Stellar Spectroscopy and Atmospheres

Session 5: 1000–1630 (Civic)

05.01 Stellar Corona in the Hyades. R. STERN, J. UNDERWOOD, Jet Propulsion Laboratory/California Institute of Technology, M. ZOLLIKOFER, and S. ASTUCHOS, Stanford University. - As participants in the HEAO-2 (Einstein Observatory) guest investigator program, we have conducted a soft X-ray survey of the central 5" of the Hyades cluster. Using the Imaging Proportional Counter (IPC) on Einstein, over 40 discrete sources were detected, most of which have bright (V<10) stars as optical counterparts. X-ray luminosities (L_x) for these stars are in the range 10^{38.5}–10^{39} erg/s. From the fraction of Hyades detected (50%), and the observed range of L_x, we may infer that stellar corona are common phenomenon in the cluster. The X-ray emission from the late F and early G stars in the Hyades is ~30 times that of the sun viewed as a star. The significant difference in rotational velocity of a typical Hyades dwarf compared to the sun, probably the most important factor in producing such increased coronal activity.

05.02 Radiative Stellar Winds. P. Pacharintamkul, UCLA. - The effect of the radiative cooling on the steady state transonic wind structure, coupled to the radiation field, has been calculated. It is found that there exists a mass-loss-rate limit to the steady flow. A temperature plateau is found, perhaps giving a clue to the ultraviolet and infrared excesses observed in many T Tauri stars. In the outer coronal region, the temperature can get below 10^7 K with the gas being ionized because most of the ionizing photon energy goes into kinetic energy of the flowing material. This work was partly supported by the National Science Foundation.

05.03 High Resolution Spectroscopy and Mass Loss Rates for LMC Yellow Supergiants. W. HAGEN, Wellesley College, R. HUMPHREYS, U. of Minn., and R. STENCHEL, JILA, U. of Colo., & NBS. - We have obtained high dispersion echellegrams, at 2.5 and 5.1 A/mr dispersion, of four F and G-type LMC supergiants (M_v ~ -9) for the purpose of evaluating the outer atmospheres of such objects, as compared to Main-Sequence counterparts. In combination with IR photometry, line doubling at Na I "b," and circumstellar cores in Ca I 4226 Å, and Sr II 4077 Å, indicate extensive CS envelopes and mass loss rates in excess of 10^{-6} M_☉/yr, with outflow speeds of 10-60 km s^{-1}, assuming a detached spherical CS shell. Deep exposures at Ca II H&K reveal new information about the chromospheres of extragalactic stars. The presence of H&K "wing emission lines" augments this, and also provide an independent way of estimating M_v. The physical connection between layers in the outer atmosphere, in terms of chromospheric heating and the steady wind energy source, will be discussed, and comparisons made with galactic supergiants.

05.05 Paper withdrawn by author.

05.04 X-Ray Heating of the Quiescent Chromospheres of dMe Stars. L. E. CRAM, Sacramento Peak Observatory. - The Einstein satellite has shown that dMe stars are surprisingly strong X-ray sources, with an x-ray luminosity that may be as large as 10% of the visual luminosity of the star. Atmospheric regions beneath the x-ray emitting corona of these stars are thus bathed in an intense flux of x-rays, and are consequently heated above the temperature that would exist in a radiative equilibrium model. By considering both the amount and the distribution of radiation losses from a dMe star model chromosphere, we show that such x-ray heating is an important factor in the energy balance of the quiescent chromospheres of dMe stars. This fact helps resolve the long-standing problem of the inadequacy of the acoustic shock dissipation chromospheric heating hypothesis for such stars.

05.06 A Search for Mg II Asymmetry Variations Among Cool Evolved Stars. R. MULLAN, H. Hartsook Research Foundation, H. Delaware and R. STENCHEL, JILA, U. of Colo., & NBS. - We have investigated the degree of Mg II profile asymmetry variations among stars which lie near the velocity and temperature dividing lines in the cool portion of the HR diagrams. We measured 238, 221 and addendum Sept. 1, Ap. J.) in the context of stars whose outer atmospheres may be near the transition between closed magnetic fields (coronal heating) and open magnetic fields (rapid mass loss) - see Mullan 1980 Erice Workshop on Red Giants. Our observations cover nearly two years with IUE, and are sensitive to changes on timescales of months. Shorter timescale variations in single stars have not been adequately searched for, nor longer timescales (decades). The preliminary results of our observations suggest three types of Mg II profile variations among cool post main sequence stars: (a) radial asymmetry variables, such as 56 Peg, which completely change their asymmetry ratio; (b) circumstellar variables, such as Alpha Aqr and Alpha Tuc which show changes in the strength of the CS absorption component, and (c) "nonvariables" which show no changes thus far. These latter objects, preponderant in our sample of ~20 stars, may be variable in total emission strength, given the photometric accuracy of IUE. At this point, there is little evidence for variations among non-binary coronal-type objects (the yellow giants), while CS variations presumably reflect non-steady mass loss and/or rotational modulation among the red giants. Our hypothesis for the radial variables includes phenomena analogous to star sized prominences as seen on the Sun, based on similarities in Ca II and Mg II asymmetry from such stars and observations of solar prominences (Bonnet 1980).

*Guest Observer, IUE satellite.