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Theory of colossal magnetoelectric response near spin-flop transition in Ni3TeO6[1]

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The manipulation of magnetic ordering with applied electric fields is of pressing interest for new spintronic and information storage applications. Recently, such magnetoelectric control was realized in multiferroics [1]. However, their magnetoelectric switching is often accompanied by significant hysteresis, resulting from a large barrier, separating different ferroic states. Hysteresis prevents robust switching, unless the applied field overcomes a certain value (coercive field). I will discuss the role of a switching barrier on magnetoelectric control, in particular, in a collinear antiferromagnetic and pyroelectric Ni3TeO6 [2,3]. The barrier between two magnetic states in the vicinity of a spinflop transition is almost flat, and thus small changes in external electric/magnetic fields allow to switch the ferroic state through an intermediate state in a continuous manner, resulting in a colossal magnetoelectric response. This colossal magnetoelectric effect resembles the large piezoelectric effect at the morphotropic phase boundary in ferroelectrics. [1] T. Kimura, T. Goto, H. Shintani et al., Nature 426, 5 (2003) [2] Y.-S. Oh, S. Artyukhin J. J. Yang et al., Nature Communications 5, 3201 (2014) [3] J. W. Kim, S. Artyukhin, E.?D. Mun et al., Phys. Rev. Lett. 115, 137201 (2015)

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