# Papers

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## B10

### Spectroscopic Properties of $Nd^{3+}$ in $Cs_2Na(La,Nd)Cl_6$

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The results of the absorption, infrared, Raman and fluorescence spectra are reported. Owing the analysis of vibrational levels based upon the IR and Raman spectra the assignment of vibronic peaks of fluorescence spectra is proposed. The anomalous concentration dependence of fluorescence decay rates is found. A discussion of the possible mechanism responsible for concentration quenching of $Nd^{3+}$ fluorescence in the $Cs_2Na(La,Nd)Cl_6$ crystal indicates that at low temperature the non-resonant cross relaxation occurs whereas at room temperature both the non-resonant cross relaxation and the anti-Stokes resonant cross relaxation contribute in the Process.

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## B11

### Magnetic Circular Dichroism of Rare Earths and $UO_2^{++}$ Complexes

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## B12

### Quasi-relativistic SCF-X$\alpha$ Scattered-wave Calculation of Uranocene, Thorocene and Cerocene

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## B13

### Evidence for 1D Coupling in the Neutron Spectroscopy Study of Uranium Trihalides

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Published data of magnetic susceptibilities for $UBr_3$ and $UCl_3$ show apparent but rather broad maxima occurring at 15 and 22 K respectively. They were interpreted as due to cooperative magnetic transitions [1] However, recent neutron scattering experiments performed at low temperatures on polycrystalline samples of $UBr_3$ and $UCl_3$ have proved unambiguously that the long range 3D antiferromagnetic ordering occurs at temperatures ($UBr_3$: $T_N < 4.2$ K, $UCl_3$: $T_N = 6.5$ K) which lie substantially below the values anticipated from magnetic susceptibility measurements [2].

This highly unusual behaviour can be explained by the suggestion that the magnetic exchange interaction is strong within linear chains of uranium ions lying parallel to the *c* axis of the crystal, and much weaker between uranium ions lying in different chains. The above hypothesis has interesting consequences in the case when intrachain coupling between nearest neighbours is antiferromagnetic, since the dominance of the nearest-neighbour magnetic interaction will result in the ions ordering in antiferromagnetic linear chains along *c* axis. This by itself does not lead directly to a long-range-ordered structure, and by symmetry argument appears to preclude any simple magnetic ordering.

Consequently, we may expect these compounds to behave as antiferromagnetic linear chains over a considerable range of temperature. The magnetic susceptibility maxima at 15 K and 22 K observed for $UBr_3$ and $UCl_3$ may be interpreted as due to exchange interactions within the chains, whereas at sufficiently low temperature, interchain interactions become important. They are expected to be largely, if not entirely dipolar in character, and tend to align the ions which lie in planes perpendicular to the *c* axis, into what is equivalent to the highly degenerate antiferromagnetic triangular net arrangement [3]. In fact, neutron experiments performed at $T < T_N$ revealed in both compounds a rather complex non collinear magnetic structure. However, the theoretical interpretation of the ordered state is found to be complicated by the unusual symmetry of the lattice.