

bly C I (UV 33.04). The most dramatic difference in the spectra from star to star is the ratio in the strength of the O I and S I features, which varies by a factor in excess of 100 (from greater than 10:1 in Eta Per to less than 1:10 in Alpha Ori, and perhaps even smaller in Psi-1 Aur or 119 Tau), as measured by the ratio of primarily O I (UV 2) feature near 1300 Å to that of the primarily S I (UV 2) feature near 1810 Å. Although differences in the relative amounts of interstellar and circumstellar extinction at 1300 and 1800 Å can exaggerate these variations, they cannot cause the tremendous range seen in these spectra. This suggests that the well-known Bowen fluorescence excitation of the O I lines by hydrogen Lyman beta suffers a greatly reduced efficiency in some stars, since the strength of the S I feature is approximately as expected in each star and there is evidence of substantial intrinsic hydrogen emission in these stars, based on the Lyman-alpha pumped fluorescent features seen at longer wavelengths in, e.g., Alpha Ori.

## 22.12

Photometry of a sample of Stephenson's K and M Dwarfs.

E. W. Weis (Van Vleck Obs.)

Broad band UBVR photometry has been obtained for a sample of 323 stars from among the 2201 stars of small or unknown proper motion which have been classified as K and M dwarf stars on the basis of an objective prism survey by Stephenson (A.J. 91, 145.). Included in the sample are all of the stars with types K7/M0 and later, about 60% of the K7 stars, and a small fraction of the stars with earlier types. Overall about 25% of the sample stars appear to be giants on the basis of the photometry. Among the later types where the sample is complete about 31% are giants. The fraction of stars in the sample which are giants appears to correlate with galactic latitude and apparent magnitude.

## 22.13

Catalog of Stellar Maser Sources

I.R. Little-Marenin, P.J. Benson, J. Attridge, K. Blais, D. Rudolph, and T.C. Woods (Wellesley C.)

We have prepared a catalog of H<sub>2</sub>O, OH and SiO masers primarily associated with circumstellar shells of late-type stars. Our catalog includes references to observations found in the literature from 1967 through June 1988. For each type of maser we list references for both detections and non-detections. Our listing includes about 2300 objects. The catalog is listed in RA order by the 1950 coordinates of the object and will include up to three names (variable star name, IRC number, IRAS name etc), their spectral class, variability type, period and radial velocity if known. A list of all the papers referencing the observations is given. We have excluded maser sources known to be located in starforming regions and/or H II regions. Out of the 2300 objects listed, about 300 are known to be H<sub>2</sub>O maser sources, 680 are OH sources and about 170 are SiO sources. Only about 80 sources have been detected in all three maser molecules. The catalog will be submitted to the Astrophysical Journal Supplement for publication.

We intend to keep the catalog up to date and invite preprints or reprints of maser observations.

## 22.14

A New Collaboration in Modeling the Atmospheres of Mira-type Variables

D. G. Luttermoser (JILA/Iowa State U.), G. H. Bowen, L. A. Willson (Iowa State U.), E. H. Avrett (CfA), H. R. Johnson (Indiana U.)

We introduce a new collaboration in the atmospheric modeling of pulsating asymptotic giant branch (AGB) stars. An iterative procedure is presented for determining the thermal structure and dynamics of Mira-type stellar atmospheres, where the non-LTE radiative transfer code PANDORA is used in conjunction with the Iowa State University hydrodynamics code (ISUHC) developed by George Bowen. The equations of radiative transfer and statistical equilibrium are solved with PANDORA in a "snapshot" approximation at various phases of an initial ISUHC model. Cooling and heating rates and electron densities calculated with PANDORA are then used in a subsequent run with ISUHC. The resulting ISUHC model is used in PANDORA to calculate new rates and densities. This procedure is continued until a consistent model is achieved.

We report on preliminary results for an atmospheric model of a pulsating AGB star of one solar mass, 240 solar radii,  $T(\text{eff}) = 3000$  K, and a period of 320 days. The non-LTE heating and cooling rates are determined initially for H, H<sup>+</sup>, C I, C II, O I, O II, Mg I, Mg II, Ca I, and Ca II. Synthetic spectra of H-alpha, Mg II h and k, and Ca II H and K are displayed at various phases as well.

"Support from the NASA Astrophysics Theory Program (NAGW 1364) is gratefully acknowledged."

## 22.15

The Calibration of Strömgren Photometry for F and early G Supergiants

R.O. Gray (Washington State University)

Strömgren *uvby* photometry has been obtained for over 500 A, F and early G supergiant stars with the Danish 50cm telescope on La Silla. These data are being used to formulate an empirical calibration of *uvby* photometry for F and early G supergiants. So far very promising progress has been made in devising a method for finding the intrinsic colors of these stars. The method, which has been calibrated using 12 supergiants with well-known color excesses gives  $(b - y)_0$  to an accuracy of about 0.02 mag. Various tests have been devised to check the validity and accuracy of this calibration. This calibration can be applied to Cepheids, and can reproduce the color excesses of Feltz and McNamara (1980) to an precision of 0.02 mag. The intrinsic colors derived from the method have been used to further calibrate *uvby* photometry against the effective temperatures and gravities of Luck (1979, 1982) with good results.

This research has been supported by a NATO Postdoctoral Fellowship (1986) and an American-Scandinavian Foundation Fellowship and was carried out during a stay at Copenhagen University Observatory.

## 22.16

Chromospheric Emission from the Red Giant A59 in NGC 6752

A. K. Dupree, L. Hartmann (CfA), C. Jordan (U. of Oxford), A. W. Rodgers (MSSSO), and G. H. Smith (STScI/MSSSO)

Spectroscopy of red giants in globular clusters can be used to investigate the properties of chromospheric activity in stars considerably older and more metal deficient than those in the galactic disk, as well as to search for the presence of stellar winds.

The red giant A59 ( $V = 10.9$ ;  $B - V = 1.6$ ) in the globular cluster NGC 6752 has been observed at H $\alpha$  (6562.8Å), the Ca II K-line (3933.7Å), and in Mg II (2800Å, *h* and *k*). The optical spectra were obtained with the Naysmith echelle spectrograph and