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Mott Insulator Phase Transition in Graphene[1] JIA NING LEAW, HO-KIN TANG, JOAO N. B. RODRIGUES, National University of Singapore, SHAFFIQUE ADAM, National University of Singapore and Yale-NUS College — Controllably tuning the semimetal to Mott insulator phase transition in graphene could allow for the development of graphene-based low-power electronic devices. It is known in the literature (e.g. Juricic et al., PRB 80, 081405(R); Kaveh et al., PRB 71, 184519 and Gamayun et al., PRB 81, 075429) that increasing the long-range Coulomb interaction decreases the critical contact coupling for the phase transition of spinless Dirac fermions from a semi-metal phase to a charge-density-wave phase (CDW). In this work we consider the more realistic Gross-Neveu model relevant for spinfull Dirac fermions and study the transition between the semimetal and the Mott insulator spin-density-wave (SDW) phase. In contrast to the CDW phase transition, and contrary to conventional wisdom, our Renormalization Group calculation shows that the SDW phase transition occurs at stronger onsite potential if the nearest neighbour potential is increased. Our result implies that high-k dielectrics should favour the Mott transition in graphene.

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