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The origin of the dusty envelope around Betelgeuse

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Abstract. The origin of red supergiant mass loss still remains to be unveiled. Characterising the formation loci and the dust distribution in the first stellar radii above the surface is key to understand the initiation of the mass loss phenomenon. Polarimetric interferometry observations in the near-infrared allowed us to detect an inner dust atmosphere located only 0.5 stellar radius above the photosphere of Betelgeuse. We modelled these observations and compare them with visible polarimetric measurements to discuss the dust distribution properties.

Keywords. Convection-techniques: interferometric- stars: fundamental parameters- infrared: stars- stars: individual: Betelgeuse

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Summary

Depending on their characteristics and composition, dust grains could interact with the stellar radiation from red supergiants and trigger mass loss via a dust wind. We observed Betelgeuse using the NACO/SAMPol instrument and detected a polarizing structure at 1.5 stellar radius that we modelled as a thin dust shell. The dust-shell-to-stellar-disk flux ratio can be modelled as the fraction of the stellar light that is scattered on the grains of the dust shell. We fit the wavelength variation of this fraction using a Mie scattering routine. Parameters of this model are the grain radius and density, which is translated in a dust shell mass. We derived similar grain sizes of about 300 nm and masses of about 10^{-10} $M_\odot$ for three dust species (enstatite $MgSiO_3$, forsterite Mg_2SiO_4 and alumina Al_2O_3). Extrapolating to the visible wavelengths, we can compare our radiative transfer modelling to the SPHERE/ZIMPol data reported in Kervella *et al.* (2016). A preliminary analysis shows that the forsterite and enstatite models match the data better than the alumina dust except in the V-band filter. More spectral filters in the visible should be obtained to infirm/confirm this hint on the dust composition.

Reference

Kervella, P., Lagadec, E., Montargès, M., *et al.* 2016, *A&A*, 585, A28