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Press release

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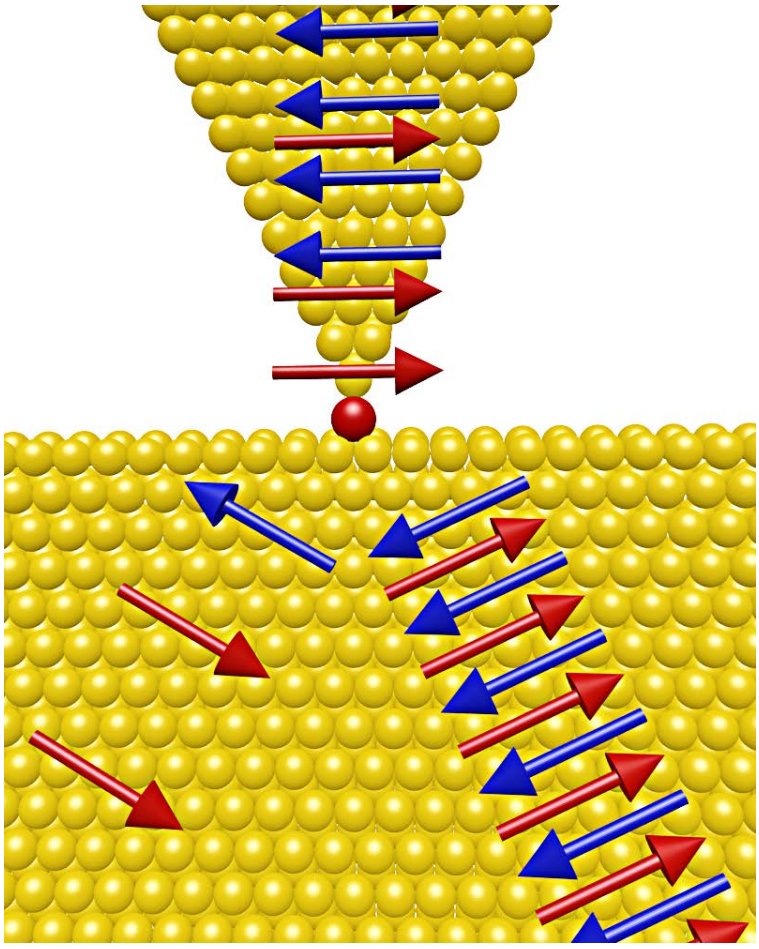
PRL Editors' Suggestion:

Shot Noise as a Probe of Spin-Polarized Transport through Single Atoms

Noise in electronic circuits is an inevitable nuisance. How does it change when a circuit is scaled down to the ultimate limit of a single atom?



In a recent publication in Physical Review Letters Andreas Burtzlaff, Alexander Weismann and Richard Berndt together with Mads Brandbyge from the Technical University of Denmark report the first experimental data on the shot noise of the current through single magnetic atoms. The noise turns out to be surprisingly low. The sophisticated measurements are complemented by state-of-the-art calculations and reveal that the electron spin plays a crucial role in lowering the noise level. Detailed knowledge on how the current depends on the electron spin is an invaluable piece of information to assess the suitability of single atom contacts as building blocks for future spintronic devices. The article has been highlighted by an Editors' Suggestion. The idea of the experiments in layman's terms: The way electrons move through a single atom contact is similar to a crowd of people passing through a revolving door. When such a door works smooth-

ly people leave it at a constant rate. This corresponds to electrons passing through a fully open quantum transport channel of the atom. However, it may happen that a channel randomly reflects some of the electrons that are coming in. This is analogous to a door that occasionally gets stuck. The resulting irregularities of the flows of people or electrons thus provide an extra piece of information about the door or the atomic channel. In the case of electrons, the randomness leads to noise of the current which may be amplified to become audible.
The experiment adds another twist by having different channels for opposite spin orientations of the electrons. This is comparable to having separate doors for, e. g., men and women. The noise of the electron current reveals that the transmission through magnetic atoms depends on the electron spin. This corresponds to men and women getting stuck in their respective doors with different probabilities. The former information will be useful in better understanding spin transport at the ultimate limit of miniaturization. The latter probably suggests that it's time to call a mechanic.

Original Publication:
Shot Noise as a Probe of Spin-Polarized Transport through Single Atoms,
A. Burtzlaff, A. Weismann, M.Brandbyge, and R. Berndt,
Phys. Rev. Lett. 114, 016602 (2015).
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Related websites:
http://www.ieap.uni-kiel.de/surface/ag-berndt/
http://www.sfb668.de

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