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Title:Response of an atom interacting with an arbitrarily polarized electromagnetic field
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Abstract:We develop the theory of interaction of the electromagnetic field and a single atom being in an arbitrary state and having an arbitrary direction of the angular momentum of the atomic electron with respect to the direction of the field polarization vector. It is shown that the atom response current has a tensor structure and depends on both the direction of the angular momentum of the atom, and the polarization vector of the external field. The tensor character of the response is determined by the externally induced anisotropic distribution of the probability density of spatial localization of the atomic electron. It is shown that the induced-anisotropy effects clarify the harmonic generation mechanism at play during the non-resonance interaction of laser radiation with atomic media. The developed theory is applied to the analysis of the problem about the generation of terahertz waves in a two-color laser field. It is shown that the change in the mutual orientation of wave polarization vectors leads to a significant increase in the efficiency of conversion of high-frequency fields to low-frequency ones. It is shown for the first time that the generation of terahertz waves is possible in the preionization regime, when the generation mechanism is related to atomic nonlinearity. © 2011 Springer Science+Business Media, Inc.