Vanishing bulk heat flow in the nu=0 quantum Hall ferromagnet in monolayer graphene

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Under high perpendicular magnetic field and at low temperatures, graphene develops an insulating state at the charge neutrality point. This state, dubbed nu=0, is due to the interplay between electronic interactions and the four-fold spin and valley degeneracies in the flat band formed by the n=0 Landau level. Determining the ground state of nu=0, including its spin and valley polarization, has been a theoretical and experimental undertaking for almost two decades. Here, we present experiments probing the bulk thermal transport properties of monolayer graphene at nu=0, which directly probe its ground state and collective excitations. We observe a vanishing bulk thermal transport, in contradiction with the expected ground state, predicted to have a finite thermal conductance even at very low temperature. Our result highlight the need for further investigations on the nature of nu=0.

Delagrange, *et al.,* under review at Nature Physics