Supplementary Materials: Analogous Black Holes in Type-III Dirac Semimetal $Ni_3In_2X_2$ (X = S, Se)

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1. Topological Charge analysis

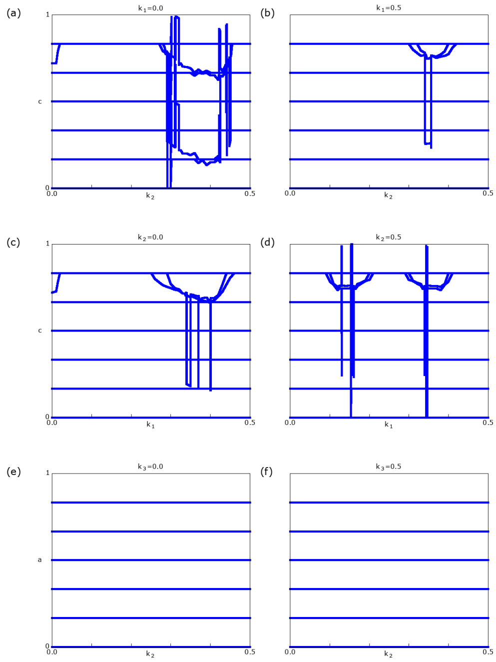

Figure S1. Topological Charge Analysis: Wilson loop calculation near the Dirac point (a) $K_1 = 0$, (b) $K_1 = 0.5$, (c) $K_2 = 0$,(d) $K_2 = 0.5$, (e) $K_3 = 0$, (f) $K_3 = 0.5$,

Topological charge analysis is conducted near the level of the Dirac cones. The planes which intersect the Dirac cone at planes $K_1 = 0$ [Fig. S1(a)] and $K_2 = 0.5$ [Fig. S1(d)] show non-trivial topology.

2. Crystal analysis

Table S1. Crystal Parameters: lattice parameters for $Ni_3In_2S_2$ and $Ni_3In_2Se_2$

