy, four years ago, of his daughter being killed in an automobile accident while a first-year law student at UCLA.

The Institute feels fortunate to have the benefit of this extensive personal and professional background as STScI itself matures. We are hopeful that we can keep him for 21 years too.

Calendar

Cycle 7 (NICMOS only):

Phase I proposals due September 5, 1997 (firm)

Observations begin January 1998 (tentative)

Cycle 8:

Call for Proposals released April 1, 1998 (tentative)

Phase I proposals due June 1, 1998 (tentative)

Proposers notified October 15, 1998 (tentative)

Cycle 9:

Call for Proposals issued May 1, 1999 (tentative)

Phase I proposals due July 15, 1999 (tentative)

Proposers notified October 15, 1999 (tentative)

Meetings and Symposia

HST Calibration Workshop September 22-24, 1997

Space Telescope Institute Council November 6-7, 1997

Space Telescope Users Committee November 17-18, 1997

New on the WEB

Some items on STScI's web pages you may find of interest:

- 1 The 1997 HST Calibration Workshop — with a New Generation of Instruments
Information and registration at:
<http://www.stsci.edu/stsci/meetings/cal97/CalibWSForm.html>
- 2 STScI preprints can now be accessed directly:
<http://www.stsci.edu/science/preprints/>

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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

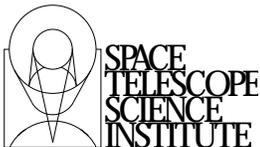
Fourth, if you are a current HST user you may wish to address questions to your Program Coordinator or Contact Scientist; their names are given in the letter of notification you received from the Director, or they may be found on the Presto Web page (<http://presto.stsci.edu/public/propinfo.html>).

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

Fred Walter (chair), SUNY Stony Brook,
fwalter@sbast1.ess.sunysb.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
Ted Snow, U. Colorado
Rodger Thompson, U. Arizona
John Trauger, JPL
Will van Breugel, Lawrence Livermore

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