1982BAAS...14..671.

The Johns Hopkins University
Department of Physics
Baltimore, Maryland 21218

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 Giacconi, Director of the Space Telescope Science Institute, also is on the coordination committee. Professor Giacconi 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 $\sim$1000 and $\sim$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 $\sim$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 $\sim$2-Å resolution on flat-spectrum objects as faint as $V \simeq 17$, 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.

© American Astronomical Society • Provided by the NASA Astrophysics Data System

1982BAAS...14..671.

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 δ-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'Aeronomie du CNRS (France). Several new results were obtained from the comet observations including the identification of the forbidden O I (^1S–^3P) transition at 2927 Å and several CO_2^+ bands of the $\tilde{A}$-$\tilde{X}$ system; the identification of CS_2 as the probable parent of the observed CS and S; and the identification of the $C_2 \Delta\nu = 0$ Mulliken band sequence at 2313 Å. All of the spectra are consistent with H_2O 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 $(cm^2\ s\ sr\ Å)^{-1}$ 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 $g \geq 0.7$. 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 5.8×10^{-17} ergs cm^{-3} $Å^{-1}$. 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 Davidsen (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 Davidsen 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)

A'Hearn, M. F., and Feldman, P. D. (1980). "Carbon in Comet Bradfield 1979*l*," Astrophys. J. Lett. **242**, L187.

Anderson, D. E., Feldman, P. D., Gentieu, E. P., and Meier, R. R. (1980). "The ultraviolet dayglow: 2, Ly α and Ly β emission and the H distribution in the mesosphere and thermosphere," Geophys. Res. Lett. **7**, 529.

Anderson, D. E., Feldman, P. D., Gentieu, E. P., and Meier, R. R. (1980). "The ultraviolet dayglow: 3, O I emissions at 989, 1027, 1304, and 1356 Å," Geophys. Res. Lett. **7**, 1057.

Anderson, R. C., Brune, W. H., Henry, R. C., Feldman, P. D., and Fastie, W. G. (1979). "The spectrum of the diffuse cosmic ultraviolet background," Astrophys. J. Lett. **233**, L39.

© American Astronomical Society • Provided by the NASA Astrophysics Data System

1982BAAS...14..671.

Anderson, R. C., Henry, R. C., Brune, W. H., Feldman, P. D., and Fastie, W. G. (1979). "Far-ultraviolet studies. V. Rocket observation of the diffuse cosmic background," Astrophys. J. **234**, 415.

Ayres, R. R., Basri, G. S., Landsman, W., Henry, R. C., Linsky, J. L., Moos, H. W., and Stencel, R. E. "Outer atmospheres of cool stars. XII. *IUE* echelle spectra of late-type dwarfs and giants," submitted to Astrophys. J.

Beiting, E. J., and Feldman, P. D. (1979). "Ultraviolet spectrum of the aurora (2000–2800 Å)," J. Geophys. Res. **84**, 1287.

Broadfoot, A. L., Belton, M. J. S., Sandel, B. R., Shemansky, D. E., Takacs, P. Z., Holberg, J. B., Atreya, S. K., Donahue, T. M., Moos, H. W., Bertaux, J. L., Blamont, J. E., Strobel, D. F., McConnell, J. C., Dalgarno, A., Goody, R., and McElroy, M. B. (1979). "Extreme ultraviolet observations from *Voyager 1* encounter with Jupiter," Science **204**, 979.

Broadfoot, A. L., Sandel, B. R., Shemansky, D. E., Holberg, J. B., Smith, G. R., Strobel, D. F., McConnell, J. C., Kumar, S., Hunten, D. M., Atreya, S. K., Donahue, T. M., Moos, H. W., Bertaux, J. L., Blamont, J. E., ... Pomphrey, R. B., and Linick, S. (1981). "Extreme ultraviolet observations from *Voyager 1* encounter with Saturn," Science **212**, 206.

Brune, W. H., Mount, G. H., and Feldman, P. D. (1979). "Vacuum ultraviolet spectrophotometry and effective temperatures of hot stars," Astrophys. J. **227**, 884.

Clarke, J. T., Weaver, H. A., Feldman, P. D., Moos, H. W., Fastie, W. G., and Opal, C. B. (1980). "Spatial imaging of hydrogen Lyman α emission from Jupiter," Astrophys. J. **240**, 696.

