REPORT ON THE CONFERENCE

"IUE OBSERVING AT THE LIMIT"

Held at the University of Colorado, Boulder

August 15-17, 1983

INTRODUCTION

The conference was attended by 100 people, of which only 5 were from the European astronomical community. A total of 7 sessions was held (in series) covering the 6 major IUE subject areas, with the final one devoted to reviews of proposed future UV missions. The meeting as a whole served to advertise the existence of the new Regional Data Center which hosted the meeting. The intended emphasis of the conference was on special observing or data analysis techniques which use the satellite near the limit of its capabilities.

Here I offer an inevitably subjective summary of the, for me, most interesting and relevant points arising in the different sessions.

1. SOLAR SYSTEM

In his invited review P. Feldman (Johns Hopkins) demonstrated that solar system research is deriving great benefit from IUE. He suggested that an IUE-type facility should be made available for use exclusively in the field. Tricky observations of planets, asteroids and fast moving comets stretched IUE's pointing and tracking capabilities to the limit. Observations of the Jupiter aurora at the planet's north pole and of the Io Torus (a sulphur/oxygen plasma in the orbit of Io originating from Volcano activity on the satellite) were made possible with the special procedure FINDBRITE. This enables the "centre-of-light" of the extended and saturated FES image of Jupiter (or any other similar source) to be found, from which accurate offsetting can be performed. Other topics included observations of specific areas of Jupiter/s surface by means of offsetting from the Galilean satellites (M. Allen, Caltech) and the detection of S2 in Comet IRAS-Araki-Alcok (Feldman).

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2. COOL STARS

Stars in this category (type F and later) have relatively weak UV fluxes; hence the ability of IUE to observe a particular target for very long periods is of crucial importance to obtain useful spectra of such stars. According to T. Ayres (Colorado) the longest exposure made with IUE to date was 1290 mins. (21.5 hrs) on 21 May 1983 of Arcturus (a 0th mag. star). However, this was contested by A. Brown (JILA) who pointed out that this exposure was not continuous having been interrupted by an Earth occultation and an unload of the reaction wheels. He claimed that the record for the longest continuous exposure was still held by the Oxford Group (1273 mins). Ayres mentioned that judging from the rate of background build-up in the SWP camera, the longest useful exposure time was probably about 30 hrs.

B.M. Haisch (Lockheed, Palo Alto) discussed the problem of scattered light contamination of low dispersion SWP spectra which arises in the spherical cross-disperser. The problem is especially acute in studies of cool stars because the continuum rises steeply with increasing wavelength in the IUE spectral range. Using a number of different exposures of a well-determined source, an improved scattering profile has been generated which can be used to apply corrections, thus enabling accurate stellar continua to be determined from IUE spectra.

M. de la Pena (Colorado) addressed the question of accurate wavelength measurements with IUE. The dispersion characteristics of the spectrographs tend to vary with time, hence for accurate wavelength determination WAVCAL spectra taken at about the same time as the astronomical exposure are required. Since the camera read beam can be deflected by accumulations of charge resulting from heavy exposure, it is also important to take WAVCAL exposures at roughly the same exposure level as the astronomical exposure.

3. HOT STARS

The invited reviewer was H. Lamers (Colorado and Utrecht) who said that investigations with IUE in this field were often at the limit, and sometimes beyond it. He discussed the phenomenon of stellar winds with reference to the ejection of shells or "puffs" which are now thought to be common phenomena in these stars. The evidence for such inhomogeneities in stellar winds derives from observations with IUE of changes in line profiles which are just above the noise. He also pointed out that temperature estimates of the hottest stars require very good E(B-V) and spectral slope determinations. In the discussion it was mentioned by G. Basri (Berkeley) that there may be a problem with the low dispersion calibration of the LWR camera at around 2200 Å since it is often difficult to derive consistent E(B-V) values from the 2200 Å absorption feature. This would increase the uncertainty in the T(eff) estimates of WR and early O-type stars. G. Sonneborn (GSFC) added that it is in this range that the sensitivity of the LWR camera is decreasing most rapidly.

4. INTERSTELLAR MEDIUM

Both K. Davidson (Minnesota) and D. York (Chicago) presented reviews. In his talk Davidson said that observations of emission nebulae with IUE were relatively scant. This was partly due to the high extinction associated with many of these sources. He claimed that "analysis of UV nebular emission lines is always at the limit". The lines are very temperature dependent and hence temperature gradients in even the small portion of a nebula in the IUE field of view confuse the analysis. He mentioned some problems associated with IUE observations of nebulae.

1. There is no overlap of the IUE spectral range with the optical; hence there can be no optical check on lines measured with IUE.

