authors are able to reveal that the low-temperature sign change in the Hall effect — indicative of long-range charge order — is confined to a narrow doping range (marked as CO in Fig. 1) that terminates at or near optimal doping ($p = 0.16$).

Even more significantly, Badoux *et al.* have discovered a second marked change in the Hall response, namely a six-fold decrease in its magnitude, at a doping level of $p \sim 0.2$, which previous thermodynamic and transport measurements have identified with the extinction of the pseudogapped state[6,7]. Indeed, the authors demonstrate that this marked decrease in the Hall resistance (which corresponds to an increase in the carrier density) is consistent, qualitatively if not quantitatively, with the closing of the pseudogap and the restoration of the full Fermi surface. Thus, pseudogap formation and the charge ordering terminate at different doping concentrations, implying that they stem from different origins.

So what is responsible for the pseudogap? Other, more exotic forms of order have been proposed. Whenever a second-order phase transition in a correlated metal is suppressed to the zero-temperature axis, either by pressure, magnetic field or doping, the bulk physical properties are governed by proximity to the associated quantum critical point. Until now, however, the evolution of the transport and thermodynamic properties of the cuprates in the vicinity of the pseudogap endpoint did not support this conventional picture of quantum criticality[6,7]. This contrasts markedly with observations in pnictide superconductors[8,9] and heavy fermion systems[10], for example, and thus raises a fundamental question about the nature of the pseudogap and its description in terms of an order parameter.

The work by Badoux and co-workers will no doubt redouble efforts to investigate the origin of the, now isolated, pseudogap phenomenon. ❐

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FLUID DYNAMICS

Spirited away

A coffee spill, after drying up on a solid surface, leaves a deposit along the spill's original perimeter — a well-understood phenomenon known as the coffee-ring effect. An evaporating whisky drop, however, results in a more uniform stain. Why?

Hyoungsoo Kim and colleagues tackled this question by monitoring the time-evolution of evaporating drops of various brands of Scotch and model liquids (*Phys. Rev. Lett.* in the press; preprint at http://arxiv.org/abs/1602.07937). In one experiment, micrometre-sized fluorescent particles were added to a whisky droplet with a radius of 1.3 mm and a height of 0.46 mm on a solid substrate. The flow in the drop during evaporation was then visualized by means of particle image velocimetry — a method for working out 2D flow fields from the recorded motion of the tracer particles.

During the first eleven seconds, the flow field near the substrate displayed vortices, which can be understood as Marangoni flows resulting from concentration variations. Then, two types of radially circulatory flow were observed, followed (after 230 seconds) by an outward capillary flow — the authors assumed that the ethanol had evaporated by then.

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An ethanol–water mixture did not lead to a uniform stain, nor did it develop the circulatory flow regimes. Kim *et al.* concluded that the origin for the uniform deposits produced by drying whisky lies precisely in these regimes, and that they are caused by the presence of certain components in the whisky.

The authors tested whether the phospholipid surfactants present in whisky — remnants of the drink's raw materials (barley, wheat, corn and rye) — cause the intermediate, circulatory regimes. Although adding sodium dodecyl sulfate (SDS, a common synthetic surfactant) to an ethanol–water mixture did lead to the circulating flows, interpreted as different manifestations of the Marangoni effect, the ensuing deposit was not uniform.

In addition to natural surfactants, whisky contains polymers. Kim and colleagues therefore added a polymer to their ethanol–water–SDS mix. They found that the polymer makes the particles stick to the substrate; the resulting deposits were almost uniform. The role of the surfactant remains essential though: evaporation of an ethanol–water–polymer mixture led to a coffee-ring stain.

Understanding whisky stains is not as frivolous as it might seem. Protocols for producing uniform particle deposits are highly sought-after by the coating industry. The results of Kim *et al.* show that whisky's deposition capabilities can be mimicked by the right synthetic mix. Indeed, you wouldn't want to use whisky as a coating solvent — there's enough angels' share already.

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