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Model grids of C-type AGB stars and the effect of dust opacities on wind properties

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Stars on the asymptotic giant branch (AGB) lose a substantial part of their mass through stellar winds. Pulsations induce shock waves throughout the stellar atmosphere which compresses and elevates gas to cooler regions where dust can form. The newly formed dust particles are accelerated outwards by radiation pressure, dragging gas along, resulting in a wind. Dynamical atmosphere and wind models are used to explore the wind driving mechanism and include descriptions of complicated physical processes such as the formation and destruction of dust. In this work we generate and compare two grids of models for C-type AGB stars where the optical properties of dust are varied. The grids are computed using the DARWIN code and consist of models with masses from 0.75 $M_{\odot}$ to 2 $M_{\odot}$, luminosities from 3500 $L_{\odot}$ to 10000 $L_{\odot}$, and effective temperatures from 2400 K to 3200 K. The pulsation amplitude and carbon excess are also varied for each model.
The results show that there is an overall trend in the wind properties that is directly related to the dust opacity. The differences in grain sizes are fully consistent, resulting in either smaller or larger particles for the entire grid. For the model grid with more opaque and smaller dust particles, the mass loss rates and wind velocities are in general higher, which is in better agreement with observations. The dust condensation and dust-to-gas ratios are also generally higher in this case. Some models deviate from the trend and require further analysis.

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