Laser Ablation: Fundamentals and Applications in Environment, Medicine and Materials Science

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Our group has developed for more than fifteen years a variety of experimental and theoretical capabilities for the fundamental study of complex processes involved in laser ablation and its applications in various fields. Fundamental studies on laser ablation plasma plume dynamics have been performed both experimentally by optical (ICCD fast imaging, space- and time-resolved optical emission spectroscopy) and electrical (Langmuir probes, mass spectrometry) methods, and theoretically (development of a new model based on fractal concepts). Various laser pulse durations have been explored (from ns to ps to fs [1]) and some peculiar features have been evidenced in both experimental and theoretical data [2].

Applications of laser ablation have been developed in three fields: environment (mainly analysis of combustion-generated particles [3, 4]), medicine (in-vivo real-time detection of cancer markers [5, 6]), and materials science (pulsed laser deposition of various thin films [7], study of the accelerated erosion of ceramic materials used in plasma space propulsion [8], etc.). Parametric studies and coupling with other on-line or off-line techniques (e.g. mass spectrometry) have led to outstanding results in terms of sensitivity, selectivity or space- and time-resolution for the proposed analytical approaches.

An overview of these fundamental and applied studies will be presented.

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