Novel Thermodynamics in Dy$_2$Ti$_2$O$_7$ Spin Ice: Two experimental case studies$^1$ LAURA BOVO, London Center for Nanotechnology; Department of Physics & Astronomy, UCL, LUDOVIC D.C. JAUBERT, OIST, Okinawa, PETER C.W. HOLDSWORTH, École Normale Supérieure de Lyon, CNRS, STEVE T. BRAMWELL, UCL — Spin-ice systems$^{[1,2]}$ can be described by a network of corner-shared tetrahedra of localised magnetic moments: geometrical spin frustration arises. This problem is topologically equivalent to proton ordering in water ice: to minimise the energy the spins obey the ‘ice-rule’. Emergent magnetic monopoles$^{[3,4]}$ have been modelled as deconfined excitations carrying a magnetic Coulomb charge which are associated with violations of the ice rule. Spin ices show a variety of properties some of which are better described by spins, other by monopoles. Magnetic susceptibility is a spin property and it shows a peculiar crossover$^{[5]}$. Here$^{[6]}$ we present a careful experimental observation for spherical crystals. The magnetic entropy$^{[2]}$ is another signature that can be described in terms of magnetic monopoles. Here$^{[7]}$ we show an alternative method based on Maxwell’s thermodynamic equations that can yield to the magnetic entropy on an absolute scale.


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