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Studying the wind-driving region of nearby AGB stars with ALMA and SPHERE

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Despite many important advances in recent years, we are still unable to predict the dust formation process and the wind-driving mechanism in AGB stars remain impossible to predict from first principles. Particularly, the initial step of dust nucleation and the properties of the grains that drive the outflows in oxygen-rich environments have eluded empirical characterization for a long time.
In this talk, I will present high-angular-resolution observations of nearby AGB stars using ALMA and SPHERE/VLT which are used to constrain the distribution of gas and dust in the innermost regions of the circumstellar envelopes. These data allow us to probe the crucial region where the wind is being accelerated in unprecedented detail and to test the wind-driving paradigm for AGB stars. The maps of the molecular lines reveal the density, velocity, and temperature distributions of the gas, while the polarized-light data constrains the density distribution and sizes of the dust grains. By combining these two complementary datasets, we can determine the dust-to-gas ratio in the wind-acceleration regions. Moreover, we also investigate the radiation pressure force experienced by the dust, which directly relates to how efficiently grains can drive an outflow.

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