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An extensive grid of DARWIN models for M-type AGB stars

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Asymptotic giant branch (AGB) stars are luminous, cool giants with non-spherical morphology and substantial mass loss. Dust formed in the stellar atmospheres plays a key role for the mass-loss mechanism: radial pulsations of the surface layers of the stars levitate material to distances where dust can form, which then is accelerated outward by radiation pressure. AGB stars are significant dust donors to the interstellar medium through these stellar winds.

To model these dense winds, we have constructed an extensive grid of M-type AGB stars (stars with oxygen dominated chemistry) using DARWIN models (Dynamic Atmosphere and Radiation-driven Wind models based on Implicit Numerics). The mass-loss process is modelled from first principles, with frequency-dependent radiation-hydrodynamics, and dust growth and evaporation. In the grid we cover a wide range of the relevant stellar parameters (0.75-3 M_sun, 1000 –70 000 L_sun and 2200-2300 K). Direct outputs from the models include mass loss rates, wind velocities, dust-to-gas ratios and grain sizes.

We plan to combine this grid with stellar evolution codes, where parameterised relationships (e.g. Reimer's classical mass-loss formula) are widely used to describe the mass-loss rates of AGB stars. This can then be used to estimate the dust contribution for entire populations of AGB stars.

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Yes

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