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Spin qubits in graphene quantum dots[1] BJOERN TRAUZETTEL, DENIS BULAEV, DANIEL LOSS, GUIDO BURKARD, Institute of Physics, University of Basel, CH-4056 Basel, Switzerland — We propose how to form spin qubits in graphene. A crucial requirement to achieve this goal is to find quantum dot states where the usual valley degeneracy in bulk graphene is lifted. We show that this problem can be avoided in quantum dots based on ribbons of graphene with semiconducting armchair boundaries. For such a setup, we find the energies and the exact wave functions of bound states, which are required for localized qubits. Additionally, we show that spin qubits in graphene can not only be coupled between nearest neighbor quantum dots via Heisenberg exchange interaction but also over long distances. This remarkable feature is a direct consequence of the quasi-relativistic spectrum of graphene.

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