IUE NEWS

March 25, 1985 Special Edition Greenbelt, Maryland

IUE CELEBRATES ITS SEVENTH BIRTHDAY

Seven years ago, on January 26, 1978, IUE was launched into orbit on a Delta rocket. Past and present IUE staff members met on January 25 for the traditional "birthday party" and mutual congratulations at the Goddard Recreation Center. Many happy returns, IUE!

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LWR CAMERA UPDATE

The flare in the Ultraviolet Converter (UVC) of the LWR camera has continued to increase in brightness, despite the limit in usage imposed by the IUE Project in the fall of 1983. At present the flare produces a bright spot on the lower edge of the image with an intensity of about 100 DN per hour. The flare currently affects most high dispersion images and may affect the background for low dispersion spectra obtained with long exposure times.

Studies are nearly finished of the new configuration of the LWR camera. By resetting the UVC to a lower voltage of 4.5 kv instead of 5.0 kv, the effects of the flare can be avoided for a number of years. However, the sensitivity is correspondingly reduced. The "official" estimate of the change in sensitivity is a factor of 1.37, as determined by SERC-VILSPA Resident Astronomer Alan Harris. Thus to obtain spectra of comparable DN, the exposure time will be longer by 1.37 with the 4.5 kv UVC than for the current 5.0 kv UVC setting. Other calibration studies of the camera response and ITF behavior indicate that the camera performs essentially the same at either UVC setting, aside from the sensitivity change. A small effect, less than 5%, may be seen along the outer edge of the image, at the ends of the orders for high dispersion images.

Changes are being made in the ground computer system to accomodate the new configuration. They represent the first major change in the camera configuration since about 1979. When these preparations are completed, the LWR will become available to Guest Observers in the new configuration. The changeover is expected to occur in May or June this year.

Currently the LWR continues to be available to GOs only with Project approval. A limit of 200 hours of exposure time per year was set by the IUE Project last May, but actual use of the camera has been well below this rate. Users must justify scientifically the use of the camera and must absorb the extra overhead required to turn the camera on and off (15 to 30 minutes). Requests to use the camera should be addressed to the Project Scientist Yoji Kondo. Other questions may be referred to the Resident Astronomers at (301) 344-7537.

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IUE SIDESWIPED BY METEROID

During the US1 shift on 16 July 1984 a meteroid apparently struck IUE; no known damage resulted. An exposure was in progress, with the FES tracking on a guide star. At 04:35 UT the IUE staff noticed that the satellite was no longer automatically tracking the guide star and had apparently jumped about 32 arcsec. The attitude control system of the satellite returned it to its original pointing almost immediately.

Analysis of the spacecraft systems indicates that a net change in the angular momentum of the satellite occurred. Since only an external force can be responsible, a meteroid hit is suspected. So far as can be determined, no damage was done to currently operating spacecraft systems.

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IUE BLINKS - TWICE!

During last fall, IUE's sun shutter was observed to close itself twice. The first occurence was during a VILSPA shift on 31 August 1984. The cameras were exposing at the time. The staff opened the sun shutter and resumed the exposure without any further problems. The second closing occurred during the US2 shift on 26 September. A camera was being prepped for the next exposure. As before, the IUE staff were able to open the shutter and resume operations with no other problems.

Spacecraft analysts have been unable to determine why the sun shutter closed itself. In the telescope tube there is a photodiode that is designed to detect bright light. If light in excess of 10% of the Sun's brightness strikes the diode, the sun shutter is automatically commanded to close. However, no indication of bright light was seen (observations of the bright Earth have been performed without triggering the diode). Possible explanations are that (a) a high energy particle struck the diode, (b) a high energy particle hit the sun shutter electronics, and (c) the on-board computer malfunctioned. There seems to be no conclusive evidence that any of these circumstances occurred.

ANTENNA DEVELOPS SPORADIC PROBLEMS

During the fall of 1984, spacecraft analysts noted that the signal strength from S-band antenna 4 sporadically dropped by 10 db (a factor of ten). Because the S-band telemetry includes the science data that are transmitted to the ground facilities, this has become an item of concern. The problem has been traced to the sporadic failure of a power amplifier for S-band antenna 4. The exact cause of the problem is unknown (not the meteroid - we thought of that!) and it is unlikely that it can be "cured".

The problem with SB4 is most troublesome when the camera is read and an image is transmitted to the ground receiver. The IUE staff are making every effort to plan around the problem and to insure the quality of the data. This sometimes requires some extra observing overhead, such as slewing the spacecraft to a position where the signal strength is stronger.

