Functional bosonization of interacting graphene

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Abstract:
Graphene has been at the centre of the attention in the past few years due to its remarkable electronic and mechanical properties. These properties are a consequence of the peculiar band structure of graphene, that at low energy assumes a Dirac cones structure. Away from zero energy (the Dirac point) it is generally believed that electrons in graphene behave according to the standard Fermi liquid picture with an enhanced velocity.
In this talk, I will consider the effect of electron-electron interactions at the Dirac point, where the system undergoes a quantum phase transition to a non-Fermi liquid state. Using functional bosonization techniques, we reconsider the standard result predicting a divergent Fermi velocity renormalization at low energy. We find that when the non-Fermi liquid behaviour of the system is correctly taken into account, the artificial divergence of the velocity disappears and we obtain a finite, non-perturbative result for the renormalized velocity. We evaluate the interacting density of states and argue that experimental observations are better understood in terms of an anomalous dimension encoding the non-Fermi liquid behaviour of the system.