Physical processes of nanoparticle formation at laser ablation in liquid

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The laser ablation of a target substance in a liquid produces nanoparticles (NPs) as a result of a number of fundamental phenomena that have not yet received an exhaustive explanation in terms of modern physics and mechanics.
In femto-picosecond exposure, the formation of the flyaway liquid layer with its subsequent fragmentation plays an important role. In nanosecond exposure, (a) supercritical states of the target substance play an important role. The formation of NPs is related to the surface. Therefore, the disappearance of the capillary barrier in the supercritical state is essential. (b) Let S_{cr} be the entropy at the critical point of the target substance. It appears that the rate of NPs production depends on the hydrodynamics of steam condensation with a stratified distribution of the overcritical entropy $S > S_{\mathrm{cr}}$ in the target matter. An eroded condensation jump appears with a collapse of the volume occupied by the vapor in the two-phase mixture. (c) After the diffusion-condensation formation of the NPs inside the near-contact layer hot liquid, the fate of the NPs is determined by the expansion mechanics of this liquid layer. This expanding layer consists of matter in a highly supercritical gaseous state with respect with respect to the critical parameters of the initial liquid.
Numerical simulations of ablation into a liquid using molecular dynamics and hydrodynamics codes were performed.