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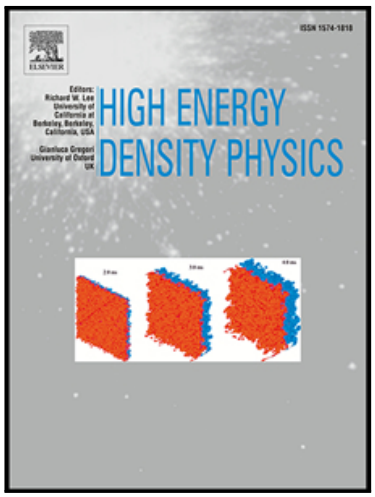

Bloch equations for intense x-rays

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ACCEPTED MANUSCRIPT

Bloch equations for intense x-rays

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Abstract

Density matrix equations for ultrafast electron-hole dynamics in solid target under intense x-rays are presented. The theory is an extension of the usual optical Bloch equations to the case of intense x-ray free-electron lasers, where the creation of multiple core holes and the associated orbital relaxation dynamics are additionally incorporated through the cluster model combined with the time-dependent unrestricted Hartree-Fock approximation. Numerical examples are demonstrated for *K*-edge excitation of sodium by a femtosecond x-ray pulse; nonlinear dynamics of absorption, orbital energy shifts and induced electric polarization are discussed.

PACS numbers: 32.80.Aa, 41.60.Cr, 78.70.Dm

Keywords: x-ray free-electron laser, inner-shell excitation, density matrix

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