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Realization of kagome spin ice state in an intermetallic compound

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Spin ices are exotic phases of matter characterized by frustrated spins obeying local ice rules that minimize the number of spatially isolated magnetic monopoles, in analogy with the electric dipoles in water ice. In two dimensions, one can similarly define ice rules for inplane Ising-like spins arranged on a kagome lattice, which require each triangle plaquette to have a single monopole, and can lead to various unique orders and excitations. By integral experimental and theoretical approaches including magnetometry, thermodynamic measurements, neutron scattering and Monte Carlo simulations, we establish HoAgGe as the first crystalline (i.e. non-artificial) system to realize kagome spin ice state. It features a variety of partial and fully ordered states and sequence of field-induced phases at low temperatures, all consistent with the kagome ice rule.

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