density statement is corrected. Examples are cited from planetary nebulae in which emission lines are observed to be emitted in regions with electron densities considerably higher than their critical densities. The importance of the C III λ877(C III) λ1909 ratio in determining the mean electron density and/or the range in electron densities in BLRs, or at least in rejecting certain models, is emphasized. The meager observational data presently available for this ratio are summarized and evaluated. It appears that for most observed objects λ877/λ1909 probably ≤ 0.5, and almost certainly < 1. For BLR models with constant electron density or smoothly varying power laws in distance as have been published, this estimate corresponds to mean values ≤ 10^{13} - 10^{17} cm^{-2}. However, all the objects with observed spectra at λ877 are at relatively high redshift, and have considerably higher luminosities than the AGNs to which the time-variability studies refer.

36.06

Kappa Effect Pulsational Instability for Hot Extreme Helium Stars

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A long standing problem for the extreme helium pulsating stars has been the mechanism for the pulsation instability for the hottest members of this class. The usual κ mechanism works well for stars that are in the hydrogen and helium ionization instability strip, which extends to perhaps 20,000K at high luminosity (Salo and Jeffery, 1988). However, several pulsators are definitely hotter. It is possible that the mixing instability mechanism is the rapid increase of iron lines absorption as the temperature increases above 150,000K in the low density envelopes of these luminous stars. Recent calculations by Roznay (1989) and Rogers and Iglesias (1989) at Livermore show that the n=5 to n=3 transitions in iron that were assumed unimportant in the earlier Los Alamos calculations (Cox, and Tabor 1976) can double or triple the opacity suddenly as the iron lines appear in a very sensitive part of the spectrum of the diffusing photons. Here the iron abundance is the primordial value, unaffected by the advanced evolution. It has been proposed that these iron lines also cause the many varieties of normal B star pulsations, and the extreme helium stars are merely another example of this new κ effect for pulsating stars. A model for the extreme helium star V2076 Oph at 31,900K, and 40000 L⊙ for a mass of 1.4 M⊙ pulsates in the radial fundamental mode at about 1 day period with a very large linear growth rate when the iron lines double the opacity, but is stable with the usual opacity. Probably the first one or two radial modes, but not the nonradial modes, are pulsationally unstable for many of the highly evolved hot stars by this mechanism.


36.07

Spectroscopic Determinations of the Properties of Planetary Nuclei

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Many apparent contradictions in the basic parameters of planetary nuclei cloud the general picture of the late stages of evolution of low- and intermediate-mass stars. The primary uncertainty is the mass distribution of the central stars. Different methods (non-LTE photospheric analyses (e.g. Mengel et al. 1988), analyses of the wind spectra (e.g. Pauldrach et al. 1988), application of the Zanstra method, use of the optical fading diagram (e.g. Heap and Augensen 1987) yield different results for the stellar mass, and there is no clear consensus as to which method, if any, is the correct one (Pottasch 1989).

In this paper we report on a spectroscopic study of four planetary nuclei (the central star of NCC 6543 (O1-4), NGC 6826 (O3f), NGC 6210 (O3f), and NGC 7663 (cont.)) for which existing mass estimates in the literature are highly discrepant. We base this study on high-dispersion SW spectra obtained with the IUE and on high-dispersion spectra obtained at the Kitt Peak 4-m telescope. We have used Hubeny's (1988) non-LTE model atmosphere code to analyze the photospheric spectrum. We have also made use of Lamers et al.'s (1987) SEI code to determine the terminal velocity of the wind, and we have applied the results of Gabler et al.'s (1989) unified model atmospheres to analyze the properties of the wind. We compare our results with those based on the Zanstra method and on the optical fading diagram, in an effort to obtain a reliable estimate of mass for each of the four central stars and to isolate the sources of error in the various methods.

36.08

Fe II Emission Lines: Chromospheric Spectra of Red Giants

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High quality, high-dispersion, long-wavelength IUE spectra of three well-studied giant stars, a Boo (K1 III), a Tau (K5 III) and a Gru (M5 III), are constructed using a "difference filtering" algorithm developed by Ayres. Measurements of all the emission lines seen between 12230 and 3100 Å are tabulated, including upper limits for absent (but important) lines of Fe II. The spectrum of Fe II is discussed in comparison with other lines (e.g. Mg II h and k) whose formation mechanisms are well understood. Different physical conditions in the three stars are reflected by systematic changes in the Fe II emission spectrum. These changes are used to infer the excitation mechanisms for the Fe II lines. Most of the Fe II emission results from collisional excitation, with some lines which are fluorescent by other strong chromospheric lines. Total radiation losses in Fe II lines from red giant chromospheres are less than the losses from Mg II h and k, in sharp contrast to recent models of the solar chromosphere. The data will be used in future papers to constrain atomic excitation parameters and models of the chromospheric emitting regions and winds.

36.09

Automatic Classification of WN Spectra

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Digital spectrophotometry is becoming the default technique for obtaining stellar spectra. Since they already exit in computer-compatible form, automatic morphological classification seems a natural procedure.

The nitrogen-sequence Wolf Rayet Stars were chosen as a sample case because of the availability of line strengths for a large number of Galactic and LMC examples (Conti and Massey, 1989) and the known difficulty in their classification.

A back-propagating neural network (NeuroShell, Ward System Group) was used on a variety of WN