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## **Nonadiabatic Pure Spin Pumping in Graphene Nanoribbons with Proximity Induced Ferromagnetism**

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Abstract:

By combining Floquet theory with Green's function formalism, we present non-adiabatic quantum spin and charge pumping through a zigzag ferromagnetic graphene nanoribbon including a double-barriers structure driven weakly by two local ac gate voltages operating with a phase-lag. Over a wide range of Fermi energies, interesting quantum pumping such as i) pure spin pumping with zero net charge pumping, ii) pure charge pumping and iii) fully spin polarized pumping can be achieved by tuning and manipulating driving frequency in the non-adiabatic regime. Spin polarized pumping which is measurable using the current technology depends on the competition between the energy level spacing and driving frequency.