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Reading valley-hybridization and universal symmetry of graphene with mesoscopic conductance fluctuations[1] VIDYA KOCHAT, ATINDRA NATH PAL, ARINDAM GHOSH, Indian Institute of Science — In graphene, the K and K' valleys act as spin-like entities, and can form the basis of valley-based electronics, having applications ranging from valley-based quantum computation, to valley filters or polarizers. The valleys hybridize to form new quantum states, such as the valley singlet and triplets, that lead to anti-localized quantum transport, non-locality and flavour Hall effect. Here we demonstrate a direct route for reading and manipulating the valley coherent states of disordered graphene by measuring the mesoscopic conductance fluctuations. We observe that the conductance fluctuations in graphene at low temperatures are reduced by a factor of four at high carrier densities, due to the gapping out of valley triplet states by short-range disorder. We also show that this results in a gate-tunable universal symmetry class, which is yet another unique and fundamental feature of the 2D honeycomb lattice of graphene.

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