ABSTRACT

This work is a study in two parts of some magnetic properties of Ni^{++} ions in the planar (2-dimensional) antiferromagnet K_2NiF_4 and the spatial (3-dimensional) antiferromagnet NiF_2.

In the first part which deals with symmetry properties, the 3-D magnetic space group for K_2NiF_4 is derived and standard group theoretical methods are used to study the various crystal-field splittings of the Ni^{++} ions in both compounds. We also obtain the various magnon and paramagnon symmetries throughout the Brillonin Zones and investigate the occurrence of magnetic Davydov splittings. Spinwave dispersion relations are given and their magnetic field dependence discussed in the case of NiF_2. Selection rules for exciton-exciton interactions and magnon-phonon interactions are also derived. The two-magnon states in K_2NiF_4 are identified and scattering matrices for the Raman effect are applied in the study of first order scattering.

In the second part, the spinwave theory is used to calculate the magnon contribution C_M to the specific heat of both K_2NiF_4 and NiF_2. These values of C_M are later used to calculate the temperature dependence of the zone-centre magnons in each compound. Our results are shown to be good in comparison with existing experimental data. For NiF_2, the effects of an external magnetic field on the spinwave spectra and on C_M are also calculated.

In the last chapter we indicate how C_M may be accurately determined from the present A.F.M.R. and N.M.R. experiments being conducted on low dimensional magnetic systems.