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IR EMISSION FROM CIRCUMSTELLAR ENVELOPES OF C-RICH STARS

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Various authors have developed theoretical models to solve the radiative transfer equation in dust clouds surrounding a central star (Leung, 1975; Rowan-Robinson, 1980). Recently, Orofino et al. (1987) have proposed a simplified model that allows to compute the flux from circumstellar envelopes around carbon stars. The computation has been performed under the hypothesis of spherical geometry and neglecting both dust scattering contributions and the heating of inner dust by IR radiation from outer grains ("back-heating").

The use of optical properties measured in laboratory on different kinds of amorphous carbon grains (Bussoletti et al., 1987), together with those quoted in literature for graphite (Draine and Lee, 1984), has shown that observations are better fitted by amorphous carbon particles rather than by graphite grains.

In the present work we check the reliability of our model comparing its results with those obtained using the more general elaboration of Leung (1975). In particular we find that both the classical scattering by dust and the "back-heating" effects are negligible in the radiative transfer when envelopes similar to IRC+10216 are taken into consideration.

In addition we present new fits of IRC+10216 spectra, obtained when the source is in different luminosity phases, assuming amorphous carbon grains in the circumstellar envelope.

The best-fit values of the free parameters in our model are in agreement with previous determinations and with the variability phase of the source.

In these fits we have taken into account the work of Sutton et al. (1979) who found that the formation of solid grains around several Mira objects, including IRC+10216, seems to occur rather far from the central star, even if its temperature could allow the condensation of solid particles very close to the photosphere.

The same model is currently used to simulate the emission from carbon-rich sources showing the silicon carbide (SiC) feature at 11.3μm (Cohen, 1984; Baron et al., 1987). In this case extinction data for various kind of amorphous carbon and SiC grains mixtures have been used. These data have been experimentally obtained in laboratory with the usual pellet technique (Borghesi et al., 1983).

Due to the importance of matrix effects, first of all we have investigated what would be the behaviour of the optical properties of such mixtures in vacuum.

Here we show that matrix effects are not important on the band intensity (at least within experimental errors) for mixtures with an amount of SiC up to 25% by weight.

On the other side, a matrix effect is evident for the band position, since a clear shift towards shorter wavelengths appears extrapolating from KBr to vacuum. The displacement for the mixture ($\Delta\lambda_{peak} \simeq 0.3\mu m$) is the same that has been found for SiC alone (Pégourié, 1987).

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