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Microscopic theory on the electromagnetic phase diagram for multiferroic RMnO_3 : A-type, incommensurate spiral, and E-type spin phases NOBUO FURUKAWA, Dept. of Physics, Aoyama Gakuin Univ., and ERATO-Multiferroics, JST, MASAHITO MOCHIZUKI, Dept. of Applied Physics, University of Tokyo — We have theoretically studied the electromagnetic phase diagram for the multiferroic Mn perovskites (RMnO_3), which exhibits successive three magnetic phases of A-type, incommensurate spiral, and E-type spin orderings at low temperatures. We first show that bond alternations in the J_1 - J_2 model successfully reproduce successive transitions among above three phases. We then studied the diagram by using a realistic spin model of the Mn perovskites, which contains the spin exchanges coupled with phonons, the DM interactions, and the single-ion spin anisotropies. This realistic model enables us to solve many puzzling issues of the diagram such as spin spiral-plane flop between ab to bc , anomalous temperature dependence of electric polarizations, and ferroelectricity in the E-type phase. Comparison between above two studies highlights the roles of each interaction and anisotropy on the related intriguing phenomena.

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