questions about the effective role of vacancies in explaining the regular collapses of the solid leading to the geyser bursts. The present study, while confirming the geyser effect over a wider temperature and pressure domains, provides an answer to those questions by monitoring the pressure inside the source and comparing data with the gas inlet valve (Figure) open and closed. The new results indicate that the geyser collapse does not occur near the orifice, as previously suggested, but at a plug in the feed line upstream of the source chamber. Each collapse is triggered by the increasing vacancy concentration which makes the solid behave much as a liquid. On this basis it is argued that vacuum expansion provides a novel approach for investigating exotic non-equilibrium phases of quantum solids such as helium. ■

▮▮▮ **G. Benedek, P. Nieto** and **J. P. Toennies**, 'Geyser Pressure Oscillations in the Expansion of Solid Helium into Vacuum', *Eur. Phys. J. B* **76**, 237 (2010)

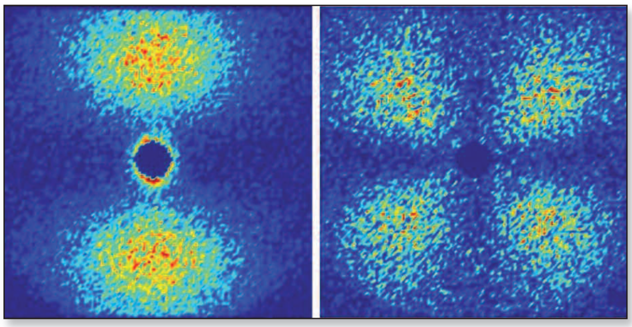
CONDENSED MATTER

One-D neutron-polarization **analysis on magnetic nanostructures**

Small-angle neutron scattering (SANS) is a prominent and powerful method to investigate the bulk of magnetic nanostructures on a length scale between a few and a few hundred nanometers. However, up to now, SANS was almost exclusively utilized with an unpolarized or a polarized incident neutron beam (denoted as SANSPOL), and an analysis of the spin state of the neutron after the scattering process is frequently not performed. The recent development of efficient ^{3}He spin filters (for cold neutrons) allows one to perform *routinely* one-dimensional neutron-polarization analysis (POLARIS) in a SANS experiment. The general equations for the non-spin-flip (nsf) and spin-flip (sf) POLARIS cross sections of a bulk ferromagnet suggest that a variety of angular anisotropies and asymmetries may be observed on a two dimensional detector.

First experiments on an FeCr based two-phase nanocrystalline alloy demonstrate the power of the POLARIS technique for the investigation of magnetic nanostructures. In particular, the analysis of the sf data, which does not contain the coherent nuclear scattering, permits the independent determination of the magnitude-squares of the three vector (Fourier) components of the bulk magnetization. In the figure below, the nsf data (left image) is a superposition of nuclear and magnetic scattering, whereas the sf channel at magnetic saturation (right image) exclusively contains the signal due to longitudinal (M_z) magnetization fluctuations; analysis of the sf data along certain directions in momentum space provides access to the transversal (M_x and M_y) spin components. Such studies are now feasible at the SANS instrument D22 of the Institut Laue-Langevin, Grenoble. ■

▮▮▮ **D. Honecker**, **A. Ferdinand**, **F. Döbrich**, **C.D. Dewhurst**, **A. Wiedenmann**, **C. Gómez-Polo**, **K. Suzuki** and **A. Michels**, 'Longitudinal polarization analysis in small-angle neutron scattering', *Eur. Phys. J. B* **76**, 209 (2010).



▲ **Neutron non-spin-flip (left) and spin-flip scattering cross section of a nanocrystalline Fe-Cr-based alloy at magnetic saturation (B_0 = 1.31 T).**

STATISTICAL PHYSICS

The relationship between **quality and quantity in research**

A new sociophysics model has led to quantification of the hitherto intuitive notion of critical mass in research. By treating research groups as complex systems, in which interactions between individuals are taken into account, a relationship between quality and quantity has been established. The model posits that the collaborative effect dominates quality, being an order of magnitude stronger than other factors such as individual calibre or institutional prestige. This means the strength of a research community is greater than the sum of its parts.

The research shows that there exist two critical masses, the sizes of which are discipline dependent. A small group is vulnerable and must strive to achieve the *lower critical mass*. Up to approximately twice this value, research quality is strongly dependent on the quantity of researchers. However, once beyond the value of the *upper critical mass*, research quality does not significantly improve with team quantity (the figure illustrates this for physics). The upper critical mass is interpreted as the maximum number of colleagues with whom an individual researcher can meaningfully communicate. When a group grows larger than this value, it tends to fragment. The lower critical mass is half the upper value, and for biology, physics and Earth sciences is 10, 13, and 15, while for pure and applied mathematics is about 2 and 6 respectively.

The research draws on data from evaluation exercises in Britain and France and suggests that to maximise the overall strength of a discipline, it is best to provide support for ▮▮▮