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FINAL REPORT

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# Mg II SPECTRAL ATLAS AND FLUX CATALOG for LATE-TYPE STARS IN THE HYADES CLUSTER

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## I. Background

In the course of a long-running IUE Guest Observer program, UV spectral images were obtained for more than 60 late-type members of the Hyades Cluster in order to investigate their chromospheric emissions. The emission line fluxes extracted from those observations were used to study the dependence of stellar dynamo activity upon age and rotation (T. Simon 1990, ApJ Lett. 359, 51–54: IUE Observations of Rapidly Rotating Low-Mass Stars in Young Clusters: The Relation between Chromospheric Activity and Rotation). However, the details of those measurements, including a tabulation of the line fluxes, were never published. The purpose of the investigation summarized here was to extract all of the existing Hyades long-wavelength Mg II spectra in the IUE public archives in order to survey UV chromospheric emission in the cluster, thereby providing a consistent dataset for statistical and correlative studies of the relationship between stellar dynamo activity, rotation, and age over a broad range in mass.

## II. Results

Sixty low- and high-resolution spectral images for known Hyades members were downloaded from the IUE public archives. Each image was measured to determine the integrated chromospheric emission flux in the Mg II *h* and *k* lines near 2800 Å. The resulting measurements are summarized in the attached table, which provides: the cluster star name; the image number and spectral resolution (the prefix P or R denotes the LWP or LWR camera); the $B-V$ color index and spectral type of the star; the measured chromospheric emission line brightness in units of $10^{-14}$ erg $cm^{-2}$ $s^{-1}$; the logarithm of the apparent bolometric luminosity of the star; and in the final column, the normalized chromospheric emission line flux (also expressed in log units). The Mg II emission features were determined from two different versions of each image, the first being processed through NASA's NEWSIPS pipeline system, the second being processed through ESA's INES pipeline system. In most cases, the extracted NEWSIPS and INES spectral fluxes were in close agreement with each other and with the earlier IUESIPS results adopted in my 1990 ApJ publication. In a half a dozen cases, however, the NEWSIPS fluxes proved to be a factor of two smaller than the corresponding INES and IUESIPS values. The reason for the discrepancy is unknown. The flux values tabulated in this report are the INES ones, which seem to adhere more closely to the corresponding IUESIPS measurements.

When this project was initially conceived, it was expected that additional UV spectra would be acquired with the Hubble Space Telescope to enlarge the sample of cluster members with high dispersion data, and that additional rotational velocities and rotational periods would also be available for comparison with the observed emission line strengths – the combination of the two improved datasets providing a comprehensive picture of activity and rotation in a significant sample of stars with a well-established age. However, no Hyades stars have yet been observed by HST at the resolution needed to resolve their Mg II features, nor have any new rotational measurements been published for stars in the cluster (in the course of this grant, two observing runs at Mauna Kea that I arranged to obtain photometric rotation periods for stars with existing IUE data were clouded out). Without this kind of supporting information, the original goals of this project unfortunately cannot be met. I am therefore contemplating no further work on these IUE data, although my intention is to present the flux measurements reported here in a poster paper at the upcoming 12$^{Th}$ Cambridge Cool Star Workshop in July 2001 at the University of Colorado in Boulder CO.

