EFFECTS OF CORONAL AND SHOCK-PRODUCED X-RAYS ON THE IONIZATION DISTRIBUTION IN HOT STAR WINDS

J.J. MacFarlane (UW), W.L. Waldron (ARC), M. Wolff, P. Wang, J.P. Castinelli (UW)

Results are presented from calculations in which we examine the effects of coronal and shock-produced X-rays on the ionization balance in hot star winds. Detailed statistical equilibrium calculations were performed using detailed atomic modeling and including Auger ionization due to the X-ray radiation field. We will show how the spatial distribution of the X-ray source affects P-Cygni profiles and the emergent X-ray flux. We examine in detail the particular case of Zeta Puppis (O4 II), and compare calculated OVI P-Cygni profiles and X-ray spectra with observation.

HD 229041: AN X-RAY BRIGHT A-TYPE GIANT?

M.F. Corcoran (USRA/GSFC), J. Siah, E. F. Guinan (Villanova U)

X-ray emission is virtually unknown from evolved A-type stars. However, Einstein IPC and ROSAT PSPC observations reveal the presence of an X-ray bright source about 20 arcsec away from the unreddened late A/early F giant HD 229041. We present an analysis of about 18 ksec of ROSAT PSPC data from this source which shows an unabsorbed thermal X-ray spectrum having log T (K) = 6.96. If the source of the X-rays is HD 229041, then the star has L_x / L_B = 3 x 10^{-5}. We also present UBV photometry of the star obtained with the Automated Photometric Telescope on Mt. Hopkins. Analysis of this photometry suggests possible periodic variability on a timescale of about 17 days.

NON-LTE LINE BLANKETED MODEL ATMOSPHERES: APPLICATION TO A-STARS

I. Hubeny (USRA), T. Lanz (NASA/GSFC)

We present a new method for calculating realistic line blanketed model atmospheres without the assumption of local thermodynamic equilibrium (LTE). The method is based on complete linearization, with the following two important modifications with respect to the standard variant.

i) Instead of dealing separately with individual energy levels of a complicated metal species (e.g. Fe II), several levels with the same parity and close enough energy are grouped together to form a "superlevel". Transitions between superlevels, the so-called "superlines", are treated by resampling the detailed absorption cross-section and forming a partial "NLTE opacity distribution function", which is representable by a relatively small number of frequency points (typically 15-30 points per superline).

ii) The radiative rates (together with the heating/cooling rates, and the contributions to the rates in other important transitions - e.g. the hydrogen and carbon continua) are not fully linearized. However, in contrast to the earlier approaches, they are not held fixed. The only fixed quantity here is the approximate lambda operator. The new method is therefore a hybrid combining the complete linearization and the classic model methods called accelerated lambda iteration (ALI).

We have contracted several non-LTE model atmospheres for T_eff = 10000 K, log g = 4, with H, C, N, Mg II, and Fe II treated in NLTE. A variable number of Fe II lines, up to 45815 (i.e. all lines originating between the levels with measured energies), have been included, to form 221 superlines. The most interesting preliminary result is that the first 8 Fe II superlevels (about 13000 lines) produce most of the total blanketing effect.

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BBXRT OBSERVATION OF THE BLACK HOLE CANDIDATE CYGNOUS X-1


The 0.4 to 11 keV spectrum of the black hole candidate Cyg X-1 was determined during a 1250 second observation on 6 December 1990 with the BBXRT experiment aboard Astro 1. This is the first moderate resolution (R ~ 60) X-ray spectrum of a galactic black hole candidate in the important Fe K emission band. The integrated spectrum is well described as a simple power law with absorption by cold material, but the amount of absorption varied by ~50% during the observation. There is also clear evidence for a broad emission line at about 6.3 keV with an equivalent width of about 130 eV and an intrinsic FWHM of about 1200 eV. We will discuss this spectrum in terms of a Compton scattering model and models of emission from a relativistic accretion disk.