# MgII SPECTRA OF LATE TYPE STARS USED TO PROBE THE LISM

J.E. Beckman (1), L. Crivellari (2), M.L. Franco (3)
P. Molaro (2,4) and G. Vladilo (2)
1) Queen Mary College, Univ. of London, England; 2) Osservatorio Astronomico di Trieste, Italy; 3) I.A.F.E., Buenos Aires, Argentina; 4) I.S.A.S., Miramare, Trieste, Italy.

## ABSTRACT

IUE spectra of Mg II **h** and **k** in late type dwarfs and giants have been used to detect and measure absorption components due to the LISM. This technique gives a method of probing the awkward range from **d** = 3 pc to **d** = 80 pc from the sun . In spite of interpretational uncertainties we can plot the HI component of the LISM well enough to confirm it as a cloud some 20-30 pc in extent, peaking sharply in density towards $\ell^{II}$= 25°, moving towards the sun from $\ell^{II}$= 25°, $b^{II}$= +10°, at 28 Km/sec. The "hole" towards $\ell^{II}$= 150° is confirmed, suggesting a solar position close to the cloud's edge in this direction.

## OBSERVATIONS

In order to explore the LISM using MgII absorptions at **h** and **k** we employed high resolution IUE spectra of late-type stars, some from our own programme on chromospheres, some from the IUE archive, and some taken specifically by ourselves for LISM measurements. The observational parameters are summarized in Table 1: col. 6 gives the radial velocity of the stars (RV), col.7 gives the predicted heliocentric velocity of the LISM according to Crutcher (1982) ($V_{CR}$) and col.8 the velocity of any interstellar feature with respect to the photospheric rest frame (Vis=$V_{CR}$-RV). Detection of a feature at Vis implies its origin in the LISM.

Table 1

| Star | Type | **d** (pc) | $\ell^{II}$(°) | $b^{II}$(°) | RV(km/s) | $V_{CR}$(km/s) | Vis(km/s) |
|---|---|---|---|---|---|---|---|
| τCet | G8 V | 3.6 | 173 | -63 | -16 | +15 | +31 |
| δPav | G5/8 V | 5.9 | 338 | -32 | -22 | -11 | +11 |
| βHyi | G1 IV | 6.3 | 305 | -40 | +23 | - 1 | -24 |
| ζTuc | G0 V | 7.5 | 308 | -52 | + 9 | 0 | - 9 |
| βTrA | F2 V | 12.8 | 322 | - 8 | 0 | -12 | -12 |
| αHyi | F0 V | 24.4 | 298 | -54 | + 1v | + 6 | + 5v |
| 24UMa | G2 III | 25.6 | 143 | +39 | -27 | + 7 | +34 |
| γMic | G6 III | 29.4 | 12 | -40 | +18 | -17 | -35 |
| δDra | G9 III | 31.3 | 99 | +23 | +25 | - 9 | -34 |
| 20Mon | K0 III | 33.3 | 219 | + 2 | +79 | +27 | -52 |
| ζVol | K0 III | 58.8 | 285 | -22 | +48 | + 6 | -42 |



https://doi.org/10.1017/S0252921100097992 Published online by Cambridge University Press

