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Spin-polarized tunneling time for non-centrosymmetric photonic barriers with out-of-plane magnetization.[1] ION BITA, EDWIN THOMAS, Dept. of Materials Sci & Eng, Massachusetts Institute of Technology — Tunneling barriers that lack space-inversion and time-reversal symmetries along the tunneling axis are found to display fundamentally different tunneling dynamics properties than normally expected. In a model 1D photonic crystal barrier, we show that the two symmetry constraints lead to indirect photonic band gaps which contain eigenmodes that are complex, with nonzero and frequency dispersive real components of their wavevectors. These nonpropagating modes are circularly polarized, and appear as complex conjugate pairs for opposite decay directions. We show that the Hartman effect does not apply, and that the tunneling phase time becomes dependent on barrier length, with, remarkably, the sign of the group delay changing with spin. The tunneling phase time for finite barriers of varying widths is found to agree with the group-like velocity, $1/v_g = \mathrm{dRe}\{k_{gap}\}/\mathrm{d}\omega$, of the gap eigenmodes of the photonic crystal. The implications of these results for the case of spin-polarized electronic tunneling in noncentrosymmetric barriers (e.g. GaAs-like semiconductors, or chiral carbon nanotubes) with magnetization along the tunneling axis will be discussed.

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