A DIATOM MODEL OF DUST IN THE TRAPEZIUM NEBULA

(Letter to the Editor)

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Abstract. Measurements are reported of the 5–35 µm infrared spectrum of a mixed diatom culture dispersed in a CsI disc. These data are used to compute the flux from a diatom model of dust in the Trapezium nebula, where dust grain temperatures are assumed to be distributed in the range 230–130 K. Good agreement with the observational data is found for the model.

We have argued for several years that the infrared spectrum of dust observed in the Trapezium nebula could serve as a touchstone for interstellar grain models (Wickramasinghe, 1974; Hoyle and Wickramasinghe, 1977; Hoyle et al., 1982). On this basis several classes of grain model have been sifted out: mineral grains which were at first thought to be the cause of the 8–12 µm emission feature were later shown to be difficult to maintain, and so were grains comprised of relatively simple organic polymers such as polyoxymethylene. In sharp contrast we found that polysaccharides could match the Trapezium data over the 8–30 µm waveband (Hoyle and Wickramasinghe, 1977). The best fit obtained thus far over the limited 8–12 µm spectral region was for a mixed culture of diatoms, a class of microorganisms that incorporate polymers based on Si–O units within their structure.

In our earlier investigations relating to diatoms the situation remained uncertain, however, for wavelengths λ > 14 µm due to the lack of laboratory data (Hoyle et al., 1982). In the present Letter we report an extension of this earlier work to a wavelength λ ≈ 35 µm. The mixed culture of diatoms used here is the same as that for which our earlier results were obtained in the 8–13 µm waveband, so the results over this limited wavelength interval remain essentially unchanged. To obtain good quality infrared spectra further in the infrared, up to λ = 35 µm, it was necessary to use CsI instead of KBr as the disc material for the reason that the latter material has strong absorptions near 28 µm. A quantity of the dry, purified diatom culture weighing 0.6 mg was pressed into a disc in the usual way and an infrared spectrum over the 5–40 µm wavelength region was read out using a 780 series Perkin–Elmer spectrophotometer. From the known CsI disc diameter of 1.3 cm and the mass of diatoms used, we calculate the mass absorption coefficient κ(λ) which is plotted in Figure 1.

The function κ(λ) given in Figure 1 can now be used to calculate relative fluxes from the diatom model. Instead of using a single temperature for the dust we use a distribution

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The mass absorption coefficient of the mixed diatom culture.

Fig. 1. Flux curves for diatom model computed according to Equation (1) and normalised to agree with the observational data at the '10 μm band' peak.