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Colossal Magnetoelectric Effect with Competing Multiferroic and Weak-Ferromagnetic Phases YOUNG JAI CHOI, Rutgers University, CHENGLIN ZHANG, University of Tennessee, NARA LEE, SANG-WOOK CHEONG, Rutgers University — From our investigation of magnetoelectric properties of $\text{Eu}_{0.75}\text{Y}_{0.25}\text{MnO}_3$, where a multiferroic phase competes with a weak ferromagnetic phase in magnetic fields, we found intriguing hysteretic behaviors of physical properties with variation of temperature and magnetic field. These hysteretic behaviors arise from the kinetic arrest/de-arrest processes of the first order magnetic transition, resulting in freezing or melting of a magnetoelectric glass state with the coexistence of two competing phases. We note that most of large magnetoelectric coupling effects in multiferroics are associated with the large change of polarization with magnetic fields, but the control of ferromagnetic-type magnetization by applying electric fields is most relevant to technological applications, which is scarcely observed. This important issue of mutual controllability is achieved in $\text{Eu}_{0.75}\text{Y}_{0.25}\text{MnO}_3$ utilizing dynamical modulations of the coexistence of two contradictory phases, highly susceptible to the external perturbations such as electric and magnetic fields.

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