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Quantum Hall phase diagram of ABC-trilayer graphene

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At low-energies, the massive Dirac electrons in ABC-stacked trilayer graphene exhibit a cubic dispersion with a Berry phase of 3π. Landau quantization of ABC-trilayer graphene leads to a quantum Hall (QH) plateau sequence $\sigma_{xy} = \pm 4(N + 3/2)e^2/h$(where $N \geq 0$ is the Landau level index). This results in a 12-fold degenerate zero-energy Landau level (LL) which supports a degenerate set of triplet ($n = 0, 1, 2$) LL orbitals along with the spin and valley degeneracies. In this talk, I will show that interactions within the zeroth LL induce charge gaps which drive additional integer QH plateaus at intermediate filling factors ν ($-6 < \nu < 6$). The competition of remote hopping between the layers, interactions and pseudo-spin anisotropy leads to various ferromagnetically and anti-ferromagnetically pseudo-spin ordered states. Additionally, the unique LL orbital degeneracy influences the ground state at filling factors $\nu = -5, -2, 1, 4$. At these filling factors, a quantum phase transition from a quantum Hall liquid state to a triangular charge-density wave occurs when an electric potential difference Δ_V between the layers is reduced below a critical value $\Delta_V^{(c)}$