Evolutionary Models of Accreting Massive White Dwarfs. E. M. Sion, M. Acquino and S. Tomczak, Villanova University. Preliminary results of evolutionary model computations are presented for a massive (1.3M⊙) degenerate star burning hydrogen-rich matter in a steady state with accretion. This investigation examines the occurrence of hydrogen shell flashes and phases of stable burning. In addition, the possibility of an accretion rate-interstellar period relation such as that found by Paczynski and Zytkow (1973, Ap. J., in press) at M = 0.8 M⊙ is also studied. The evolutionary computations were started with a 1.30M⊙ white dwarf obtained from the model grids reported by Sion et al. (1978, Ap. J., March 1). The initial model is accreting mass at the rate M = 2.36 × 10⁻⁸ M⊙/yr. Hydrogen was burning in the shell source at the same rate. The accreting matter had hydrogen content X = 0.70 and heavy element content Z = 0.03. The initial model had luminosity Log (L/L⊙) = 3.36, T_eff = 5.5 × 10⁵, radius R = 0.006 R⊙ and an isothermal hydrogen exhausted core with T core = 8.2 × 10⁷ K. The model sequence exhibits a strong initial hydrogen shell flash. The subsequent behavior of our model sequences and their possible relevance to certain astrophysical objects is discussed.

WEDNESDAY, 11 JANUARY

Session 39: Room 2-120, 0930-1215

The Dependence of Ca II Emission Widths (log W_o) on [Fe/H]. T. E. Lutz, Washington State U., and E. E. J. Pagel, Roy. Greenwich Obs. - It has been suggested that log W_o is a function of surface gravity (g) and effective temperature (T_e) (Reimers, D., Astron. and Astrophys. 24, 79, 1973; Neckel, H., Astron. and Astrophys. 35, 99, 1974). We have assembled log W_o, g, T_e, and [Fe/H] data for 55 stars. Using these data, we have estimated the dependence of log W_o upon g and T_e using a least squares analysis. We find that a systematic error is present if [Fe/H] is ignored. The addition of a term in [Fe/H] is found to be statistically significant at the 0.1 percent level. The equation

\[ \log W_o = -0.22 \log g + 1.65 \log T_e + 0.10 [\text{Fe/H}] - 3.69 \]

predicts values of log W_o with a standard deviation of ±0.06 for stars with a range in [Fe/H] from -2.7 (HD 122563) to -0.44 (HD 182572).

Our approach differs from the previous work of Reimers and Neckel in that we have utilized parameters determined from analyses of the atmospheres of the stars in our sample instead of more general considerations, such as the mass-luminosity relation. It should be noted that our result does not bear directly on the question of the dependence of N(H,K) upon metal abundance.

The Effective Temperatures of G Dwarfs. Johannes Hertel, State University of New York at Stony Brook. - Energy distributions from 3500 - 5500 A were measured, in 40 A bands, of stars whose gross spectral features in the 3600 - 4100 A region had been found equal to those of the Sun in a search conducted with 20 A resolution (Hertel 1976, Astron. Astrophys. In press). Several Hyades G dwarfs are included. Comparison with the solar energy distribution (Labs and Neckel 1968, Z. Astrophysik 69, 1) shows that G dwarfs are hotter than was thought before. Consequences of these findings on the overall metal abundance of the Hyades with respect to the Sun will be discussed.

Can Partial Redistribution Explain the Ca II H-K Wing Emission Lines? R. T. Stenholm, NASA/MSFC. - Radiative transfer studies of the wing emission lines found in the wings of the Ca II H and K lines in late-type stars (Stenholm, 1975 Ap. J. 215, 176) have been made, examining photon-pumping and K-line photon redistribution effects in particular. The luminosity-sensitive effect under study drives moderately strong absorption lines of iron-peak elements in cool dwarf stars into weak emission lines among G, K and M giants and supergiants. Various photon-pumping schemes in a complete redistribution approach produce only a weakening of absorption line strength with increasing luminosity. However, the difference in the intensity of the Ca II K-line inner wing as computed in the complete versus partial-redistribution approximations (Shine, et al. 1975 Ap. J. 210, 222) is sufficient to produce the wing emission lines in low-gravity stars and hence the observed luminosity variation. In addition, partial-redistribution seems to produce a variation of emission line strength with wavelength displacement from the K-line center which mimics the observed situation in supergiant spectra. Subject to further calculations including the effects of velocity fields and spherical geometry, it may well be that the appearance of the H-K wing emission lines in cool giant and supergiant spectra maps out the region of influence of partial redistribution in the Ca II H and K resonance lines. Comparable effects may be important for the Mg II h and k lines as well. Grateful acknowledgment is made to B. Lites and R. Shine for assistance with codes, and to the National Center for Atmospheric Research, sponsored by the National Science Foundation, for the computing facilities provided for this research.