Clarke, J. T., Moos, H. W., Atreya, S. K., and Lane, A. L. (1980). "Observations from Earth orbit and variability of the polar aurora on Jupiter," Astrophys. J. Lett. **241**, L179.

Clarke, J. T., Moos, H. W., Atreya, S. K., and Lane, A. L. (1981). "*IUE* detection of bursts of H Ly α emission from Saturn," Nature **290**, 226.

Clarke, J. T., and Moos, H. W. (1981). "Spatial imaging of UV emission from Jupiter and Saturn," in *The Universe in Ultraviolet Wavelengths: The First Two Years of IUE*, NASA CP-2171 (GPO, Washington, D.C.), p. 39.

Clarke, J. T., Moos, H. W., Atreya, S. K., and Lane, A. L. (1981). "Observations of the Io plasma torus," in *The Universe in Ultraviolet Wavelengths: The First Two Years of IUE*, NASA CP-2171 (GPO, Washington, D.C.), p. 49.

Clarke, J. T., and Moos, H. W. (1981). "Extracting spatial information from large aperture exposures of diffuse sources," in *The Universe in Ultraviolet Wavelengths: The First Two Years of IUE*, NASA CP-2171 (GPO, Washington, D.C.), p. 787.

Clarke, J. T., Moos, H. W., Atreya, S. K., and Lane, A. L. (1981). "Observations of polar aurora on Jupiter," in *The Universe in Ultraviolet Wavelengths: The First Two Years of IUE*, NASA CP-2171 (GPO, Washington, D.C.), p. 45.

Clarke, J. T., Moos, H. W., and Feldman, P. D. (1981). "IUE monitoring of the spatial distribution of the H Ly α emission from Jupiter," Astrophys. J. Lett. **245**, L127.

Davidsen, A. F. (1980). "Some implications of ultraviolet observations of quasars and active galaxies," in *Objects of High Redshift*, edited by G. O. Abel and P. J. E. Peebles, Proceedings of IAU Symposium No. 92 (Reidel, Dordrecht), p. 235.

Davidsen, A. F., Fastie, W. G., Feldman, P. D., Hartig, G. F., and Fountain, G. H. (1981). "The Johns Hopkins ultraviolet telescope for shuttle astronomy," SPIE J. **265** (Shuttle Pointing of Electro-Optical Experiments), 375.

Feldman, P. D., Moos, H. W., Clarke, J. T., and Lane, A. L. (1979). "Identification of the ultraviolet nightglow from Venus," Nature **279**, 221.

Feldman, P. D. (1980). "Ultraviolet albedo of Comet West (1976 VI)," in *Solid Particles in the Solar System*, edited by I. Halliday and B. A. McIntosh, Proceedings of IAU Symposium No. 90 (Reidel, Dordrecht), p. 263.

Feldman, P. D., Weaver, H. A., Festou, M. C., A'Hearn, M. F., Jackson, W. M., Donn, B., Rahe, J., Smith, A. M., and Benvenuti, P. (1980). "*IUE* observations of the ultraviolet spectrum of Comet Bradfield," Nature **286**, 132.

Feldman, P. D. (1981). "New insight into the physical state of solar system objects," in *The Universe at Ultraviolet Wavelengths: The First Two Years of IUE*, NASA CP-2171 (GPO, Washington, D.C.), p. 21.

Feldman, P. D. (1981). "Ultraviolet spectroscopy of comets using sounding rockets, IUE and Spacelab," in *Modern Observational Techniques for Comets*, JPL Publication 81-68, p. 139.

Feldman, P. D. (1981). "Ultraviolet spectroscopy of comets," in *Comets and the Origin of Life*, edited by C. Ponnamperuma (Reidel, Dordrecht), p. 31.

Feldman, P. D., Anderson, D. E., Meier, R. R., and Gentieu, E. P. (1981). "The ultraviolet dayglow: 4. The spectrum and excitation of singly ionized oxygen," J. Geophys. Res. **86**, 3583.

Gentieu, E. P., Feldman, P. D., and Meier, R. R. (1979). "Spectroscopy of the extreme ultraviolet dayglow at 6.5 Å resolution: atomic and ionic emissions between 530 and 1240 Å," Geophys. Res. Lett. **6**, 325.