# Mg II FLUXES FOR HYADES CLUSTER

| Star | Image Number | Disp | B - V | Sp.Ty. | Mg II Flux [E-14] | -log I(bol) | log R(hk) |
|---|---|---|---|---|---|---|---|
| vA 294 | P01954 | LO | 1.30 | K5.5Ve | 45.99 | 8.600 | -3.737 |
| vB 25 | P01958 | LO | 0.99 | K3 V | 30.53 | 8.277 | -4.238 |
| vB 191 | P05562 | LO | 1.31 | dM1 | 14.49 | 8.644 | -4.195 |
| vA 297 | P05563 | LO | 1.49 | dM0 | 3.43 | 8.993 | -4.472 |
| vA 366 | P05564 | LO | 1.45 | dM1 | 3.95 | 9.022 | -4.382 |
| L71 | P13912 | LO | 1.49 | | 10.42 | 9.097 | -3.885 |
| L86 | P13919 | LO | 1.51 | | 6.99 | 9.201 | -3.954 |
| vA 288 | P14764 | LO | 1.54 | | 11.13 | 9.049 | -3.904 |
| L44 | P14765 | LO | 1.52 | | 7.49 | 9.321 | -3.804 |
| vA 45 | P14786 | LO | 1.53 | | 4.06 | 9.321 | -4.070 |
| vB 175 | P16681 | LO | 1.03 | K4 V | 22.44 | 8.535 | -4.114 |
| vB 174 | P16682 | LO | 1.06 | K4 V | 28.03 | 8.391 | -4.161 |
| vB 181 | P17508 | LO | 1.17 | K3 V | 24.69 | 8.461 | -4.146 |
| vA 502 | P21047 | LO | 1.41 | K7 Ve | 5.52 | 8.928 | -4.330 |
| vB 43 | P21048 | LO | 0.91 | K2 V | 39.17 | 8.240 | -4.167 |
| L20 | P21049 | LO | 1.09 | K3 V + K8 V | 114.02 | 8.133 | -3.810 |
| vA 135 | P21054 | LO | 1.11 | dK | 41.25 | 8.373 | -4.012 |
| L83 | P21056 | LO | 1.15 | dK5 | 14.66 | 8.417 | -4.417 |
| L90 | P21057 | LO | 1.00 | dK0 | 35.13 | 8.373 | -4.081 |
| vA 72 | P21060 | LO | 1.38 | dK | 11.43 | 8.752 | -4.190 |
| vA 486 | P21061 | LO | 1.48 | dM1e | 21.67 | 8.737 | -3.927 |
| vA 677 | P21062 | LO | 1.22 | dK0 | 48.30 | 8.706 | -3.610 |
| L95 | P21063 | LO | 1.41 | dK9 + dK9 | 28.62 | 8.577 | -3.966 |
| vA 146 | P21077 | LO | 1.42 | dK | 6.02 | 8.903 | -4.317 |
| L33 | P21078 | LO | 1.18 | dK8 | 32.53 | 8.253 | -4.235 |
| vA 622 | P21499 | LO | 1.44 | K7 V | 7.84 | 8.845 | -4.260 |
| vA 559 | P21500 | LO | 1.49 | | 7.85 | 9.053 | -4.052 |
| L92 | P21522 | LO | 0.97 | dK0 | 42.36 | 8.281 | -4.092 |
| vA 68 | P21523 | LO | 1.24 | K5 V | 16.06 | 8.585 | -4.209 |
| L57 | P21524 | LO | 1.07 | dK2 | 26.26 | 8.461 | -4.120 |
| vA 383 | P21534 | LO | 1.48 | | 5.30 | 8.889 | -4.386 |
| V833 Tau | R09654 | LO | 0.82 | K0 V | 302.91 | 8.097 | -3.422 |
| vB 117 | R09657 | LO | 1.07 | K3 V + K3 V | 54.63 | 8.260 | -4.003 |
| vB 7 | R10012 | LO | 0.90 | K2 V | 27.93 | 8.077 | -4.477 |
| vB 190 | R16605 | LO | 1.36 | K8 V | 30.10 | 8.469 | -4.052 |
| vB 173 | R16606 | LO | 1.24 | K5 V | 18.98 | 8.484 | -4.238 |
| vA 334 | R16616 | LO | 1.41 | dM0e | 20.92 | 8.785 | -3.894 |
| | | | | | | | |
| vB 29 | P13933 | HI | 0.56 | F8 V | 150.49 | 7.329 | -4.493 |
| vB 52 | P13934 | HI | 0.60 | G1 V | 115.45 | 7.689 | -4.249 |
| vB 64 | P13948 | HI | 0.66 | G6 V | 73.00 | 7.809 | -4.328 |
| vB 63 | P16678 | HI | 0.63 | G5 V | 108.35 | 7.793 | -4.172 |
| vB 31 | P16679 | HI | 0.57 | G0 V | 159.34 | 7.564 | -4.234 |
| vB 65 | P16685 | HI | 0.54 | F8 V | 127.25 | 7.548 | -4.347 |
| vB 73 | P17518 | HI | 0.61 | G1 V | 102.22 | 7.709 | -4.281 |
| vB 97 | P17521 | HI | 0.63 | G1 V | 91.67 | 7.745 | -4.293 |
| vB 91 | P18653 | HI | 0.88 | K1 V | 50.71 | 8.069 | -4.226 |
| vB 92 | P18674 | HI | 0.74 | G8 V | 55.71 | 8.009 | -4.245 |
| vB 43 | P21046 | HI | 0.91 | K2 V | 47.00 | 8.240 | -4.088 |
| vB 69 | P21059 | HI | 0.75 | G8 V | 52.90 | 7.997 | -4.280 |
| vB 17 | P21079 | HI | 0.70 | G5 V | 63.84 | 7.937 | -4.258 |
| vB 178 | P21508 | HI | 0.84 | K0 V | 48.83 | 8.112 | -4.199 |
| vB 59 | P21521 | HI | 0.54 | F8 V | 136.84 | 7.577 | -4.287 |
| vB 21 | P21535 | HI | 0.82 | K0 V | 46.20 | 8.180 | -4.155 |
| vB 57 | R08571 | HI | 0.49 | F7 V | 170.51 | 7.173 | -4.595 |
| vB 77 | R11809 | HI | 0.50 | F7 V | 208.16 | 7.409 | -4.273 |
| vB 50 | R11810 | HI | 0.60 | G1 V | 137.59 | 7.617 | -4.244 |
| vB 40 | R11828 | HI | 0.56 | G0 V | 158.98 | 7.373 | -4.426 |
| vB 22 | R11829 | HI | 0.77 | G8 V + K6 V | 92.52 | 7.869 | -4.165 |
| vB 96 | R16576 | HI | 0.84 | K0 IV-V | 83.82 | 7.916 | -4.161 |
| vB 176 | R16608 | HI | 0.94 | K2 V | 79.51 | 8.064 | -4.036 |