Model Hamiltonian and Time Reversal Breaking Topological Phases in Anti-Ferromagnetic half-Heusler Materials

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We proposed 4-band and 6-band $k \cdot p$ models for half-Heusler materials with anti-ferromagnetism propagated along $(1/2, 1/2, 1/2)$. Dirac semimetal phase was found in 4-band model protected by inversion symmetry and the combination of half-translation and time reversal symmetry $\hat{S}$. 4-band model also gives rise to Weyl semimetal, Type-A triple point phase (if $C_{3v}$ symmetries exist) and topological mirror insulating phase (if mirror or glide symmetry exists). In 6-band model, we found anti-ferromagnetic topological insulating phase protected by $\hat{S}$ resulted from band inversion between $\Gamma_6$ and $\Gamma_8$ bands.

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