BROADBAND PHOTOMETRY OF T TAURI STARS AT VISIBLE AND INFRARED WAVELENGTHS

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During the past several years we have obtained extensive photometric observations of T Tauri stars, especially in the Taurus region, at visible and infrared wavelengths. For our sample of about 50 T Tauri stars in the Taurus region we find that the intrinsic T Tauri loci in the (*J-H*, *H-K*) and (*H-K*, *K-L*) diagrams are remarkably narrow. This implies a characteristic maximum dust temperature near 1300 Kelvins which appears to be independent of the optical thickness of the dust shell.

Observations of G-type stars in Orion and K-type stars in NGC 2264 suggest the presence of circumstellar reddening. Multiple sets of simultaneous *UBVRI* and *JHKL* photometry of several actively variable T Tauri stars suggests that the thermal dust emission remains nearly constant as the central star varies in brightness. Sinusoidal light variations have been observed in seven pre-main sequence K stars with weak line emission; this apparently results from large starspots on a rotating stellar surface. These weak-emission stars appear to be rotating at least as fast as typical T Tauri stars, which raises questions about the role of stellar rotation in producing the T Tauri phenomenon.

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DISCUSSION

Franco: How do these rotational velocities compare with the ones derived by Vogel and Kuhi (*Ap. J.*, **245**, 960, 1981)?

Rydgren: The equatorial rotational velocities implied by our photometric periods are comparable to the Vogel and Kuhi values, with some possibly even larger than their T Tauri stars.

Mendoza: (*Comment*) I have an *H-K* versus *K-L* diagram that shows larger scatter than yours.

Montmerle: Do you rule out the possibility that dust may be in the form of a thick disk, instead of a (spherical) shell?

Rydgren: *If* the evidence for circumstellar reddening in the stars with circumstellar dust is correct, it implies that at least some fraction of the light from the stellar surface passes through the dust on the way to the observer. A disk which is geometrically thick would probably also be compatible with the observations.

Bastien: The temporal variations in the wavelength dependence of the polarization do require changes in dust grains radius, in agreement with your proposition of dust formation around T Tauri stars. With regard to the symmetry, the polarization gives us the following information. Since we are dealing with scattering models, spherical symmetry can be eliminated. One can also show that in general the intrinsic position angle is a function of both wavelength (*Astr. and Ap.*, **94**, 294, 1981) and time (*Ap. J.* (*Letters*), **229**, L137, 1979). This means that in general there is no axis of symmetry. However, for many stars, the polarization vector wanders around in a confined region in the (*Q*,*U*) (stokes parameters) plane, implying that these stars do have a tendency to keep some axial symmetry, although not perfectly. One could think for example, of a thick disk with denser condensations orbiting within it.

Rydgren: The polarization work on T Tauri stars at visible and infrared wavelengths is extremely important and should be pursued.