conditions to the more realistic case of open boundaries. In this way, charge build-up on the surfaces, together with the long-range Coulomb interaction, leads to a statistical spread of relaxation times. To recover the long-time tail, the authors consider the inclusion of non-stoichiometric magnetic impurities, so-called stuffed spins, which seem to act as both sources and traps for monopole excitations — ensuring a localized monopole concentration and providing the observed long-time behaviour.

Finally, Revell *et al.*[6] proposed that the large 9 K energy scale inferred from magnetic relaxation measurements could be incorporated into the stochastic hopping model if the hopping rate is itself proportional to the monopole density. This might be the case if the quantum-tunnelling mechanism driving the spin flips were directly related to the magnetic fields generated by the monopoles: an interesting phenomenological proposition requiring further experimental investigation.

This work opens the door to a rich array of future experimental and theoretical studies, pushing the framework of the magnetic Coulomb gas to new limits. The results suggest that intrinsic and extrinsic properties could in fact be combined and controlled to produce samples with specific functions. Together with the study of quantum fluctuations, which characterize emerging materials, these developments herald the beginning of the second ice age, which promises to be at least as interesting as the first. ❐

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ULTRAFAST PHENOMENA

Attosecond beacons

Electron dynamics that occur on subfemtosecond timescales inside atoms and molecules can only be probed using even shorter light pulses of attosecond duration. Such ultrashort pulses can be produced through high-order harmonic generation, using high-intensity femtosecond lasers focused onto a gas or a laser-generated plasma, but only in trains of pulses: there has been no simple way of isolating a single attosecond pulse from a pulse train. Jonathan Wheeler and colleagues have, however, found an elegant solution to this problem, in the form of the so-called attosecond lighthouse effect (*Nature Photon.* **6,** 829–833; 2012).

The first attosecond-pulse trains were demonstrated in 2001 by two groups, at Commissariat à l'Energie Atomique and Technische Universität Wien. Progress since then in the generation and control of ultrafast light means that now pulses as short as 67 attoseconds can be generated (*Optics Lett.* **37,** 3891–3893; 2012). Attosecond light-sources exploit the nonlinear interaction between matter and intense femtosecond laser-pulses that gives rise to high-order harmonics and a train of extreme-ultraviolet attosecond bursts. For example, when the electric field of the intense laser pulse ionizes the surface of a target, it creates a high-density plasma — a plasma mirror. The beam reflected from the plasma mirror consists of a train of attosecond pulses.


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Following a theoretical proposal (*Phys. Rev. Lett.* **108,** 113904; 2012) from Henri Vincenti and Fabien Quéré, who are also co-authors of the *Nature Photonics* paper, Wheeler *et al.* set up a plasma-mirror technique with a twist. They rotate the wavefront of the intense femtosecond laser-pulse — achieved by simple tilting of one of the glass prisms placed in the path of the beam before it reaches the plasma mirror — and the pulse is then reflected into a fan of spatially separated attosecond pulses. Thus, the temporal distortion is translated into a spatial separation of the reflected beams, their slightly different directions similar to the sweeping beams of a lighthouse.

This simple method produces perfectly synchronized isolated pulses that will be ideal for pump–probe experiments. In principle, it is applicable to any high-order harmonic generation scheme, and could illuminate new possibilities for the generation of attosecond pulses at X-ray wavelengths.

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