CIRCULAR POLARIZATION IN T TAURI STARS

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ABSTRACT. We report the detection of circular polarization in three T Tauri stars with known intrinsic linear polarization. A circumstellar origin is required.

T Tauri stars are known to be surrounded by dust grains from their linear polarization (Bastien and Landstreet 1979) and their infrared excess (Cohen and Kuhi 1979). The linear polarization is variable in at least 60% of the stars with sufficient data (Ménard 1986; Ménard and Bastien, in preparation). Circular polarization has been reported previously in only one young star, an FU Orionis star, V1057 Cyg (Wolstencroft and Simon 1975), although with a signal/noise ratio of $\simeq 3$.

In a search for circular polarization in young stars, we detected a significant polarization in the T Tauri stars RY Tau, T Tau, and SU Aur, with a signal/noise ratio of 5 to 7. Three sigma upper limits can be given for two other stars, DG Tau and FU Ori. These measurements and previous circular polarization measurements are presented in Table I.

Two mechanisms are likely for producing circular polarization in T Tauri stars: multiple scattering by grains in a circumstellar envelope, or scattering by aligned, non-spherical grains. Woltencroft and Simon interpreted the variable circular polarization in V1057 Cyg as due to changes in the alignment of elongated particles distributed in a disk- like configuration which we are looking at from the pole. However, a careful analysis of circular polarization data presented here and published linear polarization data shows that both mechanisms occur in different stars.

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TABLE I

Star	JD-244 000.0	λ	V/I	Ref
V1057 Cyg	1984.5	6250	- 0.9 ± 2.4	1
		4500	- 14.0 6.0	
	2012.5	6250	- 1.9 2.6	
		4500	- 1.3 1.7	
	2193.5	6250	+ 1.2 2.4	
		4500	- 3.7 1.4	
	2247.5	6250	- 4.0 3.6	
		4500	+ 17.5 4.7	
RY Tau	3746.89	7543	+ 4.1 3.9	2
RY Tau	6388.654	7925	+ 6.4 1.0	3
T Tau	6385.613	7925	- 5.5 1.0	3
	6482.578	7925	- 6.0 2.5	3
SU Aur	6385.731	7925	+ 4.9 1.0	3
DG Tau	6385.865	7675	+ 0.6 1.1	3
FU Ori	6390.859	7925	+ 0.8 1.3	3

1: Wolstencroft and Simon (1975)
2: Bastien (1982)
3: Nadeau and Bastien (1986)

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