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Since the days of our first Professor of Physics, Henry Rowland, we have been involved in the application of physics, particularly physical optics, to the solution of problems in astronomy. We take the happy occasion of the founding of the Space Telescope Science Institute (STScI) on our Homewood campus, to begin regular reporting of our astronomical and astrophysical activities in these pages. In this first report, we summarize our activity for the period 1 January 1979–31 August 1981.

I. PERSONNEL

Permanent staff contributing to research in astronomy and astrophysics are Adjunct Research Professor W. G. Fastie, and A. F. Davidsen, P. D. Feldman, R. C. Henry, and H. W. Moos, Professors. In addition, several of our theorists contribute to the study of the relationship of particle physics to cosmology. Postdoctoral research associates during this period were George H. Mount (now at Colorado), S. Durrance, and George F. Hartig (Ph.D., J.H.U.; soon to go to Cerro Tololo). Graduate students publishing in this period were William Brune (now at Harvard), John Clarke (now at Berkeley), H. Weaver (now at Goddard), R. C. Anderson (now with Hughes Aircraft), William Snyder (now at the Naval Research Laboratory), and W. Landsman.

II. SPACE TELESCOPE

Fastie is one of two “Telescope Scientists” for Space Telescope and is a member of the Science Working Group. Davidsen is a Co-Investigator on the Faint-Object Spectrometer. Fastie and Davidsen worked substantially with AURA in the preparation of their successful proposal for the Space Telescope Science Institute. Davidsen chairs a committee of the Physics Department faculty that coordinates the interface between the Physics Department and the Space Telescope Science Institute. Dr. Riccardo Giaconi, Director of the Space Telescope Science Institute, also is on the coordination committee. Professor Giaconi is on leave from Harvard, and will be joining the Johns Hopkins tenured faculty.

III. RESEARCH

William G. Fastie continued application of physical optics, particularly the Ebert spectrometer, to a wide variety of problems in auroral and planetary physics, and astrophysics. In addition to his work concerning Space Telescope and the Space Telescope Science Institute, he continued his work on evaluation of optical components, particularly gratings, and played his usual substantial role in the Johns Hopkins sounding rocket and Space Shuttle ultraviolet astronomy program.

Arthur F. Davidsen conducts a research program in space astronomy, currently focused on ultraviolet spectrophotometry of extragalactic objects and development of new instrumentation applicable to such studies. As a Co-Investigator on the Faint Object Spectrograph (FOS) for Space Telescope, Davidsen was responsible for the general optical design and has been carrying out measurements (with G. F. Hartig and graduate students C. Bowers and R. Pembroke) of the performance characteristics of the optical components for FOS. As a result of this work, a few initially inefficient components have been re-made and are now expected to yield excellent performance. The FOS will provide spectral coverage from 1200 to 8000 Å in two modes, with resolution ~1000 and ~200, as well as performing spectropolarimetry in the ultraviolet. Davidsen (with W. G. Fastie and G. F. Hartig) followed up their earlier development of the Faint Object Telescope rocket instrument (16-in. aperture) with a new 36-in. telescope designed for far- and extreme-UV spectrophotometry, and carried aloft by an Aries rocket. This prime focus f/2 telescope and concave-grating spectrograph employs a microchannel plate detector for photon counting in the windowless UV, below ~1100 Å. An initial flight of the Aries telescope in April 1981 was unsuccessful, however, owing to charged-particle contamination. Davidsen is P.I. for the Hopkins Ultraviolet Telescope (HUT) Project, which involves a 36-in. telescope to be flown aboard Space Shuttle as part of an instrument package called OSS-3. The HUT has evolved from the Aries design, but includes several significant improvements, including an evacuated spectrograph, a new detector (employing an MCP-intensified Reticon in the photon-counting mode), and an on-board microprocessor for data handling and instrument control. OSS-3 is expected to fly in early 1985. The HUT will obtain spectra at ~2-Å resolution on flat-spectrum objects as faint as V ~17, primarily in the 900–1200-Å range, but with some capability from 500 to 1800 Å. The initial flight will concentrate on quasars and other active galactic nuclei, although a broad range of observations, including planets, stars, nebulae, and galaxies, is also planned. Davidsen (along with W. G. Fastie) devoted much of his effort during the reporting period to bringing the STScI to the Johns Hopkins Campus. He chaired a University committee which worked out a joint proposal with AURA, Inc., leading to the award of the STScI contract in January 1981. He then assisted with the start-up phase of the Institute, and was responsible for the functional design of the STScI building, among other things. Davidsen was awarded the Helen B. Warner Prize of the AAS in 1979. He was elected to the AURA Board of Directors also in 1979, and has served on the AURA Executive Committee in 1981–1982. He has also served on the NASA Management and Operations Working Group in Space Astronomy since 1980, the AXAF Science Working Group since 1977, and was elected a Councilor of the AAS in 1981.
Paul D. Feldman directs the NASA-supported sounding rocket program and makes extensive use of the International Ultraviolet Explorer (IUE) satellite for ultraviolet spectroscopy of the terrestrial atmosphere and the atmospheres of comets and planets. Successful sounding rocket launches during this period included UV observations of the zodiacal light and the twilight airglow (with graduate student R. Cebula) in September 1979; a twilight auroral experiment launched at ESRANGE in northern Sweden in August 1979 in collaboration with Dr. G. Witt of the University of Stockholm; high-resolution ultraviolet spectroscopy (500-1500 Å) of the day airglow (with graduate student R. Eastes, A. B. Christensen of Aerospace Corp, and E. P. Gentieu of Goddard Space Flight Center) in June 1980; and an observation of the ultraviolet spectrum of the Io plasma torus in May 1981 (with S. T. Durrance who joined the department as a post-doc in October 1980, and graduate student H. A. Weaver). The IUE work on planets has focused on Venus and Jupiter (in collaboration with H. W. Moos). The Venus observations led to the identification of the nightglow previously observed by Mariner 5 and Pioneer Venus Orbiter as NO MP 6-band emission produced by the radiative association of nitrogen and oxygen atoms in the upper atmosphere. Several comets were observed by IUE and the analysis of these data has been carried out by Feldman and graduate student H. A. Weaver in collaboration with M. F. A’Hearn of the University of Maryland and M. C. Festou of Service d’Aéronomie du CNRS (France). Several new results were obtained from the comet observations including the identification of the forbidden O I (5S–3P) transition at 2927 Å and several CO$_2^+$ bands of the A-X system; the identification of CS as the probable parent of the observed CS and S; and the identification of the C$_3$d$
u$ = 0 Mulliken band sequence at 2313 Å. All of the spectra are consistent with H$_2$O being the dominant cometary constituent, and the observations of periodic comet Encke in particular suggest a homogeneous structure for the cometary nucleus and a common composition for all of the comets so far observed by IUE.