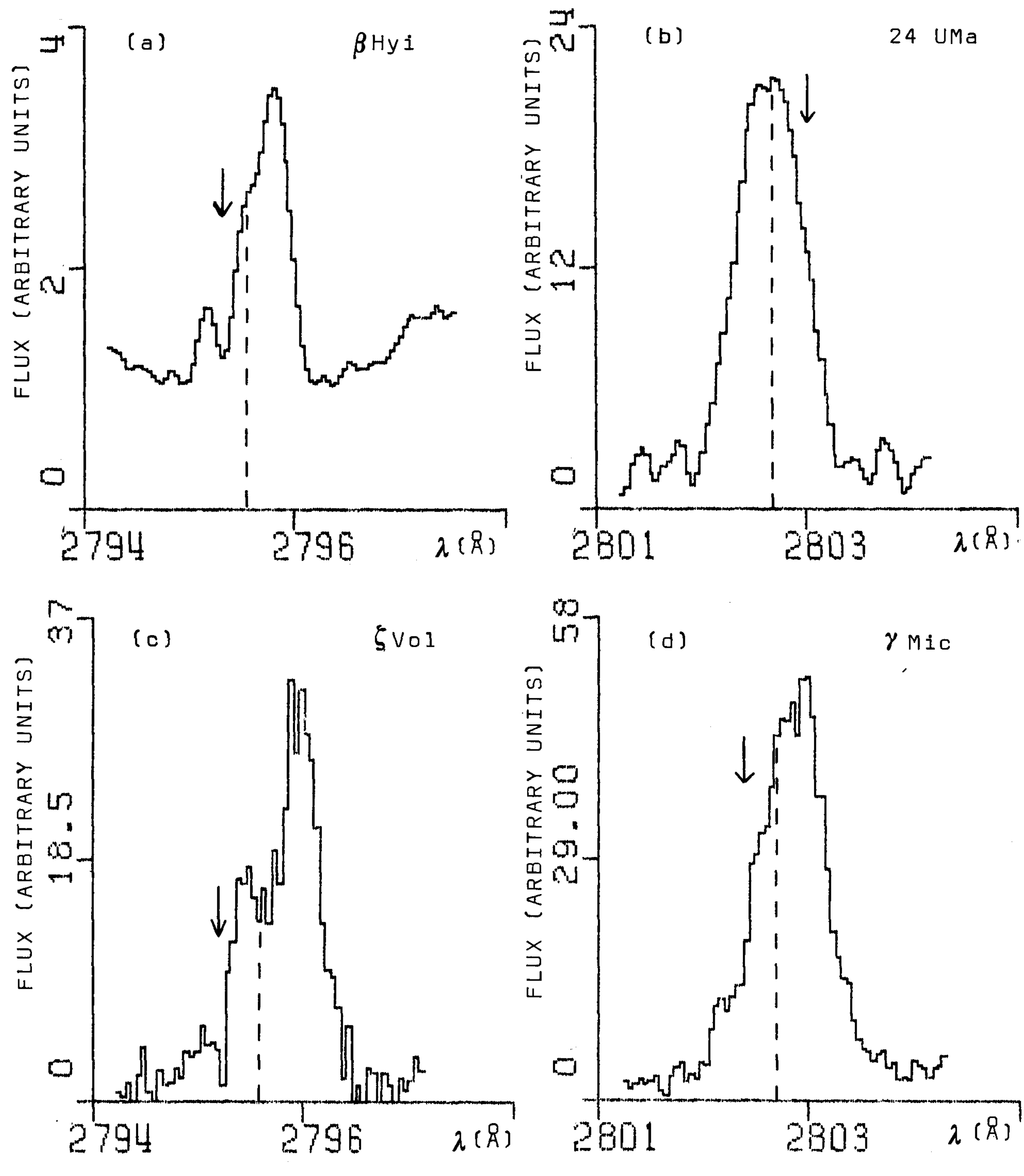


Figure 1. Profiles of MgII **h** ((a) and (c)) and **k** ((b) and (d)) in four late-type stars within 60 pc of the sun. Dashed lines show photospheric **h** or **k** rest wavelengths. Arrows show IS wavelengths predicted by the Crutcher (1982) relation.



https://doi.org/10.1017/S0252921100097992 Published online by Cambridge University Press

