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Quantum Phase Transitions on the Hexagonal Lattice

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Graphene, a system of carbon atoms arranged on a two dimensional hexagonal lattice, has been the subject of intense theoretical and experimental research in the past decade, due to its unique electronic properties. The special symmetries of its electronic band structure lead to an effective description in terms of a massless Dirac field, and strong inter-electron interactions, which can be tuned through various experimental techniques, drive quantum phase transitions to different gapped electronic ordered phases. The phase diagram of interacting fermions on a hexagonal lattice can be studied from first principles using Hybrid-Monte-Carlo simulations. Here, the present status of these efforts is reported.

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