Conformal Symmetry in Graphene

Abstract: The scale and conformal invariance in graphene as a two-dimensional system with massless Dirac Fermions is an important problem in condensed matter physics. In this talk the mono-layer graphene at the charge neutrality point is considered within Thomas-Fermi-Dirac theory, treating inhomogeneous external potentials and electron-electron interactions on equal footing. I give some general considerations concerning the probability measure of the ground state charge density. It is shown numerically that the system has degrees of self-similarity. I discuss that although the probability measure of the ground state carrier density is not Gaussian, the corresponding critical exponents are consistent with Kondev hyper-scaling relations. Using Schramm-Loewner (SLE) evolution I present some indications of conformal invariance in the system and show numerically that the random zero-charge density contours are SLEk with k=1.8 +/- 0.2.