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Light scattering on a single dust grain in the ultrasonic trap

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Light scattering by dust grains is a complex phenomenon playing an important role in all dust–light interactions. This includes light passing through dense dusty clouds in space as well as in the upper atmosphere, dust charging by photoemission, etc. When the size of the grain is close to the wavelength of the incident light, the Mie theory is often used to characterize the scattering process. However, our knowledge of necessary material constants for most of the space-related materials is limited. Moreover, solutions of Mie equations for general grain shapes is difficult and often not known.

Objective of our work is development of an apparatus for observations of light scattering on small (micrometer-sized) arbitrary shaped dust grains. We measure scattering directly by levitating grains in the field created by the standing-wave ultrasonic trap. Such setup allows us to study single grains or small grain clusters. The experiment is performed at atmosphere — unlike other experiments, where grains were measured in water or other liquids, thus, the background effects are significantly reduced. Currently, the trap is under development and first tests are carried out. In this paper, we also focus on theoretical computation of the ultrasonic field of the selected trap.