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This report covers the period October 1, 1995, to September 30, 1996. It is drastically shortened from a version available by request from the Department of Astronomy or at <http://www.astro.wisc.edu>. The long version also contains a list of papers published in refereed journals or invited talks given at conferences. There is also a list of papers submitted to refereed journals or in press.

1. PERSONNEL

Karen Bjorkman accepted an Assistant Professorship at the University of Toledo in August and Jon Bjorkman will be a Senior Scientist in that department. Emeritus Professor A. D. Code became the WIYN Observatory Scientist and is spending 1996-97 at NOAO in Tucson, AZ. John G. Hoessel was on sabbatical leave for the 1995/96 academic year. Professor J. S. Mathis retired on June 30 after 37 years of active service and was granted emeritus status. Robert D. Mathieu was promoted to Full Professor in August 1996 and Ronald J. Reynolds was hired as Full Professor from the UW Physics Department. Emeritus Professor Albert E. Whitford of Lick Observatory moved to Madison and became a Visiting Professor in June 1996. Eric M. Wilcots was appointed to Assistant Professor on July 1, 1996.

Emeritus Professor R. C. Bless' introductory text book "Discovering the Cosmos" was published by University Science Books. Churchwell continued to serve on the NRAO Visitors Committee. Mathieu serves on the National Optical Astronomy Observatory Users Committee, the Task Group for Space Astronomy and Astrophysics of the National Research Council, the WIYN Board, and the WIYN Scientific Advisory Committee. Percival was appointed to the review board of the IAU Working Group on Astronomical Standards called SOFA (Standards of Fundamental Astronomy). Savage continued as a Councilor of the American Astronomical Society and to serve on the WIYN Board of Directors (president), the Star Formation and Interstellar Medium Panel of the Task Group for Space Astronomy and Astrophysics. He also became a member of NASA's Origins Subcommittee. Sparke gave an invited review on "Polar Ring Galaxies" at the June 1996 AAS Meeting.

Andrew Afflerbach, Brian Casey, David Cohen, Andrea Cox, Richard Ignace, Eric Jensen, Andrea Schweitzer, and Deborah Shepherd received doctorates. Their titles and present locations are given in the long report.

2. SOLAR SYSTEM

Fox has investigated the albedos of Venus, Mars, and Jupiter and the polarization of Mars and Io from data collected by WUPPE. Fox has also investigated the visual polarimetric variability of Mars from data collected at PBO.

3. STARS

Ignace, Cassinelli, and J. Bjorkman have investigated equatorial compression effects on stellar winds and the Hanle

Effect as a magnetic field diagnostic for stars across the H-R Diagram. Wood, J. and K. Bjorkman, and Putman continued a study of the circumstellar geometry of Be stars using a 3D Monte Carlo transfer code.

Several groups are studying aspects of stellar variability. Anderson is monitoring the strength of CaII H&K lines for periodicities in NGC 226. He also continues to monitor AG Draconis at optical, UV and EUV wavelengths. Fox is analyzing the visible polarimetric variability of HD 108. Stassun, Mathieu, Mazeh, and Vrba have obtained light curves for about 5000 stars in the Orion Association. Walter and Mathieu are searching for Li absorption lines in this association.

Dolan and Mathieu have obtained high precision radial velocities for more than 150 stars in NGC 188.

von Hippel and coworkers Gilmore, Tanvir, Robinson, Jones, and Sarajedini continued their search for white dwarfs, determination of the luminosity function, and physical properties of several open clusters, including NGC 188.

Churchwell, Shepherd, Acord and Walmsley have obtained spectral line images of several massive molecular outflows in massive star formation regions including G5.89. Flow properties appear to scale with the luminosity of the central star.

The study of young binary star systems remains a focus of the research program of Mathieu and coworkers (including Jensen, Casey and Stassun at UW-Madison). They have studied the orbits, disk structure, periods, masses, etc. for UZ Tau, 045251+3016, TY CrA, UZ TauE, and DQ Tau. Hoffman, Nordsieck, and Fox have analyzed the polarization of the interacting binary β Lyrae using WUPPE and PBO data.

4. INTERSTELLAR MEDIUM

Anderson and coworkers have analyzed the polarization of the ISM toward targets observed by Astro-1, Astro-2, PBO, and WIYN. Their results are in press. Weitenbeck and Anderson continued their study of the ISM toward NGC 1502.

Interstellar dust properties continued to be studied by Mathis and coworkers. Grain models constrained by newly determined C/H gas phase abundances have been calculated to see if they are consistent with several spectral dust features. O'Donnell and Mathis considered grain-grain and grain-gas collisions with circulation between diffuse gas and clouds to explain the IS extinction law and element depletions. Wood and Mathis have modelled the transfer of radiation through a plane-parallel dust slab using a Monte Carlo code.

Churchwell and coworkers continued their study of UC HII regions. Afflerbach, Churchwell, Acord, Hofner, Kurtz, and De Pree completed a study of the electron temperatures as a function of galactocentric distance using multiple transition radio recombination lines from the VLA. Afflerbach, Churchwell, and Werner determined the variation of O/H,

N/H, and S/H with galactocentric distance from KAO FIR fine structure lines toward UC HII regions. Hofner and Churchwell completed a high resolution survey of water masers toward UC HII regions. A radio line study of the Vela Shell was completed by Churchwell, Winnberg, Cardelli, Cooper, and Suntzeff.

