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Non-local magnetoelectric effects via Coulomb interaction in TI-FMI heterostructures[1] STEFAN REX, Department of Physics, Norwegian University of Science and Technology, FLAVIO S. NOGUEIRA, IFW Dresden, and Ruhr-Universitt Bochum, ASLE SUDBØ, Department of Physics, Norwegian University of Science and Technology — Magnetic order on the surface of a $3D$ topological insulator (TI) has been predicted to evoke a topological magnetoelectric effect (TME) by the breaking of time-reversal invariance. In the TME, an electric field leads to a magnetic polarization in the same direction as the field and vice versa. Here, we consider heterostructures of TI and ferromagnetic insulator (FMI) layers. We show that in the presence of long-range Coulomb interactions the magnetization couples non-locally to the fluctuating electric field (non-local TME) by performing a field-theoretic calculation of the vacuum polarization. In addition, we obtain a Landau-Lifshitz equation for the magnetization dynamics, and find that charged magnetic textures lead to a net magnetization even at a large distance. Such textures can be induced by an external electric field with nonzero in-plane divergence. We apply this effect to a FMI-TI-FMI trilayer heterostructure with two parallel interfaces being well-separated by the bulk TI, where we propose to non-locally control the magnetic texture at one interface by proper gating of the other interface. A preprint can be found at arXiv:1510.04285

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Stefan Rex
Department of Physics, Norwegian University of Science and Technology

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