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Fast and slow laser light with femtosecond duration of pulse propagating in medium with nanorods due to frequency self-modulation

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Recent investigations have shown the attraction of using thin films doped with noble metal nanoparticles as recording media. Noble nanoparticles are used because of their strong resistance to frequencies range of optical radiation. As it is well known, the process of recoding is based on melting of nanoparticles into nanospheres without losing matter, which is caused by longitudinal surface plasmon resonance (SPR) induced by laser radiation. Longitudinal SPR is highly sensitive to such geometrical parameters of nanoparticles as aspect ratio and their orientation with respect to polarization of laser radiation. Thus, it is possible to record multiple patterns in one recording layer by using a number of scattered nanorods with different aspect ratio and orientation. As pattern recording is based on melting of nanorods into nanospheres of the same volume under the influence of laser radiation, detailed understanding of this process with respect to nonlinear properties of separated nanorods, as well as their closed-packed array, is the key to construction of new recording media. In this report, we investigate new nonlinear phenomenon: fast and slow laser light under a propagation of pulse with femtosecond duration in the medium with nanorods. We take into account the TPA of laser radiation by nanorods and time-dependence of changing the aspect ratio of nanorods due to their melting because of the laser energy absorption. We also take into account the dependence of the central frequency of the nanorods absorption spectrum from the aspect ratio, detuning between the central frequency of the absorption spectrum and the carrier frequency of the laser pulse, group velocity dispersion and the finite width of both the absorption spectrum and laser pulse spectrum. This phenomenon is very important for process of data storage and data processing using medium with nanorods.

Biography

Vyacheslav A Trofimov has completed his PhD at the age of 27 years from Lomonosov Moscow State University. He received Doctor of Sciences (Physics & Mathematics) degree in 1995 at Lomonosov Moscow State University. He is the Head of Laboratory of mathematical modeling in physics at Lomonosov Moscow State University. He is Full Professor at Lomonosov Moscow State University. He has published more than 400 scientific papers in reputed journals. He is an editorial board member of some scientific journals. Prof. Vyacheslav Trofimov was supervisor of 13 PhD students.

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