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The first single atom magnet FABIO DONATI, STEFANO RUSPONI, CHRISTIAN WÄCKERLIN, APARAJITA SINGHA, ROMANA BALTIC, KATHARINA DILLER, FRANÇOIS PATTHEY, EDGAR FERNANDES, HARALD BRUNE, Ecole Polytechnique Fédérale de Lausanne, JAN DREISER, Paul Scherrer Institute, ZELJKO SLJIVANCANIN, Vinča Institute of Nuclear Sciences, KURT KUMMER, European Synchrotron Radiation Facility, SEBASTIAN STEPANOW, LUCA PERSICHETTI, CORNELIU NISTOR, PIETRO GAMBARDELLA, ETH Zürich — The prime feature of a magnet is to retain a significant fraction of its saturation magnetization in the absence of an external magnetic field. Realizing magnetic remanence in a single atom would allow storing and processing information in the smallest unit of matter. Here we show that individual rare-earth atoms on ultrathin insulating layers grown on non-magnetic metal substrates exhibit magnetic remanence and, therefore, are the first magnets formed by a single surface adsorbed atom. These magnets have a magnetic lifetime of 1500 s and a coercive field of 3.7 T at 10 K. In addition, their hysteresis loop remains open up to 30 K. This first example of a single atom magnet shows bistability at a temperature which is significantly higher than the best single molecule magnets reported so far. Its extraordinary stability is achieved by a suitable combination of magnetic ground state and adsorption site symmetry, and by decoupling the $4f$ spin from the underlying metal by a tunnel barrier.

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