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Impact ionization experiments with porous cosmic dust particle analogs

Veerle Sterken (1), Georg Moragas-Klostermeyer (2), Jon Hillier (3), Lee Fielding (4), Joseph Lovett (5), Steven Armes (5), Nina Fechler (6), Ralf Srama (2,7), Sebastian Bugiel (2,7), and Klaus Hornung (8)

(1) International Space Sciences Institute, Bern, Switzerland (veerle.sterken@issibern.ch), (2) IRS, Universität Stuttgart, Germany, (3) Center for Astrophysics and Planetary Science, University of Kent, UK, (4) School of Materials, The University of Manchester, UK, (5) Department of Chemistry, University of Sheffield, UK, (6) Max Planck Institute of Colloids and Interfaces, Potsdam, Germany, (7) Mac Planck Institute for Nuclear Physics, Heidelberg, Germany, (8) Universität der Bundeswehr, München, Germany

Impact ionization experiments have been performed since more than 40 years for calibration of cosmic dust instruments using a linear Van de Graaff dust accelerator. Such an accelerator can accelerate conductive dust particles of sizes between ca. a few tens of microns, and a micron in size to speeds up to 80 km/s depending on particle size. Many different materials have been used for instrument calibration, from iron in the earlier days to carbon, metal-coated minerals and most recently, minerals coated with conductive polymers.

While different materials with different densities have been used for instrument calibration, no comparative analysis has been made yet of compact particles versus porous or fluffy particles of the same material. Porous or fluffy particles are increasingly found to be present in the solar system, e.g. dust from comet 67P Churyumov-Gerasimenko or aggregate grains from the plumes of Enceladus and recently also indications were found for low-density interstellar dust (ISD) from ISD data and trajectory simulations. These recalibrations are thus relevant for estimations of the size distributions of interplanetary and interstellar dust.

In this talk we report about the calibrations being performed at the Heidelberg dust accelerator facility for investigating the influence of particle density on the impact ionization charge after impact. We use the Cassini Cosmic Dust Analyser as an impact target. We then explain the experiment set-up, the preparation of the materials and the materials used. We elaborate on the technical challenges, and finally about the current status of the research at this stage. We conclude the talk with the relevance of the study, being the potential influence of such calibrations on the estimates of the mass distributions of interstellar and interplanetary dust.