Dynamical magnetoelectric effects in non-collinear magnets

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The coupling between the spin degrees of freedom in Mott insulators and an electric field leads to spectacular phenomena, such as the magnetic field control of electric polarization in multiferroic materials with a spiral magnetic ordering. I will focus on two dynamical magnetoelectric effects, which can be observed in non-collinear magnets. The first one is the excitation of magnons in optical absorption by the electric component of light (electromagnons). I will discuss a theory of electromagnons in magnets with non-collinear spin orders and discuss the possibility to observe them in linear magnetoelectric materials with spontaneous monopole and toroidal magnetic moments. The second effect is a new magnetoelectric interaction in multi-orbital Mott insulators. Unlike the well-known 'inverse Dzyaloshinskii-Moriya' mechanism and the Heisenberg exchange striction, this interaction is dynamical in nature: it couples electric field to the time derivative of the local magnetization. This coupling gives rise to unusual effects that may find applications in dissipationless spintronics, such as the displacement of spin textures in ferromagnetic insulators induced by an applied electric field. These effects become dramatically enhanced if a spin texture has a non-trivial topology. I will discuss the resonant absorption of circularly polarized light by Skyrmions and magnetic vortices.[1]

[1]M. Mostovoy, K. Nomura and N. Nagaosa, Phys. Rev. Lett. **106**, 047204 (2011).

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