Optical and Acoustic trapping for characterization of materials

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Contactless manipulation of particles has many important applications in different fields such as nanoscience, biology, electronic industrial processes, container-less transportation. As an example, optical tweezers (OT) are key photonic tools for the manipulation of particles from single atoms and nanoparticles to viruses and cells. Among their several applications, the ability to accurately measure forces down to the femtonewton range has been at the core of recent advances in biophysics, soft-matter, and nanotechnology. In acoustic trapping, sound waves in the ultrasonic range are used to confine and manipulate millimeter and submillimeter particles in air or a fluid, with several possible applications in biomedical research, life sciences, physics of liquids and soft-matter. This technique in the past years has been confined to few laboratories in the world due to the inherent high costs of the setup and due to potential dangers in operation. Now, the availability of low-cost commercial ultrasonic transducers has led to a large spreading of the technique, leading to interesting applications in fields such as environmental monitoring and astrophysical research. In this regard, in this presentation, after a short introduction on the fundamentals of both the techniques, we will discuss some recent results obtained by applying optical and acoustic trapping to the contactless manipulation of microplastics, of micrometeorites and of terrestrial analogs of cometary dust particles.