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INTRA- AND INTERCLUSTER INTERACTIONS IN FLUORIDES CHARACTERIZED BY DIMERIC, TRIMERIC AND TETRAMERIC MAGNETIC UNITS

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STRUCTURES

$Cs_3Fe_2F_9$ and $Cs_3V_2O_2F_7$ derive from the (2H) $CsNiF_3$ type by the presence of ordered vacancies (1 over 3) within the infinite $(MF_3)_n^{n-}$ chains ; Fe_2F_9 or $V_2O_2F_7$ magnetic groups of two octahedra sharing a face are therefore obtained.

In the hexagonal polytypes of perovskite $Rb_3Co_2CdF_9$, $Cs_4M_3^{II}CdF_{12}$ (M^{II} = Co, Ni) and $Cs_5M_4^{II}CdF_{15}$ (M^{II} = Co, Ni), linear units of two, three or four octahedra shared by faces and containing the paramagnetic species are separated one from each other by diamagnetic CdF_6 groups, respectively.

Magnetic trimers of octahedra connected by trans-corners have been obtained in $Ba_2CaCuFe_2F_{14}$ which derives from the usovite type. On the other hand the presence of closely packed M_4F_{20} tetramers, which are formed of octahedra linked together by cis-corners, characterizes the structure of RuF_5 and OsF_5.

MAGNETISM

In $Cs_3V_2O_2F_7$, the exchange interaction between the two V^{4+} (d^1) ions can be described with the Anderson's model. Both magnetic susceptibility data and specific heat measurements yield to antiferromagnetic exchange interaction ($J/k \simeq -13.6$ K). The magnetic data of the $Cs_3Fe_2F_9$ can be fitted on the basis of weak ferromagnetic interactions within Fe_2F_9 dimers ($J/k \simeq 1$K), which is unusual for d^5 ions.

The magnetic properties of the hexagonal polytypes of perovskite can be interpreted in terms of isolated units using a model based on HDVV Hamiltonian. The ferromagnetic intracluster interactions have been confirmed using inelastic diffusion of neutrons.

In $Ba_2CaCuFe_2F_{14}$, the trimers consist of two Fe^{3+} and one Cu^{2+} ions. The exchange interaction is antiferromagnetic ($J/k \simeq -19$K). At very low temperature a three-dimensional ordering has been observed ($T_N \simeq 2.5$K). The magnetic behavior of Ru and Os pentafluorides can be also described in terms of antiferromagnetic intracluster interactions ($J/k \simeq -8$K) in a large temperature range.