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POLARIZATION DUE TO DUST SCATTERING IN THE PLANETARY NEBULA CN1-1

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The peculiar emission-line object Cn1-1 (=HDE330036=PK330+4°1), classified both as a symbiotic star (Glass and Webster, 1973) and as a planetary nebula (Lutz, 1977, 1984), was detected by the Infrared Astronomical Satellite (IRAS) as a strong source of far-infrared radiation (Pottasch et al., 1984) indicating the presence of cool dust in the system. Bhatt and Mallik (1986) discussed the nature of the dust in Cn1-1 and argued that the object is a Type I proto-planetary nebula in a binary system.

Polarization measurements of Cn1-1 have been made recently by Schulte-Ladbeck and Magalhaes (1987). A high degree of linear polarization ($\sim$ 3%) was observed. However, they regarded Cn1-1 as a symbiotic star and considered the observed polarization to be of purely interstellar origin. We argue here that the polarization is intrinsic to Cn1-1 and is due to scattering by large (compared to the interstellar) dust grains in the protoplanetary nebula asymmetrically (bipolar?) distributed around the central star.

The wavelength (λ) dependence of the observed percent polarization $P(\lambda)$ ($P(0.35\ \mu m)=1.96$, $P(0.44\ \mu m)=2.58$, $P(0.55\mu m)=2.79$, $P(H_\alpha)=2.84$, $P(0.79\ \mu m)=2.97$; position angle $\theta=29\pm3°$ for all λ) shows that $P(\lambda)$ increases with λ and the wavelength of maximum polarization $\lambda_{max} >> 0.55\ \mu m$, the mean interstellar value. A fit to the emprirical law: $\ln(P_{max}/P(\lambda))=K\ \ln^2(\lambda_{max}/\lambda)$ (Serkowski et al., 1975) gives $K=0.75$, $P_{max}=2.98\%$ and $\lambda_{max}=0.74\ \mu m$. The values of K and λ_{max} are rather different from the mean interstellar values $K=1.15$ and $\lambda_{max}=0.55\ \mu m$. The value of θ ($=29\pm3°$) also differs much from $\theta=49\pm3°$ for other normal stars (HD 141318 and HD 142919, Mathewson and Ford, 1970) in the neighbourhood of Cn1-1.

The large degree of polarization ($\sim$3% for the Cn1-1 distance of $\sim$450 pc) with a large λ_{max} is naturally explained if it is caused by scattering by large dust grains in the Cn1-1 nebula. The presence of large dust grains in Cn1-1 has been suggested by Bhatt and Mallik (1986). Since the H_α line is also polarized at the same level and position angle as the continuum, the dust must be asymmetrically distributed around the central star. The morphology of the protoplanetary nebula in Cn1-1 may be bipolar. Bipolarity is quite common among the Type I planetary nebulae (Peimbert and Torres -Peimbert,1983).

The polarization observations thus support the suggestion that Cn 1-1 is a bipolar Type I planetary nebula.

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