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Evidence for the coexistence of Dirac and massive carriers in $\alpha-$(BEDT-TTF)$_2$I$_3$ under hydrostatic pressure

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The layered organic material $\alpha-(BEDT-TTF)_2I_3$ (aI3), which has been studied since the 1980s, has recently attracted renewed interest because it reveals low-energy massless Dirac fermions under hydrostatic pressure (P ¿ 1.5 GPa). Compared to graphene, or electronic states at the surface of three-dimensional topological insulators, aI3 is strikingly different in several respects. Apart from the tilt of the Dirac cones and the anisotropy in the Fermi surface, its average Fermi velocity is roughly one order of magnitude smaller than that in graphene. This, together with an experimentally identified low-temperature charge-ordered phase at ambient pressure, indicates the relevance of electronic correlations. Therefore, correlations are expected to be ten times larger in aI3 than in graphene, and ! aI3 thus opens the exciting prospective to study strongly-correlated Dirac fermions that are beyond the scope of graphene electrons. Here, we present magnetotransport measurements of aI3 crystals under hydrostatic pressure larger than 1.5 GPa where Dirac carriers are present. We show not only the existence of high-mobility Dirac carriers as already reported [1], but we also prove experimentally the presence of low-mobility massive carriers, in agreement with recent band-structure calculations [2]. The interplay between both carrier types at low energy is the main result of our studies [3]. Furthermore, we show that the measured mobilities for the two carrier types hint at scattering mechanisms due to strongly screened interaction potentials or other short-range scatterers.

[1] N. Tajima, *et.al.*, EPL **80**, 47002 (2007).
[2] P. Alemany,*et.al.*, Phys. Rev. B **85**, 195118 (2012).
[3] M. Monteverde, *et.al.*, submitted (2013).