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Constraining dust grain porosity via debris disk observations

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Debris disks are often modelled assuming compact dust grains, but more and more evidence for the presence of porous grains is found. We quantify the systematic errors introduced when modelling debris disks – composed of porous dust grains – assuming the presence of spherical, compact particles (Brunngräber et al. 2017).

We use the effective medium theory to calculate the optical properties of the dust. Furthermore, we simulate observations of debris disks with different porosities and feed them into a fitting procedure assuming compact grains only. Finally, we analyse the deviations of the results for compact grains from the original, porous model.

We find that with increasing grain porosity the blowout size increases up to a factor of two. An analytical approximation function for the blowout size as a function of porosity and stellar luminosity is derived. The analysis of the geometrical disk set-up, when constrained by radial profiles, is barely affected by the porosity. However, the estimated minimum grain size and the slope of the grain size distribution derived using compact grains are significantly overestimated. Thus, the discrepancy between the minimum grain size and the predicted blowout size found in various previous studies assuming compact grains can be partially explained by the presence of porous dust grains.

Consider for a poster?

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