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Fractional quantum Hall states and valley skyrmions in graphene

Abstract：
The ground state and low-energy excitations of single-layer graphene and bilayer graphene are studied by the density matrix renormalization group (DMRG) method.
The Coulomb interaction between the electrons and the valley degrees of freedom are completely taken into account to study the realization of fractional quantum Hall states in graphene.
The obtained results show finite charge excitation gap at various fractional fillings $¥nu_n=1/3, 2/5, 2/3$ in the $n=0$ and 1 Landau levels of single-layer graphene and $n=2$ Landau level of bilayer graphene. The lowest charge excitations at $¥nu=1/3$, and 1 in single-layer graphene are valley skyrmions.