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Oxygen-Rich AGB Stars with Low Mass-Loss Rate Observed with Herschel
T. Chousinho Khouri Silva

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Asymptotic giant branch (AGB) stars at the end of their lives experience a strong mass loss. The wind-driving mechanism is qualitatively explained by the currently widely accepted paradigm as due radiation pressure on dust grains. For oxygen-rich AGB stars (with atmospheric C/O < 1) the driving is thought to be done by scattering of photons on grains with radii about 0.4 μm on theoretical basis. Observations suggest that grains with the required size exist around these stars, lending support to this model. However, many aspects of the connection between dust formation and mass loss in these stars remain unknown.

In my PhD thesis, we studied the dust envelopes of oxygen-rich AGB stars. For this, we modelled consistently the gas- and solid-phase components of these sources in great detail using state-of-the-art radiative transfer codes. Our models are constrained mainly by data obtained with the satellites Herschel and ISO. Based on this analysis, we infer that the infrared emission of some dust species, as amorphous aluminium oxide, might originate from the extended atmosphere rather than from the wind. This is a new insight, since it is usually assumed that the dust excess is mostly produced from the outflow. The depletion of silicon was studied in detail for three sources, W Hya, R Dor and R Cas. That was done by calculating models for the gas-phase SiO emission observed with Herschel and by comparing the depletions obtained to models for the infrared silicate emission. For W Hya we also modelled molecular lines of H_2O, its isotopologues and ^{13}CO and the extended dust emission observed by PACS. These models allowed us to constrain its initial mass and its mass-loss history.

Our studies show that the wind-driving of oxygen-rich AGB stars is indeed complex and that different steps of dust formation likely happen before enough dust is formed for the wind to be efficiently driven. Our results show that analyzing the solid and gaseous components of the wind simultaneously provides interesting constraints and insights in the dust formation and wind-driving mechanism.