white dwarf stars has been identified as a resonance broadening of the Lyα due to the hydrogen quasi-molecule. Likewise, the 14400 Å absorption feature in the spectra of cool and moderately warm DA white dwarf stars appears to be due to a Lyα satellite line arising from the hydrogen ion quasi-molecule. The strength of both features is gravity sensitive and therefore promises to be an excellent indicator of surface gravity. This work was partially supported by The National Aeronautics and Space Administration, Grant No. NASG-287 and The National Science Foundation, Grant No. AST82-19474.

09.13
Optical Studies of Wolf-Rayet (Carbon and Oxygen) Stars
Ana V. Torres (APAS, Univ. of Colo. and JILA, Univ. of Colorado and NASA)

The classifications of Wolf-Rayet (WR) stars have been done by visual estimates of ratios of equivalent widths of the strongest lines (van der Bij et al., 1981). For WR carbon (WC) stars, these lines are V 0.5592 Å, C III 0.5696 Å and C IV 0.5812 Å, a further criterion being the full width half maximum (FWHM) of C III 0.5650 Å. We have analyzed the spectra of nearly all WC and WO (oxygen) stars in the galaxy and in the LMC and here we present a quantitative classification. We find that the later subtypes (WC9 to WC9) are very homogenous in their spectroscopic properties, while the earlier subtypes (WC4 to WC6) show a large scatter and a great overlap in their line ratios. Furthermore, the line widths are very similar among the later types but rather disparate among the earlier stars.

A well-known fact is that only early type stars exist in the LMC (Breyerscher, 1981, Astron. Astrophys. Suppl. Ser. 43, 203). We show that they are of an earlier class than previously thought.

We have also measured wind terminal velocities for a great number of stars. The values range between 800 km/s to 3500 km/s. In general, earlier subtypes show larger terminal velocities. WC stars have terminal velocities as high as 6000 km/s.

09.14
High-Resolution Spectra of Southern Carbon Stars
J.H. Black (Steward Obs.), E.F. van Dishoeck (Harvard U. & CfA)

We have obtained spectra with resolving power \( \lambda/\Delta\lambda = 10^5 \) at selected wavelengths between 5300 and 8900 Å of the carbon stars R ScI, HD 16115, TW Hori, HD 19001B, and T Ind by using the Cowley-Echelle Spectrometer at the 1.4m telescope of the European Southern Observatory. Results of searches for (a) circumstellar components of CN and CH lines, (b) the C\(^{-}\) negative ion, and (c) CH\(_{2}\) will be discussed. In view of the importance of carbon stars for measuring velocity dispersions of Local Group galaxies, we present accurate reference radial velocities for these five galactic carbon stars.

09.15
IUE and IRAS Observations of Luminous M Stars with Varying Gas-to-Dust Ratios
W. Hagen (U. New Mexico), K.G. Carpenter (JILA), R.E. Stencil (NASA JPL)

Previous work on circumstellar gas and dust surrounding M giants and supergiants has shown the stars to split into two distinct classes (Hagen, Stencel and Dickinson, 1983, Ap. J., 274, 286). Stars with a high gas-to-dust ratio all show chromospheric Ca II H and K emission. Stars with a high dust-to-gas ratio do not show chromospheric Ca II emission but are the only ones to show Balmer emission indicative of atmospheric shocks and are also the only ones to show maser emission. In order to determine whether all chromospheric indicators disappear in high dust-to-gas ratio stars, we are conducting a survey of stars in both of these classes with the IUE satellite. Our initial low-resolution observations of the 2200-3200 Å spectral region of a limited number of stars reveal 2800 Å Mg II emission in all of the observed stars regardless of the dust-to-gas ratio. In addition, very deep exposures of three dusty stars show Fe II, Al II and perhaps Mg II emission, and one of the three (TV Peg) even appears to show Ca II (UV 0.00) emission near 2325 Å. These lines are usually associated with chromospheres in late-type evolved stars. The impact of these observations on our understanding of the outer atmospheres of these stars will be discussed.

When the IRAS point source catalog becomes available, the long-wavelength fluxes of these two groups of stars will be compared. Implications regarding the structure of the circumstellar dust shells will be discussed.

09.16
Chromospheric Activity and Ti0 in M Giants
T. Y. Steiman-Cameron (Mullco), H. R. Johnson (Indiana Univ.), and R. H. Hønecutt (Indiana Univ.)

Low-resolution IUE spectra, obtained for twenty-three cool giant stars ranging from K3 to M5.9, have been used to examine chromospheric activity in late-type giants. Previous studies have suggested a decrease in Mg II resonance line flux (an indicator of chromospheric activity), normalized to bolometric flux, with effective temperature. Using more accurately determined effective temperatures we confirm this decrease and find it to be more rapid than previously suggested. A strong correlation is found between Ti0 abundance, as measured by the Wing Ti0 index, and the level of chromospheric activity, as measured by Mg II fluxes. Cool giants which are underabundant in Ti0 relative to the mean abundance levels for stars of similar color, also have chromospheres that are underactive relative to the mean. Possible origins of this relation related to aging effects, or to duplicity are discussed, along with their implications.

09.17
Chromospheric Expansion Velocities in Late K and M Giants
S. A. Drake and J. L. Linesky (JILA, Univ. of Colo. & NASA)

There is mounting evidence that M giants have geocentrically extended chromospheres (\( \tau_T \sim 8 \times 10^3 \) K) situated between their photospheres and the cool circumstellar regions where the blue-shifted absorption components seen in neutral species lines are formed. These intermediate chromospheric regions are also systematically outflowing away from the star, as indicated by the blue-shifted absorption features in the Ca II and Mg II resonance lines. Using high dispersion spectra obtained by IUE, we have measured the positions of these wind absorptions in the Mg II lines of late K and M giants and supergiants, and find typical expansion velocities of 10 to 25 km s\(^{-1}\). Two giants, \( \gamma \) Dra (K5 III) and \( \upsilon \) And (M0 III, P orb = 230\(^{\circ}\), have anomalously high chromospheric expansion velocities of 65 and 55 km s\(^{-1}\), respectively, making them, we believe, interesting objects for detailed spectroscopic studies. We compare the Mg II wind velocities with those obtained from the Ca II, Mg I, and neutral species resonances, and find no systematic differences, implying that the stellar winds in M giants have reached their terminal velocities within a few stellar radii. In one case, \( \beta \) And (M0 III), we find that the wind velocity, as determined from different IUE spectra, has significantly varied between the two epochs. Finally, we discuss the effects of interstellar absorption on the Mg II line profiles of these stars, and the reliability of simple, kinematical models of the local Interstellar Medium. This