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DISPATCH · ELECTRON HYDRODYNAMICS · 2 MIN

Ring-shaped graphene devices measure how viscous a flowing electron fluid is

A 2026 Science study uses magnetoresistance in Corbino-shaped graphene to separate viscous from ordinary resistance, and finds electron collisions rising linearly with temperature.

18 November 2026 · based on a paper in Science

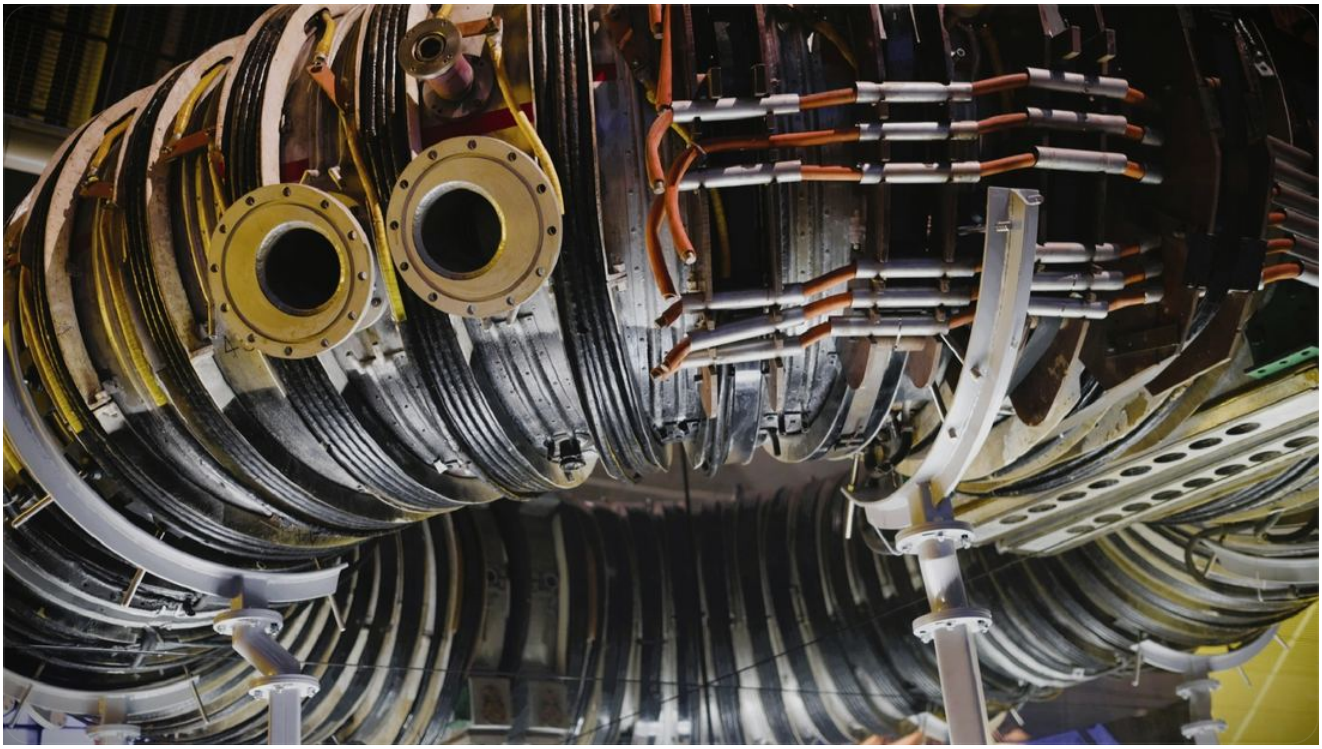


Photo: Sylvain Miklaszewski

Under the right conditions, the electrons in a material stop behaving like independent particles bouncing off obstacles and start flowing together, rather like water through a pipe. Physicists call the description of this behaviour electron hydrodynamics. Signs of such fluid-like flow have been reported in several two-dimensional materials. The core parameter of such a fluid, though, is its viscosity, or resistance to internal shearing, and it has proved hard to measure precisely. A study published in Science in 2026 describes a way to do it. The authors are at Columbia University, Cornell University, the Massachusetts Institute of Technology and Japan's National Institute for Materials Science.

The difficulty is that a real device usually shows two kinds of resistance at once. Ordinary, or ohmic, resistance comes from electrons scattering off imperfections and vibrations in the material. Viscous resistance comes from electrons colliding with one another as they flow. Telling the two apart is especially hard near the viscous-ohmic crossover, where neither dominates.

The team's answer lies in the shape of the device. They built graphene samples in a Corbino geometry, in which current flows between a central contact and a surrounding ring-shaped one. They then measured magnetoresistance, the change in electrical resistance when a magnetic field is applied. According to the study, this measurement in this geometry acts as an ohmmeter and a viscometer at the same time. That lets the authors disentangle the ohmic and viscous contributions to transport, even near the crossover. The abstract does not spell out how the magnetic-field response separates the two.

The authors applied the technique to both monolayer and bilayer graphene. In both, they report that the effective rate at which electrons scatter off one another rises linearly with temperature. That is a marked departure from Fermi-liquid theory, the standard description of interacting electrons in ordinary metals, which predicts a rate rising with the square of temperature.

The authors say the linear scaling is consistent with a tomographic fluid regime. This regime was identified only recently, and theory predicts it should be generic for two-dimensional electron systems. 'Consistent with' is an agreement between measurement and prediction, not a proof that the regime is what is at work.

The abstract does not give the temperature range studied, numerical values for the measured viscosity or the number of devices tested. The measurements cover only two forms of graphene. Whether other two-dimensional materials show the same linear behaviour, as the theory would suggest, is not addressed in the abstract.

PAPER	*Quantitative measurement of viscosity in two-dimensional electron fluids*
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