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**Filling-enforced semi-metals in magnetic-ordered materials** XU YANG, YING RAN, Boston College — Semi-metals with point-like or line-like Fermi surfaces are under intensive studies recently. Among them, Dirac semi-metals and nodal-line semi-metals are usually found in time-reversal symmetric system. Here we report two kinds of semi-metals at certain electron filling fractions in materials with build-in magnetic order. The first example is a material in which time-reversal symmetry  $T$  and inversion symmetry  $I$  are broken due to the magnetic moment but their combination  $IT$  is preserved. This symmetry  $IT$ , together with other space group symmetries, protects Dirac points at certain high-symmetry points. The second example is a material with certain magnetic space group symmetry, which, at certain filling, must have nodal rings around high symmetry points. Our results extend the search for semi-metals in  $T$ -invariant materials to that in magnetic materials, and provide a platform for the interesting interplay between magnetism and exotic phases.

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