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H. How

C. Vittoria
Northeastern University

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Photon/polariton modes in a magnetic/nonmagnetic layered structure with magnetization antiparallel to each other (abstract)

H. How and C. Vittoria

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The band structure of metallic superlattices (abstract)

W. M. Fairbairn and S. Y. Yip

Department of Physics, University of Lancaster, Lancaster LA1 4YB, United Kingdom

The bilayers which form the basic unit in superlattices define a unit cell which normally contains a large number of inequivalent sites. With over 20 such sites being involved it is not at present feasible to use the known sophisticated self-consistent and relativistic computational procedures to obtain the band structure. A simple model is considered in which the lattice structure is represented in the superlattice direction by an appropriate number of square well potentials (different for each of the constituent atoms) and in the other two perpendicular directions by a quasi-free periodic potential. The resulting three-dimensional band structure exhibits the behavior expected for that of a metallic superlattice, and is used to evaluate the RKKY interaction as a function of distance between sites within the structure. When one of the two constituent elements in the superlattice is a metallic rare earth for which the ions possess a magnetic moment then this interaction should be dominant in determining any magnetic ordering which occurs. A comparison is made between the orderings so predicted and those which have been found experimentally.

Photon/polariton modes in a magnetic/nonmagnetic layered structure with magnetization antiparallel to each other (abstract)

H. How and C. Vittoria

Department of Electrical and Computer Engineering, Northeastern University, Boston, Massachusetts 02115^{a)}

We have calculated the photon/polariton spectrum of the surface and bulk waves in a magnetic/nonmagnetic layered structure where the magnetization in subsequent magnetic layers is antiparallel to each other. The magnetic layers are magnetized to saturation by a uniaxial anisotropy field parallel to the layer surfaces and the wave propagation direction is assumed to be perpendicular to the anisotropy axis (the Voigt configuration). Similar to electronic energy bands in solids the dispersion relations of the bulk modes form dispersion bands in a 1D superlattice of the layered structure. Surface modes form dispersion curves in between the bulk bands. The results are compared with those associated with the case where the magnetization of the layered structure is aligned parallel to each other by an external magnetic field.^{1,2} Polariton/photon modes are excited for both magnetization configurations. However, under ordinary conditions we find both forward and backward wave propagation dispersions of the surface waves only for the antiparallel magnetization case. A new type of surface propagating waves is also found whose appearance is unique to the Kittel, rather than the Voigt configuration.

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¹J. Barnas, *Solid State Commun.* **61**, 405 (1987).

²H. How and C. Vittoria, *Phys. Rev. B* **39**, 6823 (1989); **39**, 6831 (1989).