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# Quantum Einstein de Haas Effect Studied With Molecular Spintronic Devices

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One hundred years ago it has been discovered that a change of magnetization in a macroscopic magnetic object results in a mechanical rotation of this magnet [1]. The effect, known as Einstein de Haas or Richardson effect, demonstrates that a spin angular momentum in the magnet compensates for the mechanical angular momentum associated with its rotation. The experiment is therefore a macroscopic manifestation of the conservation of total angular momentum and energy in electronic spins. According to Noether's theorem, conservation of angular momentum follows from a system's rotational invariance and would be valid for the ensemble of spins in a macroscopic ferromagnet as well as for an individual spin. It has been recently proposed that single spin systems would therefore manifest an Einstein de Haas effect at the quantum level [2]. Here we propose the first experimental realization of a quantum Einstein-de Haas experiment and describe a macroscopic manifestation of the conservation of total angular momentum in individual spins, using a single molecule magnet coupled to a nanomechanical resonator. We demonstrate that the spin associated with the single molecule magnet is then subject to conservation of total angular momentum and energy which results in a total suppression of the molecule's quantum tunneling of magnetization [3].


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3. M. Ganzhorn, S. Klyatskaya, M. Ruben, W. Wernsdorfer, Nature Nanotechnol., 2013, 8, 165; Nature Comm., 2016.


**Authors:** GANZHORN, Marc (Institut Néel, CNRS, Grenoble Alpes University, BP 166, 38042 Grenoble, France); KLYATSKAYA, Svetlana (Institut of Nanotechnology (INT), Karlsruhe Institute of Technology (KIT), 76344 Eggenstein-Leopoldshafen, Germany); RUBEN, Mario (Institut of Nanotechnology (INT), Karlsruhe Institute of Technology (KIT), 76344 Eggenstein-Leopoldshafen, Germany); BALESTRO, Franck (Institut Néel, CNRS, Grenoble Alpes University, BP 166, 38042 Grenoble, France); WERNSDORFER, Wolfgang (Institut of Nanotechnology (INT), Karlsruhe Institute of Technology (KIT), 76344 Eggenstein-Leopoldshafen, Germany)

**Presenter:** BALESTRO, Franck (Institut Néel, CNRS, Grenoble Alpes University, BP 166, 38042 Grenoble, France)