The size of the magnetic island nucleated around a Cd impurity is determined by the magnetic correlation length ξ of pristine $CeCoIn_5$. The correlation length, in turn, depends on the electronic structure and therefore on pressure. Seo *et al.* argue that applying pressure to magnetically ordered, Cd-doped $CeCoIn_5$ removes magnetic order by reducing ξ and thereby shrinks the magnetic islands. This produces a heterogeneous precursor state, or 'Griffiths phase'[7], in which a non-magnetic but superconducting matrix separates the magnetic islands. The percolative transition into magnetism, which occurs as islands grow and link up, differs fundamentally from the more widely discussed idealized, disorder-free picture of a magnetic quantum critical point. Accordingly, Cd-doped $CeCoIn_5$ tuned to the percolation threshold does not display the low-temperature divergence of the Sommerfeld coefficient of the heat capacity observed in other systems, and the temperature dependence of its electrical resistivity, when superconductivity is suppressed in high magnetic fields, can best be understood by parallel conduction through magnetic islands and a non-critical matrix.

The study by Seo and colleagues highlights both challenges and opportunities associated with varying the composition near a quantum phase transition. Doping has to be used with great care when aiming to access quantum critical points in narrow-band metals such as $CeCoIn_5$. However, the findings reported by Seo *et al.* also point towards exciting possibilities. Although numerous theoretical studies have explored the role of disorder near quantum phase transitions (see, for example, ref. 8), this is rarely the focus of experimental work. Percolative transitions in correlated systems could produce a wide variety of mesoscopic heterostructures and may become a rewarding research direction with potential device applications.

Moreover, the study raises the question of how the effects of quenched disorder could ever be completely avoided when approaching a quantum critical point. Given that some degree of disorder is always present, causing slight variations of the ordering temperature T_m within even undoped, high-quality samples, can the threshold of magnetism be reached without crossing an intervening precursor state? According to the Harris criterion[9], this depends on the magnitude of spatial variations of the ordering temperature, ΔT_m, coarse-grained over the correlation length ξ, which itself depends on temperature, T. If, on cooling a system through T_m, ΔT_m exceeds $(T - T_m)$, then electronic phase separation can occur no matter how pure the material. In high-quality samples, its effects will be more limited, producing 'marshlands' rather than volcanic islands, and some types of quantum phase transition are expected to be robust against quenched disorder, but it is a frequently underestimated yet ever-present possibility. Seo and collaborators remind us to look for it and motivate us to study its consequences. ❐

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SURFACE SCIENCE

Bend setters

Lotus leaves famously exhibit superhydrophobicity — the ability of a surface to strongly repel water. Sometimes called the 'lotus effect', plants exploit this property for self-cleaning purposes: tiny bits of dirt are captured in a water droplet as it rolls over a leaf. It is now well established that (super)hydrophobicity is caused by microscale surface roughness, and nature's skill has been mimicked in various coating technologies, such as liquid-repellent tablecloths.

The phenomenon is not restricted to water, a polar liquid: 'amphiphobicity' is the general term for both polar and nonpolar liquid repellence. The usual way of thinking about superamphiphobicity is in terms of a liquid drop wetting, or rather not quite wetting, a flat or slightly curved solid surface. But Ming Ye and colleagues take the opposite approach and consider a spherical particle coated with a superamphiphobic layer floating on a liquid surface (*Phys. Rev. Lett.* **112,** 016101; 2014). They wondered how small superamphiphobically coated particles can be — in other words,

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whether there are limits to the curvature of such coatings.

Ye *et al.* formed amphiphobic layers from nanoparticles of candle soot (with radii around 60 nm), assembled into structures resembling bead strands, and applied them as a coating to glass microspheres with radii of about 20 μm. The superamphiphobic effect has its origin in the nanoporous structure of the coating. When the coated microspheres are brought in contact with liquid/air interfaces, the liquid can only penetrate a little way into the applied layer; the many 'air cushions' block the liquid and result in a large macroscopic contact angle.

With one end of a coated microsphere attached to a piezo-unit (capable of converting displacements into forces and vice versa), Ye and colleagues were able to quantitatively investigate the adhesion of a coated particle to a liquid surface, with nanonewton precision, and obtain further qualitative understanding of superamphiphobicity. In particular, they have arrived at an expression for the minimal radius of the coated surface that results in superamphiphobicity, involving the surface tension of the liquid, the radius of the nanoparticles and the typical spacing between strands of them. Above the critical curvature — which is smaller for oil than for water — the capillary pressure exerted by the liquid on the superamphiphobic layer is larger than the depinning pressure required to force the trapped air out of it.

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