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Enhanced Brillouin scattering of elliptical laser beam in a collisionless plasma

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This paper presents the Enhanced Brillouin scattering of an elliptical laser beam in collisionless plasma. The transverse intensity gradient of a pump beam generates a ponderomotive force, which modifies the background plasma density profile in a direction transverse to pump beam axis. This modification in density affects the incident laser beam, ion-acoustic wave and back-scattered beam. Non-linear differential equations for the beam width parameters of pump laser beam, ion-acoustic wave and back-scattered beam are set up and solved numerically. Numerical results predict the effect of focusing of waves on the back reflectivity.

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Microwave heating of the ceramic materials by the Gaussian maser beam

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The ceramic which has a complex permittivity can absorb electromagnetic energy easily and be heated quickly. In this work, the heating of a ceramic cylinder by the Gaussian electromagnetic beam in two dimensions is investigated and the heat equation is solved. It is shown that this electromagnetic beam with Gaussian profile can heat ceramic sample better than the plane electromagnetic wave. Moreover, the effects of some important physical factors such as the permittivity of ceramic, the incident wave intensity and the spot size of the Gaussian beam on the heat transfer within the sample are studied. Also, comparing the effect of Gaussian electromagnetic beam on ceramics Al_2O_3 and, it is shown that Al_2O_3 ceramic is heated more intensively than ZnO ceramic.

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Electron-positron pairs creation in the field of two strong counterpropagating laser beams and the nonlocality of the photon-photon interaction

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We discuss various approaches to problem of the electron-positron pair creation in the strong external field. Special interest presents the circuit, in which the interaction of two strong counterpropagating laser beams in vacuum is considered. For the calculation of the probability of the creation the following formula is usually applied [1]:

$$W = 2\,\mathrm{Im}(\mathcal{L}^{(\text{E-H})}(\rho_L)) = \frac{2m^4}{(2\pi)^3}\rho_L^2\sum_{n=1}^{\infty}\frac{1}{n^2}e^{-\frac{n\pi}{\rho_L}}$$

where $\rho_L = E_L/E_{cr}$ and $E_{cr} = m^2/e = 1.3\cdot 10^{16}$ V/cm is the Schwinger field limit. However this expression was obtained even in pioneer works dedicated to vacuum nonlinearity [2] and it based on some approximations. Attempt of the strict analysis has been made in work [3] by introducing the nonlocal form-factor into the Lagrangian. But, as it is well known, such procedure leads to the loss of Lorenz invariance or unitarity. We show that the formalism of generalized quantum dynamic (GQD) [4] opens new opportunities to solve such problems. We show also how it can be made proceeding from nonlocal interaction operator obtained earlier within the framework of the formalism of GQD.

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P46.
Simple characterization method for foams and aerogels of gas-like densities

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Low-density solids are of interest for target application in ICF and are widely used in laser and in particle beams interaction experiments at present. The densities achieve as low as 1-2 mg/cc, which is comparable to that of the air at normal conditions.

The solid material done as foam or as aerogel with density comparable to that of gas is difficult to measure, owing to the poor optical density, especially in thin layers. The soft x-rays characterization was reported earlier as non-destructive method for laser targets with such layers. Here we used an optical microscopy where the object with the foam or aerogel part was illuminated by the lasers of 2 additional wavelengths and/or by white light. For measurements of refractive index the macroscopic samples were needed and used. Then by microscopic study we could report the difference between 100-micron foam/aerogel (optically transparent) layer and thin film of the same material hidden inside washer, between varying densities of the samples with similar structure, and those of the same areal mass.

Foams or alternatively aerogels can be formed from certain polymers depending on the fabrication route. The light scattering in foam structure is found capable of mixing the 2 beams of additional colors throughout the material volume, whereas in aerogel structures the mixing takes place in the beam intersection only.

Considering independent scatters in the aerogel, the measured signals are compared to the simulated Mie scattering in the material. The nanoparticles of metal inserted into aerogel could be detected through optical scattering. But we failed to register nanoparticles in foams by detecting the scattered signal as in aerogels.

Optical characterization procedure for highly transparent objects, including nanostructured microobjects, is proposed to prepare the targets for laser shots.

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P47.
Collective modes of laser excited electrons in clusters

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Clusters of material at solid state densities can form nanoplasmas after intense laser irradiation. The time evolution of the electron ion system is simulated using semi classical molecular dynamics (MD) simulations. Plasma properties like temperature and density are discussed as function of time [1].