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MAGNETIC STUDY OF INTRACHAIN EXCHANGE ENERGIES IN 1-DIMENSIONAL MAGNETIC FLUOROMANGANATES(III)

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The magnetic susceptibility of seven fluoromanganates (see Table) has been studied in the temperature range between 4.2 and 300 K. The observed broad maxima undoubtedly are due to short range antiferromagnetic interaction within the Mn-F-Mn- linear chain. In order to calculate the intrachain exchange energy the high temperature series expansion method HTE (1) and the modified Fisher model FM (2) were used. The exchange energies evaluated by these methods are given in the Table including some structural data.

Compound	$Mn-F_{ax}$ (Å)	$Mn-F_{eq}$ (Å)	Mn-Mn (Å)	ß (°)	J/k HTE	(K)	FM
Li_2MnF_5	2.123	1.847	3.70	121.5	6.0		-6.3
Na_2MnF_5	2.109	1.849	3.86	132.5	8.1		-8.4
$SrMnF_5 \cdot H_2O$	2.108	1.845	3.96	139.8	9.9		-10.3
$(NH_4)_2MnF_5$	2.091	1.853	3.97	143.4	10.0		-11.2
$BaMnF_5 \cdot H_2O$	2.127	1.854	4.09	147.7	12.2		-13.5
$Rb_2MnF_5 \cdot H_2O$	2.089	1.848	4.17	175.4	18.8		-20.0
$Cs_2MnF_5 \cdot H_2O$	2.130	1.836	4.26	180.0	16.5		-19.0

Contrary to expectations, the absolute value of the intrachain exchange energy J increases with increasing Mn-Mn distances. This indicates that the superexchange interaction depends to a great extent on the Mn-F-Mn bridge angle rather than the Mn-Mn or Mn-F distances.

1 G.S.Rushbrooke and Wood, Mol.Phys., 1, 257 (1958).
2 M.E.Fisher, Am.J.Phys., 32, 343 (1964).