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**Reaching the Landauer limit at high speeds with a quantum nanomagnet** ROCCO GAUDENZI, ENRIQUE BURZURI, HERRE VAN DER ZANT, Delft University of Technology, FERNANDO LUIS, Institute of Material Sciences of Aragon — The erasure of a bit of information, regardless of the physical system on which it is performed, is an irreversible operation bound to dissipate an amount of heat $Q = k_B T \ln 2$. As a result, work $W \geq Q$ – where equal sign means reversible operation – has to be applied to the physical system to restore the erased information content. This principle, due to Rolf Landauer, sets a universal minimal energy limit inherent to any classical computation. In the pursuit of the fastest and most efficient means of computation, the ultimate challenge is to produce a memory device combining the lowest intrinsic dissipation with the smallest possible relaxation time, i.e. minimising the product $W \cdot \tau_{rel}$. Here we use a crystal of molecular nanomagnets as a spin memory device and measure the work needed to carry out a storage operation. Full magnetic field control over these isolated spin systems allows quantum tunneling of magnetization to be exploited, yielding performance bordering the reversible limit while maintaining short relaxation times. The product $W \cdot \tau_{rel}$ results orders of magnitude lower than any existing memory device to date.

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