Abstract Submitted
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Multifractal conductance fluctuations in graphene[1] AVEEK BID, KAZI RAFSANJANI AMIN, NAIRITA PAL, Indian Institute of Science, SAMRIDDHI SANKAR RAY, International Centre for Theoretical Studies, RAHUL PANDIT, Indian Institute of Science — A multifractal (MF) system is characterized by scaling laws involving an infinite number of exponents. In condensed-matter systems, signatures of multifractality have typically been found in the structure of the critical wave functions at localization delocalization (LD) transitions. We report here the first experimental observation of MF statistics in the transport coefficients of a quantum-condensed matter system. We unearth this through a careful investigation of the magneto-conductance fluctuations in ultra-high mobility single layer graphene at ultra-low temperatures. We obtain the MF spectra over a wide range of temperature and doping levels and show that the multifractality decreases as the temperature increases or as the doping moves the system away from the Dirac point. We show that the fractal exponents are a universal function of the phase coherence length of the carriers. We propose that a probable origin of the MF magneto-conductance fluctuations observed by us is an incipient Anderson LD transition in graphene near the charge neutrality point - a phenomenon predicted but never observed in single layer graphene. We also explore alternate possibilities of the origin of the multifractality namely relativistic quantum scars.

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