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Ultrahigh mobility and giant magnetoresistance in the Dirac Semimetals Cd_3As_2 and Na_3Bi[1]

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Dirac semimetals and Weyl semimetals are 3D analogs of graphene in which crystalline symmetry protects the nodes against gap formation. Na_3Bi and Cd_3As_2 were predicted to be Dirac semimetals, and recently confirmed to be so by photoemission. Several novel transport properties in a magnetic field H have been proposed for Dirac semimetals. Here we report an interesting property in Cd_3As_2 that was unpredicted, namely a remarkable protection mechanism that strongly suppresses back-scattering in zero H. In single crystals, the protection results in a very high mobility, 10^7 cm^2/Vs at 5 K. Suppression of backscattering results in a transport lifetime 10^4longer than the quantum lifetime. The lifting of this protection by H leads to very large magnetoresistance with a striking H-linear profile. I will also report transport results on Na_3Bi and compare them with results in Cd_3As_2. I discuss how this may relate to changes to the Fermi surface induced by H.

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