Crystal	a	b	c
$Ni_3In_2S_2$	5.377	5.377	13.482
$Ni_3In_2Se_2$	5.432	5.432	13.606

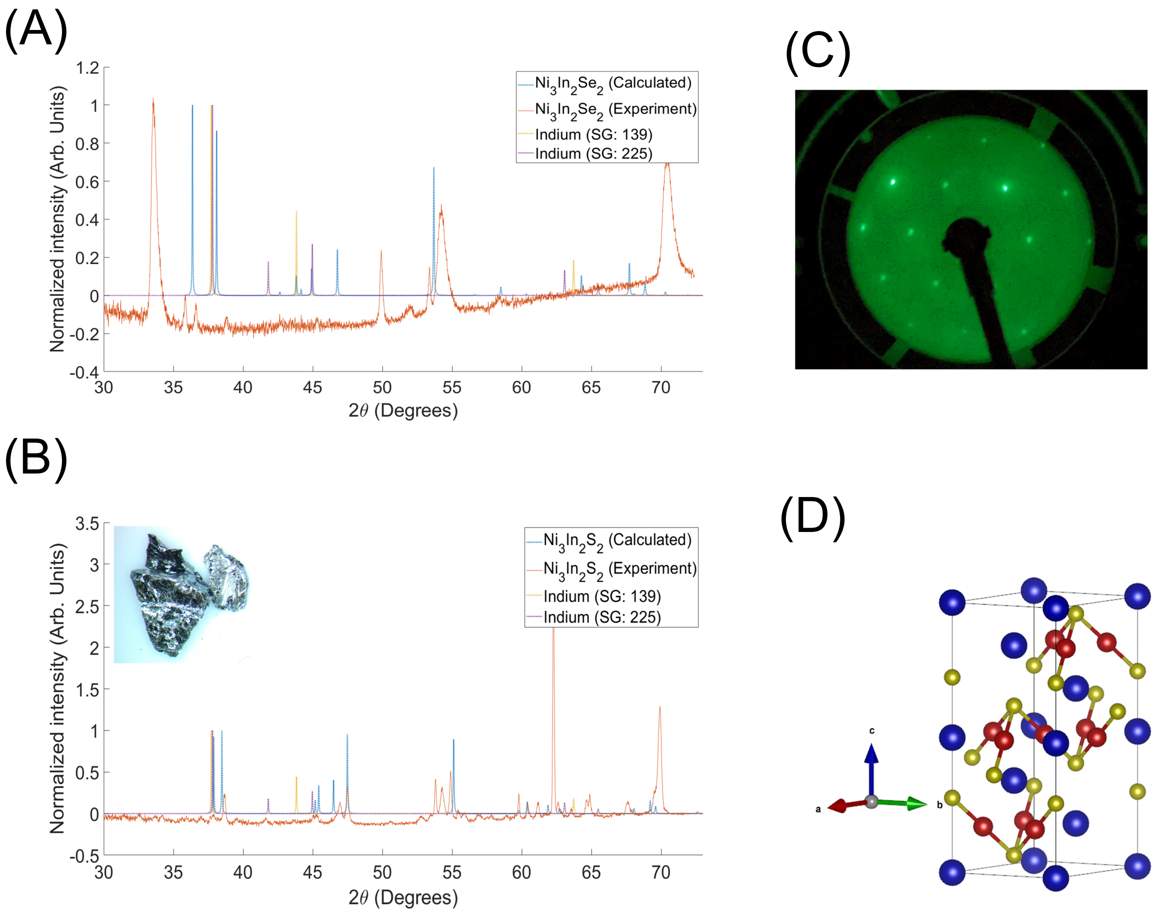

Figure S2. Crystal Characterization: (A) Powder XRD of $Ni_3In_2Se_2$, (B) $Ni_3In_2S_2$, inset shows a picture of a single crystal (∼ 2x2 cm) (C) LEED of $Ni_3In_2Se_2$ at 150 eV (D) Crystal structure: Blue: Ni, Red: In, Yellow: Se

Powder XRD of $Ni_3In_2Se_2$ [Fig. S2(a)] and Powder XRD of $Ni_3In_2S_2$ [Fig. S2(b)] using calculated crystal parameters [Table S1]. LEED shows good crystal quality [Fig. S2(b)]. Figure S2(d) shows a diagram of the crystal lattice.

3. Type-III Bulk Dispersion

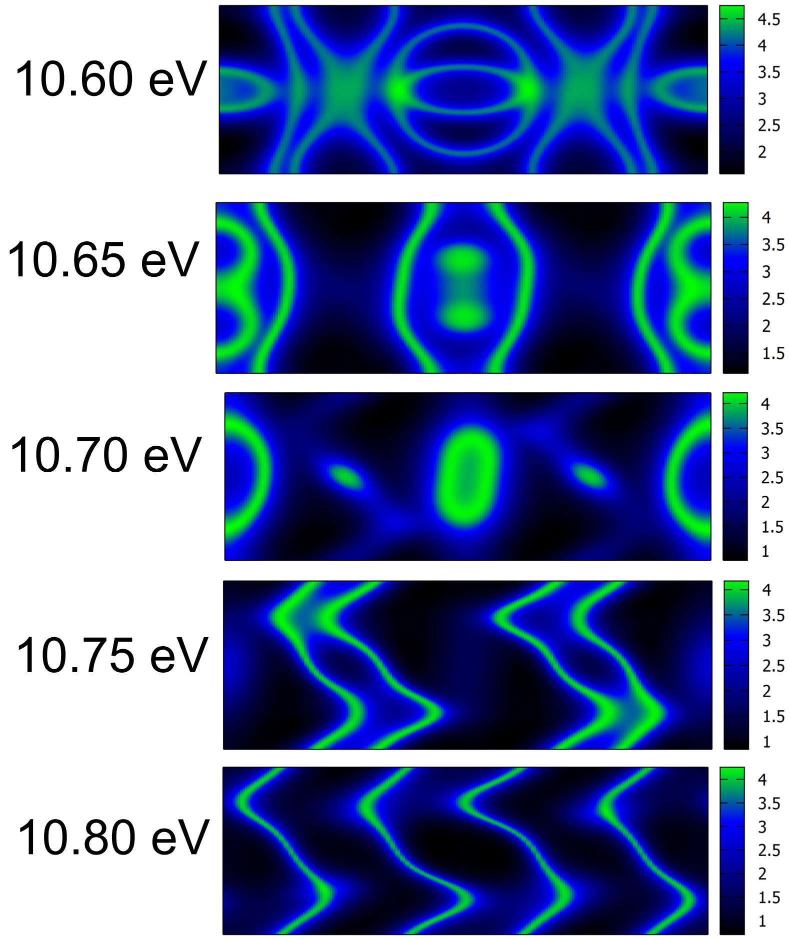

Figure S3. Bulk Band Dispersion: The bulk band dispersion for 10.6 eV, 10.65 eV, 10.7 eV, 10.8 eV for the $K_x = 0.5\pi$ and $K_y = 0.5\pi$ plane

The Fermi energy for $Ni_3In_2Se_2$ is calculated to be 11.43 eV, since the Type-III Dirac cones lie both in the bulk and below the Fermi surface, bulk surface arcs are taken at different energy levels. The upper and lower Dirac cones are estimated to be at 10.8 eV and at 10.7 eV. However, the Fermi level shifts slightly during wannerization so multiple slices are taken to see the bulk dispersion. [Fig. S3] shows that bulk dispersion at different Fermi energies. A large gap forms in the lower Dirac cone at around 10.7 eV. In order to capture the type-III dispersion the slice is shifted by 0.5/a and FS is sampled up to 2π. This shows a repeat of the type-III at the off center positions. Since this is a bulk calculation, surface effects are not shown (Dirac cones) however, the flat nature of the bulk bands which forms the Dirac cones can be seen.