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# Study of Laser-Induced Plasma Dynamics with Rapid Imaging and Shadowgraphy in an Acoustic Levitation System

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Laser-induced breakdown spectroscopy is a well-known analytical technique with a huge potential for characterization of materials in all three states of matter. It enables quick remote analysis without time-consuming sample preparation. The temporal evolution of plasma in liquid samples due to the nature of liquid itself provides further challenges. Plasma produced by a laser pulse (PPL) in liquid samples, unlike the one in solids, exhibits some difficulties during the plasma formation such as splashing, quenching and plasma duration. For solids, plasma created by laser ablation is generated on the surface of a target. However, in the case of a liquid which is usually transparent to the light source, plasma can be formed on the surface and within the liquid. Hence, the dynamic of the plasma in liquids could change depending on the PPL location.

LIBS on liquids using an acoustic levitation system has recently been reported. This device allows droplets to be suspended in the air to perform analytic determinations with LIBS technique. This approach is called LIBS-AL.

To study droplet dynamics the fast-photo and shadowgraphy techniques were integrated into LIBS-AL setup. Temporal evolution of plasma in liquids was recorded for different focal distances. Both techniques employ a secondary fast camera in addition to an spectrometer, with both cameras simultaneously triggered by the laser. Two separate images were captured: one for the shadow of the levitated sample and another for the ablated plasma. The results indicate variations in the ablated material depending on delay time and focal distance (fluence). Delay times corresponding to the maximum ablated mass were identified.

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