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Analysis of the multiple phase behavior of BiMnO₃ system under pressure with pseudospin model B.K. CHAUDHURI, C.C. CHOU, H.D. YANG, Department of Physics, Center for Nanoscience and Nanotechnology, National Sun Yat-Sen University, Kaohsiung 804, Taiwan — A two sub-lattice pseudo-spin-lattice coupled mode model has been used to describe phenomenologically the origin of the appearance of a new phase in the multiferroic BiMnO₃ under pressure. The pseudo-spins are considered to be associated with the local ordering of the Mn-O-Mn bonds in the crystal lattice structure. In such a system ferromagnetic (FM) and ferroelectric (FE) orderings co-exist and there is strong coupling of the spin with the lattice. Statistical Green's functional analysis has been made to find the energy spectrum which give two transition temperatures $T_{c1} \sim F(J,K,V)$ and $T_{c2} \sim F(J,K)$ for this system indicating the presence of two energetically different incipient structures in the crystal lattice (J and K represents the spin-spin coupling constants between the same and different sub-lattices, respectively). One of these transitions T_{c1} being coupled to the spin-lattice coupling (V) is activated only under pressure and the other one free or loosely coupled to the lattice is observed at ambient pressure with change of temperature. The FM transition around 100K where the spins are not strongly coupled to the lattice appears first, even at ambient pressure and than the other coupled to the lattice appears with decrease of temperature from ambient. Corresponding expressions for susceptibility and heat capacity have also been derived. Heat capacity might show logarithmic singularity depending on the pseudo-spin lattice coupling strength. The model is applicable to similar other systems.

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