Harms, R. J., Angel, R., Bartko, F., Beaver, E., Bloomquist, W., Bohlin, R., Burbidge, E. M., Davidsen, A. F., Flemming, J. C., Ford, H., and Margon, B. (1970). "Faint-Object spectrograph for Space Telescope," Proc. SPIE Space Opt. **183**, p. 74.

Hartig, G. F., and Davidsen, A. F. "Far-ultraviolet spectrum of the Seyfert Galaxy NGC 4151," in *COSPAR /IAU Symposium of X-Ray Astronomy*, June, 1978, edited by W. A. Baity and L. E. Peterson (Pergamon), p. 377.

Hartig, G. F., Fastie, W. G., and Davidsen, A. F. (1980). "A. Rocket instrument for far ultraviolet spectrophotometry of faint astronomical objects," Appl. Opt. **19**, 729.

Henry, R. C., Anderson, R. C., and Fastie, W. G. (1980). "Far-ultraviolet studies. VII. The spectrum of the interstellar radiation field," Astrophys. J. **239**, 859.

Henry, R. C., Anderson, R. C., and Fastie, W. G. (1980). "Far-ultraviolet studies. VIII. *Apollo 17* search for zodiacal light," in *Solid Particles in the Solar System*, edited by I. Halliday and B. A. McIntosh, Proceedings of IAU Symposium No. 90 (Reidel, Dordrecht), p. 41.

© American Astronomical Society • Provided by the NASA Astrophysics Data System

1982BAAS...14..671.

Henry, R. C. (1981). "Far-ultraviolet diffuse galactic light," Astrophys. J. Lett. **244**, L69.

Hollis, J. M., Brandt, J. C., Hobbs, R. W., Maran, S. P., and Feldman, P. D. (1981). "Radio observations of Comet Bradfield (1979*l*)," Astrophys. J. **244**, 355.

Jackson, W. M., Halpern, J., Feldman, P. D., and Rahe, J. (1981). "Analysis of *IUE* observations of CS in Comet Bradfield (1979*l*)," in *The Universe at Ultraviolet Wavelengths*: *The First Two Years of IUE*, NASA CP-2171 (GPO, Washington, D.C.), p. 55.

McClintock, W., and Henry, R. C. (1980). "The Ca II K line in Debeb," Astrophys. J. **238**, 220.

Meier, R. R., Strickland, D. J., Feldman, P. D., and Gentieu, E. P. (1980). "The ultraviolet dayglow: 1. Far uv emissions of N and N_2," J. Geophys. Res. **85**, 2177.

Moos, H. W., and Clarke, J. T. (1979). "Detection of acetylene in the saturnian atmosphere using the IUE satellite," Astrophys. J. Lett. **229**, L107.

Moos, H. W. (1981). "Ultraviolet emissions from the upper atmospheres of the planets," Adv. Space Res. **1**, 155–164.

Moos, H. W., and Clarke, J. T. (1981). "Ultraviolet observations of the Io torus from Earth orbit using the IUE observatory," Astrophys. J. **247**, 354.

Opal, C. B., Feldman, P. D., Weaver, H. A., and McClintock, J. A. (1979). "Two-dimensional ultraviolet imagery with a microchannel-plate/resistive anode detector," SPIE **172** (Instrumentation in Astronomy III), 317.

Sandel, B. R., Shemansky, D. E., Broadfoot, A. L., Bertaux, J. L., Blamont, J. E., Belton, M. J. S., Holberg, J. B., Atreya, S. K., Donahue, T. M., Moos, H. W., Strobel, D. F., McConnell, J. C., Dalgarno, A., Goody, R., and McElroy, M. B. (1979). "Extreme ultraviolet observations from *Voyager 2* encounter with Jupiter," Science **206**, 4421.

Snyder, W. A., Davidsen, A. F., Wood, K., Kinzer, R., Smathers, H., Shulman, S., Meekins, J. F., Yentis, D. J., Evans, W. D., Byram, E. T., Chubb, T. A., Friedman, H., and Margon, B. (1980). "Rapid x-ray variability of PKS 2155-304," Astrophys. J. Lett. **237**, L11.

Weaver, H. A., Feldman, P. D., and Festou, M. C. (1981). "Water production models for Comet Bradfield (1979*l*)," in *The Universe at Ultraviolet Wavelengths*: *The First Two Years of IUE*, NASA CP-2171 (GPO, Washington, D.C.), p. 65.

© American Astronomical Society • Provided by the NASA Astrophysics Data System