SPECTRAL VARIABILITY OF BETA PICTORIS AND THE SEARCH FOR NEARBY PROTO-PLANETARY SYSTEMS.

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Continued UV monitoring at high spectral resolution utilizing the International Ultraviolet Explorer (IUE) of the IRAS candidate proto-planetary system, Beta Pictoris (Also see Kondo and Bruhweiler 1985; and references cited therein.), has revealed two components to the circumstellar absorption. The first is a stable absorption component at or near the stellar photospheric velocity, possibly arising from gas orbiting in a gaseous disk, while the second component represents strong variable excess absorption sometimes extending up to +200 km s^{-1}. The variability of this second component accounts for most of the spectral variability observed in Beta Pic. Variable circumstellar absorption observed in the resonance lines and UV62 and 63 multiplets of Fe II reveal an episode of mass inflow which lasted over a period of 12 to 13 months (see Fig. 1). It is not clear if the gas falling toward the star represents a dissipation of the inner gaseous disk surrounding the star or if another explanation can be found. Although mass outflow has yet to be observed, further studies might uncover such evidence. These observations indicate that the Beta Pictoris system is far more complex than initially envisioned. Since results from IRAS imply that a significant fraction of the A stars exhibit IR excesses, we have also begun a search for UV analogues to Beta Pictoris, concentrating on stars near the Sun. This search has produced one additional object, Sigma Herculis, which displays both sharp circumstellar absorption and an IRAS infrared excess. More detailed results of our observations for Beta Pictoris and Sigma Herculis will be presented elsewhere.

References.

Kondo, Y., & Bruhweiler, F. (1985), Ap.J.(Letters), 291, L1.

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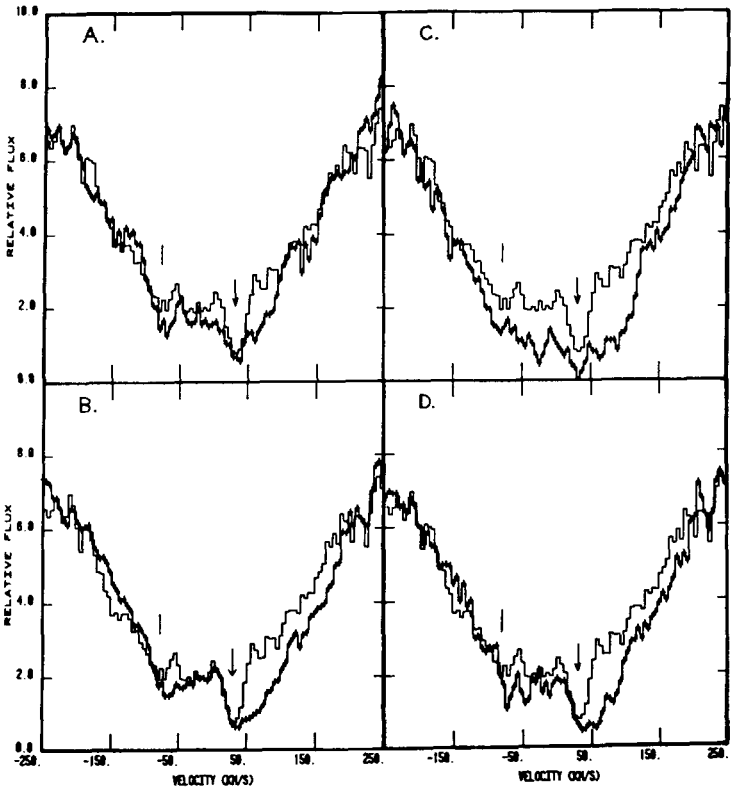

FIGURE 1. Spectral Evidence for Mass Inflow in Beta Pictoris. Each panel, A through D, shows spectral data in the velocity frame corresponding to the Fe II resonance line 2599.395 A. The dark hatched data are from IUE images: (A) LWP 5017, (B) LWP 5891, (C) LWP 6389, and (D) LWP 7417. Each of these data sets are plotted with respect to that from LWP 8132 in the panels. Data from LWP 8132 represent an inactive phase for Beta Pictoris where little or no mass infall is observed. The downward pointing arrows mark the interstellar/circumstellar feature of Fe II 2599.395. Its velocity (near +25-30 km s^{-1}) closely matches the photospheric velocity of Beta Pictoris. A weaker Fe II resonance line at 2598.37 is also indicated. This line arises from a level 287 cm^{-1} above ground and has no interstellar contributions. Note the absorption seen at large positive velocities in B, C, and D. Excess absorption at positive velocities is also seen due to Fe II 2598.37, especially in C. These data and other data indicate a mass inflow event lasting over a period between 12 and 13 months, from mid-December 1984 to the end of December 1985.

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DISCUSSION FOLLOWING BRUHWEILER

Abt:

Such shell lines can also be seen in ground-based spectra in three TiII lines near 3700 Å (and in sharp CaII H and K cores). These lines are very strong in some A-type stars with vsini $> 180\,\mathrm{kms}^{-1}$. The lines may be variable in strength (Abt and Moyd 1972).

Bruhweiler:

I agree that these lines can be quite valuable in identifying A-shell stars. However, at greater distances there may be ambiguities with CaII H and K, since these lines also are formed in the interstellar medium. Also, the TiII lines at 3700 Å are not observed in β Pic; the shell lines in this star are much weaker than in other A-shell stars. I hope that other observers, from ground-based observations, will use these and other lines to increase the number of known A-shell stars.

Harmanec:

Another possible explanation is that you are seeing the projection of a gas stream from a secondary component of a long- period binary.

Bruhweiler:

So far there is no evidence of variable radial velocities for the underlying star (or system) either from the ground or from my examination of the *IUE* spectra. Perhaps a more important point is that this system is only 16 pc distant and any secondary component producing a gas stream would be detectable. Also, the near IR imagery of β Pic shows a symmetric disk with an extent of 25 arcseconds from β Pic.

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