Optical Properties of Interstellar Dust from Cosmic Dust Analogs Studied in the Lab

Harald Mutschke (Astrophysical Institute and University Observatory, Friedrich Schiller University Jena, Germany)

Analog materials are a means to explore in the laboratory how cosmic dust particles may behave in the interaction with gas atoms and ions, electromagnetic radiation and fields, etc., and to see which properties these particles need to have in order to reproduce astronomical observations. The scarce information about the nature of interstellar dust particles requires studying a relatively wide range of compounds and structures, being partly similar to terrestrial ones and partly very unique and dedicated. In the past years, cosmic dust research has taken great advantage from the laboratory efforts to investigate the properties of dust analog materials such as amorphous magnesium/iron silicates and various forms of carbon, applying advanced techniques from solid state physics, physical chemistry, and other research fields.

Optical and spectroscopic properties of such analog materials are a primary goal to study, laying the basis for exploitation of observational information such as extinction, thermal emission, and scattering. Laboratory investigation of these optical properties means to cover a wide wavelength range from the UV to the millimeter wavelength range and to study the intrinsic temperature dependence of electromagnetic excitation processes. Not only the complex refractive index of chemically pure analog compounds is needed for dust models, but also effects of inhomogeneity and impurity are relevant. I plan to review what we have learned in the last years from the optical and spectroscopic studies on analog materials performed in astrophysical and other laboratories.