Spectrum Evolution of Accelerating or Slowing down Soliton at Its Propagation in a Medium with Gold Nanorods

V A Trofimov¹ and T M Lysak¹

¹Faculty of Computational Mathematics and Cybernetics, Lomonosov Moscow State University, 1-52, Leninskiye Gory, 119991, GSP-1, Moscow, Russia. Contact Phone: +74959395255
Contact Email: vatro@cs.msu.ru

We investigate both numerically and analytically the spectrum evolution of a novel type soliton – chirped accelerating or decelerating soliton – at a femtosecond pulse propagation in a medium with noble nanoparticles. In our consideration, we take into account one- or two-photon absorption of laser radiation by nanorods, and time-dependent nanorod aspect ratio changing due to their melting or reshaping because of laser energy absorption. The chirped solitons are formed due to the trapping of laser radiation by the nanorods reshaping fronts, if a positive or negative phase-amplitude grating is induced by laser radiation. Accelerating or slowing down chirped soliton formation is accompanied by the soliton spectrum blue or red shift. To prove our numerical results, we developed an approximate analytical soliton and derived the chirped soliton amplitude, chirp and soliton center evolution, as well as the soliton spectrum central frequency shift evolution.