THERMAL PROPERTIES OF SURFACE AND BULK SPIN WAVES IN METAMAGNETS $FeBr_2$ AND $FeCl_2$

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9.7 cm

Surface and bulk spin waves are studied in metamagnets which consist of ferromagnetically ordered layers, with the intralayer ferromagnetic exchange coupling being much stronger than the antiferromagnetic exchange coupling between adjacent layers. Due to the large single-ion anisotropy there are additional (optical) branches in the spin-wave spectrum. The dispersion relations are calculated for the $S = 1$ metamagnets $FeBr_2$ and $FeCl_2$ in both the antiferromagnetic and ferromagnetic phases (depending on the applied magnetic field). These materials have different crystallographic arrangements of the Fe^{2+} magnetic ions, which lead to differences in their spin-wave properties. The results are extended over a broad range of temperatures by allowing thermal averages for the surface layer spins to be different from the bulk values. This leads to mode splitting effects. The temperature dependence of the integrated intensities of acoustic and optical spin waves are also studied close to the surface using a Green's function method. Numerical results show that the integrated intensities for the optical branches becomes significant at higher temperatures when there is appreciable thermal population of the higher energy levels. Raman scattering would be a suitable experimental technique to investigate these effects.

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