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Dense xenon nanoplasmas in intense laser fields

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One reason for the on-going interest in laser-cluster interactions is the efficient absorption of the radiation energy of near-infrared femtosecond laser pulses by clusters. Consequently, in laser-cluster experiments the emission of highly charged ions, very energetic electrons, higher harmonics, fast fragments as well as strong x-rays in the multi-keV range is observed. The cluster response is highly nonlinear.
Different theoretical models and simulations indicate that resonant collective absorption plays a central role. The rapid expansion of irradiated clusters is essential as, at a certain time, the cluster reaches the density fulfilling the resonance condition. This can occur during a single pulse. A better control can be achieved by dual-pulse laser excitation with varying time delay between two pulses.
A further optimization is possible by pulse shaping which is a modern tool in laser experiments. With pulse shaping, the dynamics of the system determined by heating, ionization and expansion can be specifically affected. For an understanding of the underlying physical processes in the dynamics of laser–cluster interaction, a theoretical description is presented using a genetic algorithm and basing on the relatively simple nanoplasma model [1].
Recently, experiments as well as calculations were performed for silver clusters [2]. Highly charged silver ions could be produced very efficiently with a pulse structure consisting of a smaller pre-pulse followed by a larger main pulse. The focus of the present contribution is on xenon clusters and their different behavior compared to metallic clusters as silver [3].

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Evolution of plasma emission on second harmonic frequency of Nd-glass laser radiation

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The results of investigation of the second harmonic emission by the laser-produced plasma at laser radiation interaction with targets of different types are reported. The experiments have been carried out on the "Kanal 2" laser facility (a Nd-glass laser operating in a multi-mode regime, wavelength of radiation 1.06 μm, spectral width, 26Å, power density on a target, 10^{13} W/cm^2, focusing spot diameter, 350 μm.). The used targets are made of Al, Cu, $(C_2H_4)_n$, and TAC materials of 50 ÷ 500 μm thickness and 2 ÷ 8900 g/cm^3 specific density, as well as the TAC+ Cu and Cu+Al two-layer targets have been used.
Time sweep of the second harmonic generated in plasma (Fig. 1) has shown that the second-harmonic spectrum is broadened during a laser pulse. This makes it possible to believe that the turbulence developed in the laser-produced plasma due to the excitation of the short-wave plasma waves.