Balanced Quantum Hall Resistor

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The quantum anomalous Hall effect, first observed in Cr/V-doped $(Bi,Sb)_2Te_3$ [1], holds promise as a disruptive innovation in quantum metrology, for its potential to define a new generation of quantum standards of resistance operating at zero external magnetic field [2,3].

In conventional Hall bar devices, the primarily quantization breakdown mechanism is due to the buildup of an electric field (Hall voltage) between the two edges of the sample, as the measurement current is increased [3]. Here, by utilizing a multi-terminal Corbino geometry [4,5], we demonstrate a new measurement scheme that eliminates this problem by means of electrochemical potential balancing [5,6], thus improving the stability of quantization at increased currents. While demonstrated here for the quantum anomalous Hall effect, the same scheme can also be used to improve the conventional quantum metrology standard of resistance that relies on the integer quantum Hall effect for its operation.

[1] C.-Z. Chang et al., *Science* **340**, 167-170 (2013)
[2] M. Götz et al., *Appl. Phys. Lett.* **112**, 072102 (2018)
[3] E. J. Fox et al., *Phys. Rev. B* **98**, 075145 (2018)
[4] K. M. Fijalkowski et al., *Nat. Commun.* **12**, 5599 (2021)
[5] K. M. Fijalkowski et al., *ArXiv*:2402.04126 (2024)
[6] K. M. Fijalkowski et al., *European Patent Filing* EP23162996.5 (2023)