IUE has four S-band transmitting antennas, two on the end opposite the telescope tube and one on either side of the spacecraft. SB4 is on the sunward side. Thus it is used when the spacecraft is pointed at a target (1) within 90° of the Earth and (2) for which the Earth and Sun are in roughly the same direction from the target, as seen on a skymap. Because the Earth moves through the sky once a day as seen from the satellite, the antenna in use at a given pointing changes during the day. GOs may wish to consult with the Resident Astronomers before their shifts to determine if the antenna problem is likely to affect their observing run and, if so, to plan around it.

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NEW CALIBRATIONS IN PROGRESS

Five days of calibration observations were obtained in September 1984 for the creation of a new LWP Intensity Transfer Function (ITF). A series of 80 UV-flood exposures was obtained in a coordinated calibration program by VILSPA and GSFC. A number of temporary lamp failures occurred, as had happened during the LWR ITF in November 1983. In addition, record high radiation levels hampered the observations so that a fifth day of observations had to be added on short notice. In spite of the troubles, an excellent set of images was obtained for the new LWP ITF. The data are currently being analyzed.

In January 1985 an additional four days of observations were devoted to a new SWP ITF. VILSPA and GSFC again collaborated to obtain the series of UV-flood and null exposures. No problems were encountered with the firing of the short wavelength spectrograph's lamps, but some daily variations in the lamp output were seen. A total of 79 UV-flood images were obtained to be used to produce a new twelve-level SWP ITF.

The ITF calibrations are used to linearize the raw data in data numbers (DNs) and to flat field the data to flux numbers (FNs). The current ITFs are known to be slightly non-linear, producing some linearity errors in the fluxes derived from IUE spectra (Oliversen, 1984, NASA IUE Newsletter No. 24, pg. 27). These are primarily due to changes in the camera behavior since the epoch of the original observations, as well as the limitations in the construction of the original ITFs. The new LWR ITF exhibits a significant improvement in linearity over the old ITF (Oliversen, 1984, NASA IUE Newsletter No. 24, pg. 50). Thus new ITF calibrations for the LWP and SWP were deemed desireable in view of the finite lifetime of IUE.

At present the IUE staff at GSFC and VILSPA are obtaining data for new absolute calibrations of all three cameras. The LWR and SWP have exhibited some slow sensitivity degradation since 1978 (Sonneborn, 1984, NASA IUE Newsletter No. 24, pg. 67). To some extent, algorithms can be created and used to correct for the time-dependence of the absolute calibration (see Holm, this newsletter). However, some refinements in the techniques used to produce the absolute calibrations should be possible that could potentially improve them (Bohlin and Holm, 1984, NASA IUE Newsletter No. 24, pg. 74). Corrections for systematic effects between point source spectra and trailed spectra and use of overexposures to improve the signal-to-noise ratio of the data at extreme wavelength ranges are examples. It is expected that the data acquisition for the new absolute calibrations will be completed within several months.

A subtle point: because the new ITFs will produce a somewhat difference scaling of DNs to FNs, the absolute calibration that is appropriate to use for a given image is a function of which ITF is used to linearize the data. It is expected that it will be neccesary to use algorithms to scale data processed with one ITF to another and to scale one absolute calibration to another. It will be increasingly important that the users of IUE data understand which calibrations are appropriate and to document them in their research papers. As a shorthand reference to the ITF used to calibrate the data, the following designations have been adopted by the IUE Project:

- SWP ITF0: first ITF used in 1978, with only one image per level (used if processing date is before 22 May 1978 at GSFC)
- SWP ITF1: next ITF used, created with four images per level, but containing the SWP ITF error (22 May 1978 - 7 July 1979)
- SWP ITF2: current ITF (7 July 1979 to present)
- SWP ITF3: new ITF to be created from the data obtained in January 1985

- LWR ITF0: first ITF used in 1978, with only one image per level (before 22 May 1978)
- LWR ITF1: current ITF, created with four images per level (22 May 1978 to present)
- LWR ITF2: new ITF created in 1984 (not yet implemented)

LWP ITF0: first ITF, with only one image per level for most levels (17 Aug 1981 - 3 Nov 1981)

LWP ITF1: current ITF, based on ITF0 but with a correction to the effective exposure time for level 6 (3 Nov 1981 to present)

LWP ITF2: new ITF to be created from the data obtained in September 1984

Further details about the ITFs may be found in the IUE Image Processing Information Manual (Version 2.0).

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SCATTERED LIGHT

Observers who have taken long SWP exposures on bright late-type stars are probably aware that IUE's gratings scatter light. The light is scattered from long wavelengths but appears as a flat continuum from 1500 A to Lyman-alpha and beyond. Such a pseudocontinuum can easily be mistaken for the spectrum of a hot companion. Sometimes, but not always, the continuum can be seen extending well past 1150 A, the sensitivity cutoff of the SWP camera due to its MgF optics, revealing its origin as scattered light.

