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Dirac Circles and Quantum Hall Effect in 3D Inversion-Symmetric Crystals BENJAMIN J. WIEDER, Department of Physics and Astronomy, University of Pennsylvania, YOUNGKUK KIM, The Makineni Theoretical Laboratories, Department of Chemistry, University of Pennsylvania, C.L. KANE, Department of Physics and Astronomy, University of Pennsylvania — In the presence of inversion and time-reversal symmetries, materials with weak spin-orbit coupling may host topologically protected Dirac line nodes. A band inversion transition in these systems can produce a line node which closes on itself and forms a protected Dirac circle. The surfaces parallel to this circle host zero-energy puddles in momentum space which are flat if the inverting bands have the same effective mass. In cases with differing effective masses, the surface modes disperse, but the bulk Dirac circle remains gapless. Adding an external magnetic field perpendicular to this circle creates surface Landau levels, whose number can be controlled by tuning the field strength. When a new level is created or destroyed, the bulk becomes gapless and the zero-temperature bulk conductivity displays a sharp peak. The sequence of conductivity peaks describes an unusual manifestation of the integer quantum hall effect. We characterize surface and bulk transport as a function of magnetic field strength and in the presence of disorder.

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