Richard C. Henry conducts research on the interstellar medium, cosmology, and x-ray and ultraviolet background radiation. During this period, Henry (with R. C. Anderson, W. H. Brune, P. D. Feldman, and W. G. Fastie) reported results of an Aries sounding rocket experiment to measure the far-ultraviolet high-galactic-latitude background in the spectral range 1230–1680 Å. A far-ultraviolet spectrometer and several far-ultraviolet photometers were carried to an altitude of 347 km. For two of the targets, the stellar correction was negligible. After correction for O I airglow, a nearly uniform residual intensity of 285 ± 32 photons (cm$^2$ sr Å$^{-1}$) was found. The flat spectrum is consistent with an origin in the integrated light of distant galaxies, which would appear at about this level. The light is unlikely to represent galactic-plane starlight backscattered by high-Z dust in Astrophysical Journal Letters, Henry reported Apollo 17 high- and moderate-galactic-latitude ultraviolet-background data, subtracting TD-1 observations of point sources. He showed that in the far ultraviolet, the scattering parameter $g$ > 0.7. With a value of $g$ this large, little backscattered light would be expected at the highest galactic latitudes. In addition, at IAU Symposium No. 90, in Ottawa, Canada, in August 1979, Henry reported analysis of the Apollo 17 data in a search for ultraviolet zodiacal light. No signal could be detected, confirming that earlier reports of high far-ultraviolet zodiacal light intensities were incorrect. The Apollo 17 data have also been used by Henry to measure the spectrum (1180–1680 Å) and Gould-latitude dependence of the local interstellar radiation field, over one-third of the sky. The result was corrected to give expected values for the entire sky. The average local 1180–1680 Å energy density is $5.8 \times 10^{-17}$ ergs cm$^{-2}$ Å$^{-1}$. The surface brightness was found to fall toward high latitudes much more steeply than published models predict. Henry continued as Editor-in-Chief of the journal Astrophysical Letters, with Daviden (JHU), Pounds (Leicester), and Jugaku (Tokyo) as Editors. Submissions to Astrophysical Letters are increasing in number and the quality remains very high. Also during this period, Henry served on the Astronomy Survey Committee, chairing the panel on Organization, Education and Personnel. He also served on the Nominations Committee of the Astronomy Section of the American Association for the Advancement of Science, and was elected a Fellow of the AAAS. He and Daviden both served on the Scientific Organizing Committee for the Tenth Texas Symposium on Relativistic Astrophysics, which was held in Baltimore in 1980. Finally, Henry was appointed to the Committee on Space Astronomy and Astrophysics, of the Space Science Board; he will serve until 1983.

H. Warren Moos, with Professor Feldman, Dr. Durrance, and Dr. Clarke, has used the IUE satellite to study the outer planets. Recent results are concerned with the energetics of the Jovian aurorae, the stability of the Io torus, and hydrocarbon abundance in the upper part of the atmosphere of Jupiter and Saturn. Moos also continued his activity as Co-Investigator on the far-ultraviolet spectrometer experiments on Voyagers 1 and 2, and continued a vigorous laboratory program in ultraviolet diagnostics of high-temperature Tokamak plasmas, a program with direct relevance to astrophysics. Moos is a Fellow of the American Physical Society, and served in this period on the NASA Astronomy and Relativity Management Operations Working Group.

**IV. BIBLIOGRAPHY (1979–1981)**