Work is in progress to try to define the SWP scattering function and derive corrections for the scattered light. Basri, Clarke, and Haisch (1985, Astronomy and Astrophysics, in press) studied IUE spectra using the scattering function measured for a grating which was made from the same master as IUE's gratings. They found that a significant amount of light could be scattered out of emission line cores into broad scattering wings for lines, especially at short wavelengths. However, recent results using very overexposed spectra at Lyman-alpha indicate that the scattering function for the short wavelength spectrograph is much cleaner than this, i.e. only a few percent of the emission line flux is scattered. Basri reports that a new analysis will be done using the newer observational results.

To estimate whether or not significant scattered light may affect a given spectrum, some very rough "rules of thumb" may be used. In each case the DN per minute due only to grating scattered light is computed. Here F(2400) is the flux (erg cm^{-2} s^{-1} A^{-1}) at 2400 A.

Late A and early F stars:

$$S\ (DN/min) = 2 \times 10^{11} * F(2400)$$

G stars:

$$S\ (DN/min) = 1 \times 10^{11} * F(2740)$$

M stars:

$$\log S\ (DN/min) = 0.5 - 0.3 * V(mag)$$

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NEW LWP RIPPLE CORRECTION

As of 17 December 1984 at GSFC, a new LWP ripple correction has been implemented in the standard processing. For vacuum wavelengths, the following ripple constants were determined by Tom Ake:

$$k = 23071 + 5.573 * m$$
$$alpha = 0.896$$

where m is the order number. Previously the LWR ripple correction was applied to LWP high dispersion images, producing significant mismatch at the ends of the orders. For comparison, the current LWR ripple correction parameters are $k = 230012 + 17.25 * m - 0.0599\ m^2$ and alpha = 0.896.

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PHOTOWRITES OF VILSPA IMAGES

The IUE Project has authorized the creation of a photowrite browse file of VILSPA images. Photowrites containing 100 micron per pixel reproductions of the raw images, placed six to a page, are being produced. The new browse file will allow Guest Observers visiting GSFC to inspect VILSPA images visually.

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FES COUNTS NOW IN OBSERVATORY LOG

A new column has been added to the IUE Merged Log which contains the FES counts obtained for the target just before the exposure was started. Entries since 1978 have been added by hand from scripts, but the process will be automated soon. The FES counts should be helpful for GOs examining archival data on variable stars or for which the magnitude is otherwise suspect or unknown. FES counts may be converted to visual magnitudes using the relation described by Holm and Rice (1981, NASA IUE Newsletter No. 15, pg. 74; also in the IUE Users' Guide and in the preface to the IUE Merged Log).

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ADDRESS CHANGES

Please don't forget to send us your address and phone number changes so that you can continue to receive your schedules, skymaps, and other information promptly. The Observatory maintains an address list generated from the title page of the proposals, so any changes since last fall should be reported.

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OOPS!

In the last "IUE News" we reported what we thought was the first three-satellite coordinated observations of an astronomical source. However Andrea Dupree writes us that she observed Epsilon and Kappa Orionis with the IUE, Copernicus, and Einstein satellites back in March 1980. Whether the first or second time around, it's still an accomplishment!

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IUE PERSONNEL CHANGES

Keith Kalinowski has taken a position with NASA's Space Telescope group under Al Boggess. Don West has taken over the responsibilities of the Operations Scientist. Welcome back, Don!

Nancy Evans has joined the IUE operations staff as Resident Astronomer. Many of you know Nancy from her prior work as the IUE RDAF Astronomer. Carol Grady has taken over the duties of RDAF Astronomer. Carol comes to us from the Space Telescope Science Institute, where she worked on instrument calibration.

Howard Scott has joined IUE as the Data Enhancements Astronomer. Howard previously worked on the handling of IRAS data at the National Space Science Data Center here at GSFC. Joy Heckathorn has left IUE to work with the European Space Agency (ESA) group at the Space Telescope Science Institute.

Steve Walter has moved on from Telescope Operator to take another job at GSFC. He will be working on the Space Telescope attitude control system.

Bill Hathaway has left IUE to work at the Space Telescope Science Institute as a Console Operator. Some of you may remember that Bill has been with us since the launch of IUE, first as a Telescope Operator and most recently as an RDAF assistant. Rosalie Ewald has taken Bill's place at the IUE RDAF. Rosalie comes to us from the ESA group at Space Telescope.

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WEATHER FORECAST

Occasional periods of high radiation background, due to solar activity minimum conditions. Expected probability of high radiation (peak FPM > 2.4 volts) is about 25%, while the probability of low radiation (peak FPM < 1.7 volts) is around 30%.

EDITOR: C. L. IMHOFF PUBLISHER: W. A. FEIBELMAN