2. It is difficult to tell from the merged log on exactly which part of a nebula observations were made.

3. IUE and ground-based spectrograph slits have different shapes and sizes and therefore cover different areas of a nebula.

4. Permanent bright spots on the camera target present a problem which could be eliminated if it were possible to "wiggle the grating", thereby shifting the position of the spectral image slightly. A similar point was addressed in a contributed paper by C.G. Seab (NASA/Ames), who concluded that fixed pattern noise can be greatly reduced by co-adding spectra with different aperture offsets.

York discussed the problems associated with accurate measurements of interstellar absorption lines, primarily fixed pattern noise. He claimed that by dividing the astronomical image by a flat standard star image taken on the same shift, and averaging a number of spectra thus derived, it should be possible to determine equivalent widths to an accuracy of ± 1mÅ with IUE. The accuracy obtainable with an ordinary single spectrum is about ± 30mÅ. In the discussion it was mentioned that since fixed pattern noise changes with time, it might be possible to overcome the problem to some extent, by averaging spectra taken at different times. The techniques described by York have been published (York and Jura, 1982, Ap. J. 254, p88).

A. Harris reported for P. Benvenuti on a proposed modification to the low dispersion extraction procedure which would retain the extra spatial resolution in the line-by-line spectrum afforded, but as yet not exploited, by the new low dispersion IUESIPS software (which uses a smaller extraction slit than the old software). The proposed modification would involve losing some lines of background from the line-by-line spectrum which are not used by IUESIPS in the derivation of the net spectrum. R. Green (Kitt Peak) commented that workers involved in analysis of very weak spectra might regret the partial loss of background information.

5. EXTRAGALACTIC

R. Green began his invited review with a very pertinent IUE proverb: "One man's errors are another man's data" (does this imply that astrophysical models in this field are based on observations of fixed pattern noise and residual images?!). He discussed a recent paper by Ellis, Gondhalekar and Efstathiou who have used an IUE-shaped slit on a ground-based telescope in order to obtain optical data of galaxies that can be compared directly with their IUE data. The patchy nature of spiral galaxies makes meaningful comparisons of data taken with differently shaped apertures virtually impossible, hence their method is essential. Green also discussed the question of the extent of galactic haloes and the complex nature of QSO absorption line systems which are presumably produced in them.

6. INTERACTING SYSTEMS

M.J. Plavec's (UCLA) invited review highlighted the dramatic increase in knowledge of interacting binary systems brought about by IUE. It was IUE observations of absorption by NV, CIV, Si IV etc. in these systems which first provided evidence for circumstellar shells or accretion disks. Plavec also discussed the difficulties in classifying the stars in such binary pairs and demonstrated the importance of simultaneous optical and UV observations for this purpose.

J.L. Weiland (UCLA) presented evidence for wind outflow from the accreting component of the V356 Sgr system. Absorption features observed in high resolution have extended wings on the short wavelength side, presumably due to an accretion-powered expanding wind.

7. FUTURE UV MISSIONS

A. Davidson (Johns Hopkins) reviewed the Hopkins UV Telescope (90cm) project which is designed for spectrophotometry in the 900-1200 A region with 3 A resolution. This will be mounted alongside a UV imaging experiment and WUPPE (Wisconsin UV Photo-Polarimeter Experiment) on the Spacelab instrument pointing system and flown on 3 Shuttle missions in 1986/87. The combination is intended for use by guest observers and it is hoped to observe Comet Halley on the first flight. Other projects reviewed include the Extreme UV Explorer (EUVE), an all sky survey satellite for the 100-912A band, incorporating a grazing incidence spectrometer (S. Bowyer, Berkeley), and STARLAB, an Australia-Canada-US 1m orbiting telescope intended for spectroscopy (1000-8000A) and wide-field (0.5°) imagery which might be launched "about 1990 ish" (C. Anderson, Wisconsin), and FUSE/COLUMBUS which will be designed for spectroscopy in the range 80-~2000A and will have grazing incidence optics (A. Boggess, GSFC). Boggess gave an estimate of 150 M$ for the cost of COLUMBUS and said that NASA is looking towards ESA as a possible 50% partner in the project.

POSTER PRESENTATION

Examples of high dispersion spectra extracted by means of the Trieste Observatory procedure were presented. This procedure involves 2-D fourier transforming, high frequency filtering and, using the IUE instrumental profile, deconvolving the image. Background subtraction is then carried out after an inverse fourier transform. The authors claim to have reached the practical limit of IUE high dispersion extraction efficiency.

In his closing summary, T. Snow (Colorado) stressed the importance of good documentation of the special techniques and procedures presented, in order to maximise their usefulness to the IUE community.

A. W. Harris 25 Aug 1983