The properties of silicates in the interstellar medium

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Abstract

The infrared and X-ray part of the spectrum provide powerful tools to put important constraints on the properties of interstellar dust, for instance on the composition, crystallinity and size distribution of dust grains. The size distribution in particular is an important component of many dust models and there are currently many different size distribution models available. The properties of the grains in these distributions are mostly based on the properties of bulk material, although there are many small (nano size) dust grains present that may not share the properties of these materials.

Silicates are a major component of interstellar dust. Small silicate nano grains may provide insight in the formation of grains in the interstellar medium (ISM), since the observation of these small clusters may point to active grain formation in the ISM. They may also explain the absence of crystalline dust in ISM, since many atoms are near the surface of the grain, distorting the lattice structure, which may make the grains appear amorphous while they are still in their lowest energy configuration.

In order to study the small-size end of the distributions, we make use of infrared and X-ray spectra generated from calculated minimum energy structures of both cut bulk grains and the nucleation cores from Goumans and Bromley (2012) and Escatllar et al. (2019, submitted). We fit these spectra to infrared and X-ray sources in the Galaxy and present our first preliminary findings.

Furthermore we will show how we can further constrain the dust size distribution and dust composition in different environments of the Galaxy using X-ray spectroscopy techniques. Here we make use of recent laboratory dust measurements (Zeegers 2019).

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