Reynolds in collaboration with Tufte, Haffner, and Hausen have obtained initial observations of diffuse ionized ISM with the Wisconsin H-Alpha Mapper (WHAM). Lines observed during the test phase of WHAM are: [OI] 6300, [NII] 5755, HeI 5876, [OIII] 5007, H- α , and [SII] 6716.

Savage and collaborators have used the GHRS on the HST to study galactic halo and disk gas seen in absorption against background stars, galaxies, and quasars. Savage, Sembach, and Lu have obtained the scale height of CIV and NV in the Galactic halo. Sembach, Savage, and Tripp obtained properties of radio loops I and IV from NV, CIV, and SiIV. Sembach, Savage, Lu, and Murphy have detected and studied the properties of CIV-HVCs toward three clouds. Cardelli, Meyer, Jura, and Savage have measured the C/H gas phase abundance toward 6 stars to be $140 \pm 20 \times 10^{-6}$

5. EXTRAGALACTIC

Hoessel, Han, and Gallagher continued their participation in the WFPC2 team project to determine the extragalactic distance scale using Cepheids in NGC 7331. They also are studying the morphologies of dwarf galaxies in clusters and properties of NGC 147. Hoessel and Saha are studying cepheids in 15 nearby galaxies using WIYN.

Nordsieck and Harris measured the polarization of UV diffuse light in the LMC using WISP.

Sparke, with Colley and Watson, and students Cox, Erwin, and Maciejewski are investigating the stellar content, neutral hydrogen, and dynamical structure of polar rings, galaxy warps, bars, and disk stability in a variety of galaxies using optical and radio observations.

Von Hippel, Ferguson, and Tanvir continued their search for intergalactic stars in the Virgo Cluster of galaxies using HST photometry. No stars have been detected so far.

Savage with student Tripp and Lu have investigated the high z QSO absorption line systems HS1946+7658 and HS1700+6416 using HST (GHRS) and the relationship between galaxies and intergalactic $L\alpha$ clouds using WIYN (MOS/HYDRA) and HST (GHRS).

Wilcots with colleagues, including Gallagher, Pisano (grad student) and Turnbull (undergrad), are studying the distribution and kinematics of HI in IC10, IC1613, Sextans A, NGC 4449, and several Seyfert galaxies. A NIR study of barred Magellanic spirals along with optical (WIYN) studies of their morphology and star formation characteristics is underway. Gallagher and Wilcots are analyzing CO in the outer disk of M101.

6. TEACHING

Mathieu and Dolan have developed a series of computer-based laboratory exercises for the undergraduate survey

course. The Department has also decided to offer more focused introductory courses on less material for fewer credits than the current survey course. The courses will have two lectures per week and one discussion section with an option to also take an accompanying lab course. The separate courses will be: The Solar System; Stellar Astronomy; and Galaxies and Cosmology.

7. WIYN AND INSTRUMENTATION

The University of Wisconsin has a 26% share in the observing time of the 3.5-meter advanced technology telescope WIYN. The telescope is now in routine operation and producing excellent high resolution optical images and spectral data. Its median point source image size through September 1996 was 0.8". About 25% of the time it achieves 0.7" or better and the best images are about 0.4".

The "general use" instruments for WIYN include the hundred-fiber multi-object spectrograph (MOS) and fiber positioner (HYDRA) and a 2048x2048 pixel CCD camera with a FOV of 6.7'x6.7' and pixel size of 0.2"/pixel. Several faculty members, scientists, and students are actively using WIYN and are pleased with its performance.

The Halfwave Spectropolarimeter (HPOL) (Nordsieck, PI) obtained data both from WIYN and the Pine Bluff Observatory where it has successfully obtained polarization data for well over 150 objects. This program is continuing.

The Wisconsin H-Alpha Mapper (WHAM) (Reynolds, PI) is a high through-put Fabry-Perot spectrometer which saw first light in January 1996 at Pine Bluff Observatory. It is scheduled to begin the H- α sky survey at Kitt Peak in early 1997.

The Spatial Heterodyne Spectrometer (SHS) is an extremely high through-put Fourier transform spectrometer for faint UV line emission from 100,000 K gas designed as a sounding rocket payload (F. Roesler, PI and W. Sanders and J. Harlander co-PIs). A suborbital flight is tentatively scheduled for 1997.

The Goddard High Resolution Spectrometer (GHRS) is a UV spectrometer on the Hubble Space Telescope. Savage and colleagues continue to evaluate its performance which has been excellent since the repair mission of 1993.

The Wisconsin Ultraviolet Photopolarimeter Experiment (WUPPE) has successfully flown on two space shuttle missions and produced excellent results for a large number of objects many of which are still being evaluated.

Far Ultraviolet Spectroscopic Explorer (FUSE) (Savage, co-PI) is a satellite borne high resolution spectroscopy mission for the 912-1200Å wavelength region scheduled for launch in late 1998.

PUBLICATIONS

The extended version of this report lists 68 publications by staff members in refereed journals or written versions of invited talks, and 47 more that have been submitted to refereed journals.

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