Physics of laser-matter interaction: excitation of plasmons, ablation in liquid, and role of duration of a pulse

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This is a review of recent progress in physics of laser ablation. It is made based on papers presented here http://laser.itp.ac.ru/publications/index-r.shtml.

Sophisticated ways of delivery of laser energy onto target surface are considered. Spatial distributions of intensity *I* along surface and influence of these distributions on dynamics of ablation are analyzed. In the simplest way the distribution is Gaussian: *I ~ exp(-r2/RL2)*. Situations with tight focused beams, non-Gaussian distributions (e.g., Bessel’s beams), and distributions created by interference of a laser electromagnetic wave and surface plasmon-polariton wave are studied.

Laser ablation in liquid (LAL) is a technique widely used for production of nanoparticles. But up to now there are many unknowns in the corresponding processes. In the report action of a laser pulse to a metal target through transparent liquid is investigated beginning from absorption of a pulse, propagation of the thermal waves in a target and in liquid, and dynamics connected with stress fields. Later in time expansion and cooling of target matter down to supersaturated vapor, condensation of vapor, together with diffusion of liquid and vapor, and development of the hydrodynamic Rayleigh-Taylor instability take place. At the last stages pressure in liquid decreases below critical pressure for liquid. Then development of a bubble filled with vapor from liquid begins. This sequence of events is described.

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