Atomic collapse in graphene lost of unitarity

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Abstract

We explore the problem of atomic collapse in graphene due to monopole impurities, both electric and magnetic, within the context of supersymmetric quantum mechanics. For electric impurities, upon factorizing the radial Dirac Hamiltonian and identifying the supercharges, there is a critical charge that makes the ground state fall into the center, translating into loss of Hermicity for the corresponding Hamiltonian and hence loss of unitarity of the theory. For the problem of magnetic monopole impurities, preservation of unitarity for all values of the parameters of the corresponding potential translates into the absence of atomic collapse in this case..