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Observed quantization of heat flow in FQHE

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The quantum of thermal conductance of ballistic one-dimensional channels is a unique fundamental constant. Although the quantization of the electrical conductance of one-dimensional ballistic conductors has long been experimentally established, demonstrating the quantization of thermal conductance has been challenging as it necessitated an accurate measurement of very small temperature increase. It has been already accomplished for weakly interacting systems of phonons, photons and electronic Fermi liquids; however, it should theoretically also hold in strongly interacting systems, such as those in which the fractional quantum Hall effect is observed. This effect describes the fractionalization of electrons into anyons and chargeless quasiparticles, which in some cases can be Majorana fermions. Because the bulk is incompressible in the fractional quantum Hall regime, it is not expected to contribute substantially to the thermal conductance, which is instead determined by chiral, one-dimensional, edge modes. The thermal conductance thus reflects the topological properties of the fractional quantum Hall electronic system, to which measurements of the electrical conductance give no access. Here we report measurements of thermal conductance in particle-like (Laughlin–Jain series) states and the more complex (and less studied) hole-likestates in a high-mobility two-dimensional electron gas in GaAs–AlGaAs heterostructures. Hole-like states, which have fractional Landau-level fillings of 1/2 to 1, support downstream charged modes as well as upstream neutral modes, and are expected to have a thermal conductance that is determined by the net chirality of all of their downstream and upstream edge modes. Our results establish the universality of the quantization of thermal conductance for fractionally charged and neutral modes. Measurements of heat flow of fractionally charged quasiparticles provide access to information that is not easily accessible from measurements of conductance.