Theory of topological quantum phase transitions in 3D noncentrosymmetric systems

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In this talk, I am going to propose a general theory for a new class of topological quantum phase transitions in 3D systems with broken inversion symmetry. Although the consideration of the system's codimension predicts the appearance of a stable metallic phase between the normal and topological insulators, when the band touching occurs along the direction with high crystalline symmetry, a direct topological phase transition between two insulators can occur. At the quantum critical point (QCP), the energy dispersion becomes quadratic along one direction while the dispersions along the other two orthogonal directions are linear, which manifests the zero chirality of the band touching point. When a direct transition between two insulators happens, as a result of the band inversion, the conduction (valence) band develops a saddle point near the dispersion minimum (maximum) across the topological phase transition. Due to the anisotropic dispersion at QCP, various thermodynamic and transport properties show unusual temperature dependence and anisotropic behaviors.

Reference)

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