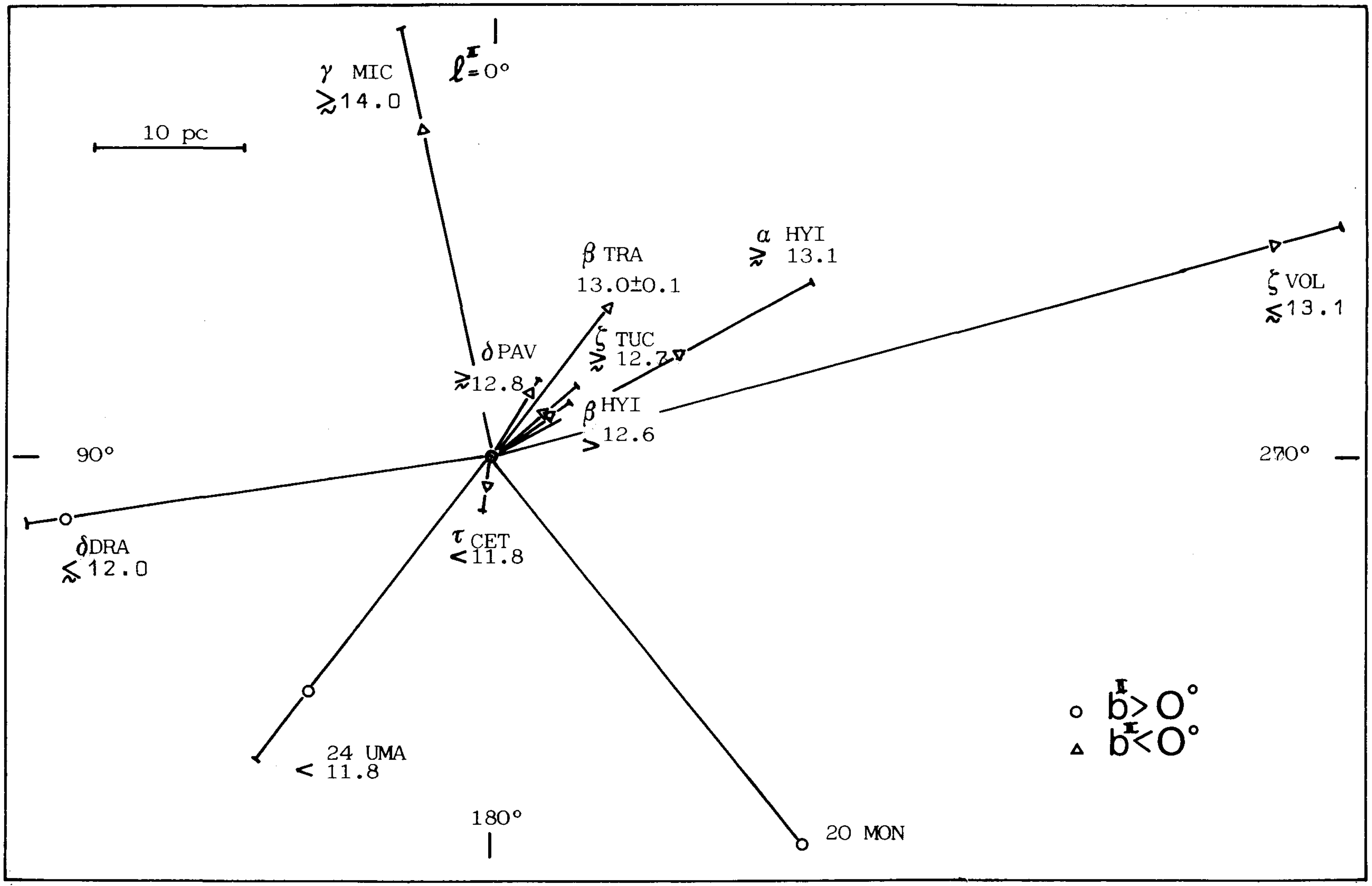


Figure 2. Log column densities of MgII towards late-type stars within 60 pc of the sun. Linear distances d to stars are solid lines. Projected distances d cosb in the galactic plane are indicated by triangles and circles.

## RESULTS

Table 2 shows the results under the following headings: cols. 2 and 3, equivalent widths of IS **k** and **h** features; col. 4, MgII column densities (derived using doublet ratio method (Spitzer,1968)); col. 5, IS turbulence parameter (km/s); col. 6, HI column densities (assuming cosmic abundance and Mg depletion factor of 10 (Paresce,1984)); col. 7, mean MgII number density along line of sight (cm$^{-3}$ x10$^{-7}$); col. 8, mean HI number density (cm$^{-3}$).

Table 2

| Star | Wk(mÅ) | Wh(mÅ) | LogN(MgII) | b | LogN(HI) | n(MgII) | n(HI) |
|---|---|---|---|---|---|---|---|
| τ Cet | < 30 | < 30 | < 11.8 | -- | < 17.4 | < 0.6 | < 0.02 |
| δ Pav | ≳ 98 | ≳ 74 | ≳ 12.8 | ≳3.9 | ≳ 18.4 | ≳ 3.5 | ≳ 0.13 |
| β Hyi | > 77 | > 55 | > 12.6 | >3.4 | > 18.2 | > 2.2 | > 0.08 |
| | <165 | <137 | < 13.2 | <5.6 | < 18.8 | < 8.9 | < 0.34 |
| ζ Tuc | ≳ 92 | ≳ 67 | ≳ 12.7 | ≳3.8 | ≳ 18.3 | ≳ 2.3 | ≳ 0.09 |
| β TrA | 158±30 | 117±20 | 13.0±0.1 | 6.5 | 18.6±0.1 | 2.5 | 0.1 |
| α Hyi | >135 | >135 | > 13.1 | -- | > 18.7 | > 1.7 | > 0.07 |
| 24UMa | < 30 | < 30 | < 11.8 | -- | < 17.4 | < 0.1 | < 0.003 |
| γ Mic ★ | ≈230 | ≈220 | ≳ 14.0 | -- | ≳ 19.5 | ≳10.2 | ≳ 0.39 |
| δ Dra ★ | < 50 | < 50 | < 12.0 | -- | < 17.6 | < 0.1 | < 0.004 |
| 20Mon ★ | <100 | <100 | ---- | -- | ---- | --- | ---- |
| ζ Vol ★ | ≲340 | ≲205 | ≲ 13.1 | ≈25(?) | ≲ 18.6 | ≲ 0.04 | ≲ 0.02 |

★ Preliminary reduction only: very recent data.

## CONCLUSIONS

We have demonstrated the value of using late-type stars for MgII LISM measurements and have augmented the sum of reported MgII column densities within 80 pc by a factor two. We confirm the observations by, i.a., Bruhweiler (1982) of a "hole" in the neutral LISM centred on $\ell^{II}$=150°, and by, i.a., Paresce (1984) of a strong density peak towards $\ell^{II}$=10°. Detailed treatment of this work will appear elsewhere (Vladilo *et al.* 1984, Molaro *et al.* 1984).

## REFERENCES

Bruhweiler,F.C.:1982,"Adv. in UV Astronomy",NASA CP-2238,p.125.
Crutcher,R.M.: 1982, Astrophys. J., 254,88.
Molaro,P.,Beckman,J.E., Crivellari,L.,Franco,M.L. and Vladilo, G.: 4th European IUE Conference, Rome 1984 (in press).
Paresce,F.: 1984, Astron. J. (in press).
Spitzer,L.:1968,Diffuse Matter in Space (Interscience),p.19.
Vladilo,G., Beckman,J.E., Crivellari,L., Franco,M.L. and Molaro,P.: 1984, submitted to Astron. Astrophys.



https://doi.org/10.1017/S0252921100097992 Published online by Cambridge University Press