Nanoparticles in Space and the Laboratory

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Small solid grains form an important component of our and other galaxies. Although only a minor contributor to the total mass of these systems, they determine the thermal, dynamical, and chemical state of the interstellar medium, thereby controlling the star formation process. The coagulation of these particles in circumstellar disks is a first, but decisive step towards the formation of planetesimals.

From a physical point of view, the interstellar grains are a very interesting system of small and well-isolated particles interacting with radiation, other grains, and gas particles at the low temperatures of interstellar space. Therefore, many bridges to solid-state physics, quantum chemistry, and physical chemistry exist. The detection of novel forms of carbon was triggered by astrophysical studies, the investigation of polyaromatic hydrocarbons (PAHs) got a new impetus from this research, and new computational and experimental methods for the investigation of the interaction of light with irregular, anisotropic, and fluffy grains were developed by astrophysicists.

In the talk, the observational evidence for the presence of nanoparticles in space will be reviewed. Production methods for such particles in the laboratory, including laser ablation and laser pyrolysis, will be discussed. Tools for the analytical characterization of the nanoparticles will be summarized. Their spectroscopic properties and the relevance for the interpretation of astronomical data will be discussed. In addition, the formation routes of such particles from the gas phase will form another topic of the presentation.

References:

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