Constraining dust properties in Circumstellar Envelopes of C-stars in the Small Magellanic Cloud: optical constants and grain size of carbon dust

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We present our recent investigation aimed at constraining the typical size and optical properties of carbon dust grains in Circumstellar envelopes (CSEs) of C-stars in the Small Magellanic Cloud.

To achieve this goal, we apply our recent dust growth model, coupled with a radiative transfer code, to the CSEs of C-stars evolving along the TP-AGB, for which we compute spectra and colors. We then compare our modeled colors in the NIR and MIR bands with the observed ones, testing different assumptions in our dust scheme and employing several optical constants data sets for carbon dust available in the literature. Different assumptions adopted in our dust model change the typical size of the carbon grains produced. We finally constrain carbon dust properties by selecting the combination of typical grain size and optical constants which best reproduces several colors in the NIR and MIR at the same time. The approach is new and has never been adopted so far.

We conclude that the complete set of selected NIR and MIR colors are best reproduced by small grains, with sizes between 0.06 and 0.1 microns, rather than by large grains of 0.2-0.4 microns. Remarkably, the inability of large grains to reproduce NIR and MIR colors seems independent of the adopted optical data set. We also find a possible trend of the typical grain size with the dust reddening in the CSEs of these stars.

We finally emphasize that this work is preparatory to follow-up studies aimed at calibrating the TP-AGB phase through resolved stellar populations in star clusters and galaxies which include dusty, mass-losing evolved stars.