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$RbCaF_3$: A PEROVSKITE FLUORIDE TO SUPPORT THEORETICAL VIEWS IN THE FIELD OF PHASE TRANSITIONS

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In the last ten years, renormalization group theory has widely been used to investigate the topology of phase diagrams near multicritical points. In structural phase transitions, such multicritical points result on application of external stresses. Most of the results were obtained in crystals with perovskite structure ABX_3 which are cubic at high temperature and undergo a structural transition connected with BX_6 octahedra rotations. In the perovskite structure, the octahedra have common corners. Due to this coupling, the forces are short range and result in critical fluctuations inducing deviations from mean field behaviour. Bicritical and tetracritical behaviours were predicted and seen in $SrTiO_3$ and $LaAlO_3$ which undergo second-order transitions. In fluoperovskites ($KMnF_3$, $RbCaF_3$) which transform to the low temperature tetragonal I4/mcm structure, the correlations between adjacent (001) planes of octahedra are very weak and weaker than in oxides : octahedra rotation in one plane couples very little to the next. These near two-dimensional correlations result in a slightly first-order character of the transition. Under external stresses, such behaviour leads to sophisticated multicritical points predicted by theoreticians. Experiments on $RbCaF_3$ under external stresses (J.Y. BUZARE, J.C. FAYET, W. BERLINGER and K.A. MULLER, Phys. Rev. Lett. 42, 465 (1979), K.A. MULLER, W. BERLINGER, J.Y. BUZARE and J.C. FAYET, Phys. Rev. B21 1763 (1980), J.Y. BUZARE, W. BERLINGER and K.A. MULLER, J. Physique Lett. 46, L 201 (1985)) were performed in collaboration with Pr. K.A.MULLER and W. BERLINGER at the IBM Zurich Laboratory, which firmly support theoretical views : Lifchitz tricritical point, critical end point, phases induced by competing forces, phase diagrams. In each experiment, E.P.R. of Gd^{3+} on Ca^{2+} sites or Gd^{3+} -O^{2-} pair substituted to Ca^{2+} - F^- bond is monitored as a probe to establish the results.