Klein-Gordon Radio and Attosecond Light Pulses

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In the present talk, first, we show that the four potential of electromagnetic fields in a homogeneous plasma medium can be considered as a massive vector boson field, whose mass is proportional to the plasma frequency. Similar vector fields (which satisfy the Klein-Gordon equation) has long been known in quantum electrodynamics, from the works of Lánczos [1] and Proca [2], but these are more fundamental, in the sense that they do not rely on plasma considerations [3]. The expression „Klein-Gordon radio" in the title of the present talk has been borrowed from the paper by Crandall and Wheeler [4], which was devoted to the study of a dynamical bound on photon mass and the peculiarities of wave propagation in free space. Here we will show that an effective mass of the photons automatically comes out, considering the photon-electron interaction for many electrons, in the framework of nonrelativistic quantum electrodynamics. In our formalism, the appearance of the well-known blue-shift of the spectral components in high harmonic generation (HHG) can be derived as a pure kinematic relation. In the HHG target volume, the radiation quanta of both the incoming laser field and the outgoing harmonics can be represented by „massive photons". So, in an nth-order process, for instance, n massive laser photons are converted to a massive high-harmonic component (which inherits the blue shift after propagating out of the interaction region). By the same kinematic consideration, the recently proposed attochirp compensation scheme [5] receives an alternative and, perhaps, a more straighforward interpretation.

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