Abstract

Nonlinear Polaritons of Antiferromagnetic Superlattices

Xuan-Zhang WANG[¶] and Shu-Fang FU

Department of Physics
Harbin Normal University
Harbin 150080
P.R. China

Laboratory of Excited State Process
Chinese Academy of Science
Changchun 130021
P.R. China

xzwang@postoffice.hrbnu.edu.cn

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We investigate nonlinear polaritons of antiferromagnetic superlattices, or antiferromagnetic multilayers. In the third-order approximation, an effective-medium theory and a coordinate system with the *y* axis normal the interfaces, and sublattice magnetization and anisotropy axis parallel to the *z* axis, are applied to obtained the dispersion equations for the polaritons in different geometries. These equations show that the nonlinearity does not influence the polaritons propagating in the *x*-*y* plane or along the three axes, but influences clearly the polaritons with wave vector in the *x*-*z* and *y*-*z* planes. Numerical results tell us that the nonlinear wavenumber shift versus frequency is always positive for those polaritons in the bulk continuum above the antiferromagnetic resonant frequency, but in the continuum below this resonant frequency, the nonlinear shift is negative in most of the frequency region and is positive in a small region. Combine linear dispersion curves, these results also show that the relevant envelope solitons can exist in most of the bulk continua, and cannot appear in the small region mentioned above. The parameters for numerical calculations come from the FeF_2/ZnF_2 superlattice.

[¶]Presenter