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Landau Level Mixing Effects in the Graphene Fractional Quantum Hall Effect[1] YONAS GETACHEW, MICHAEL PETERSON, California State University Long Beach — A two-dimensional electron system exposed to a strong perpendicular magnetic field at low temperatures forms a new state of matter that exhibits the fractional quantum Hall effect (FQHE). This phenomenon has been observed in graphene, a naturally occurring two-dimensional electron system. The nature of the FQHE state has remained ambiguous primarily because electrons in graphene have spin as well as valley degrees of freedom. As a result, the different single-particle energy levels (Landau levels) of the electrons can mix with each other. This Landau level mixing (LLM) is intrinsic to graphene and must be considered in any realistic theoretical treatment. Recently, an effective model Hamiltonian which includes LLM has been formulated in terms of Haldane pseudopotentials: this model includes emergent three-body interactions in addition to renormalizing the two-body interactions. We construct a real-space two-body interaction potential using a closed form expression found in the literature. We then use this case to benchmark our results with the pseudopotential method and extend it to include three-body interactions.

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