Secular variations and non-spherical structures in the dust shell of o Ceti observed with a long baseline interferometer at 11 μm

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Abstract. Visibility observations at 11 μm of Ceti have been made with the U.C. Berkeley Infrared Spatial Interferometer during the time period 1988-1995. The observed visibilities change dramatically from one epoch to another and are not consistent with simple heating or cooling of the dust with change in luminosity as a function of stellar phase (cf. Figure 1). Instead, large temporal variations in the density of dust within a few stellar radii of the photosphere of Ceti have occurred (cf. Lopez et al. 1997). Spherically symmetric models of the dust distribution with two dust shells, one within three stellar radii of the photosphere of the star, the other approximately ten stellar radii from the star, can account reasonably well for the observed changes. Four types of axially symmetric radiative transfer models were also compared with the data; a spherical shell with an ellipsoidal inner cavity, a disk, a spherical shell with one or two inhomogeneities or clumps (cf. Figure 2), and a set of thin partial shells with a fixed distance between them. Of the four models only the one with the ellipsoidal inner cavity is excluded. The data were best fitted with the last two models, which emphasize inhomogeneities or clumps. To fit the observed temporal changes in the visibility data, all models must include a change in the density; increasing and decreasing; of dust close to the photosphere of the star. The axially symmetric models had clumps placed at distances from the star in agreement with distances of the spherical models. Good fits to the observed broadband spectrum of the star were also obtained with these models.

Acknowledgments. This work has been supported in part by grants from the National Science Foundation, Office of the Chief of Naval Research, and the France-Berkeley Fund.

References

Lopez, B. et al. 1997, ApJ, 488.

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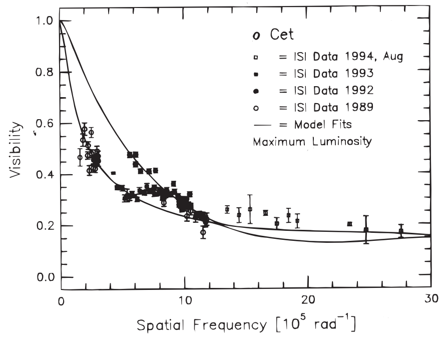

Figure 1. Visibility data and radiative transfer models for *o* Ceti.

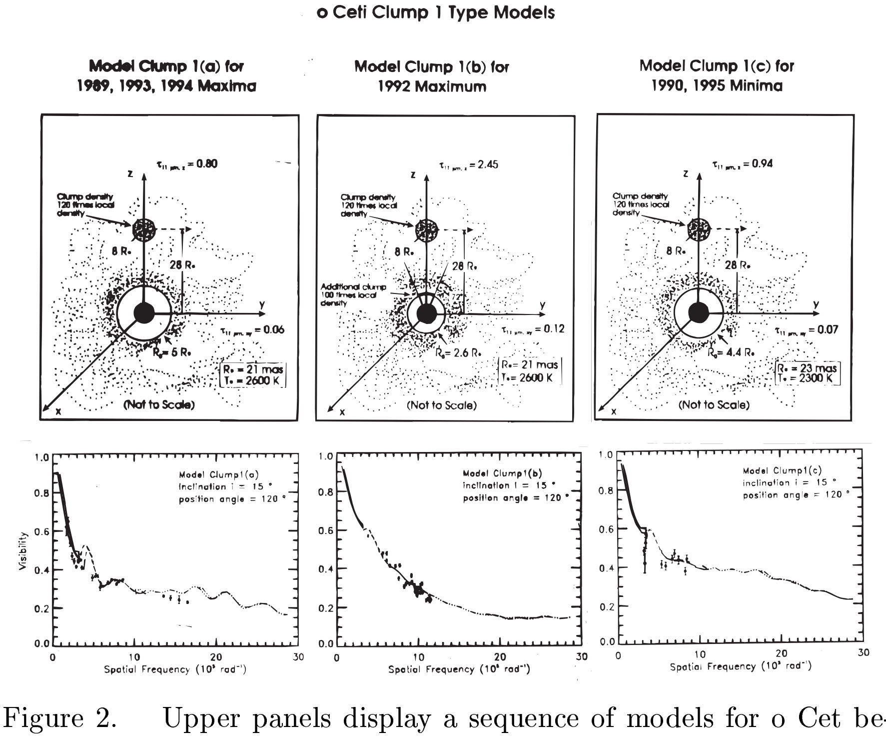

Figure 2. Upper panels display a sequence of models for o Cet beginning with the most recent epoch [Clump 1(a)]. The model Clump 1(b) is derived from Clump 1(a) by the addition of a clump close to the star, partially obscuring the original clump. Clump 1(c) is derived from Clump 1(b) by the removal of the additional clump close to the star. The lower panels display the visibility data and model curves derived from the corresponding clump models on the left hand side, respectively.