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Scanning Single Electron Transistor Microscopy on Graphene[1]

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We use a scanning single electron transistor to map the local density of states of graphene and the carrier density landscape in the vicinity of the neutrality point. At zero magnetic field our results confirm the existence of electron-hole puddles. These puddles could explain graphene's anomalous non-zero minimal conductivity at zero average carrier density. Moreover, we find that, unlike non-relativistic particles the density of states can be quantitatively accounted for by considering non-interacting electrons and holes. At high magnetic field we investigate the appearance of localized states. Particle localization is an essential ingredient in quantum Hall physics. In conventional high mobility two-dimensional electron systems Coulomb interactions were shown to compete with disorder and to play a central role in particle localization. Surprisingly, despite the stronger disorder in graphene compared to the standard two-dimensional systems, our findings indicate that localization in graphene is also dominated by Coulomb interactions and not single particle physics.

[1]in co-operation with J.Smet, MPI Stuttgart, Germany