Transporting and Storing Spins Non-Locally in an Antiferromagnet

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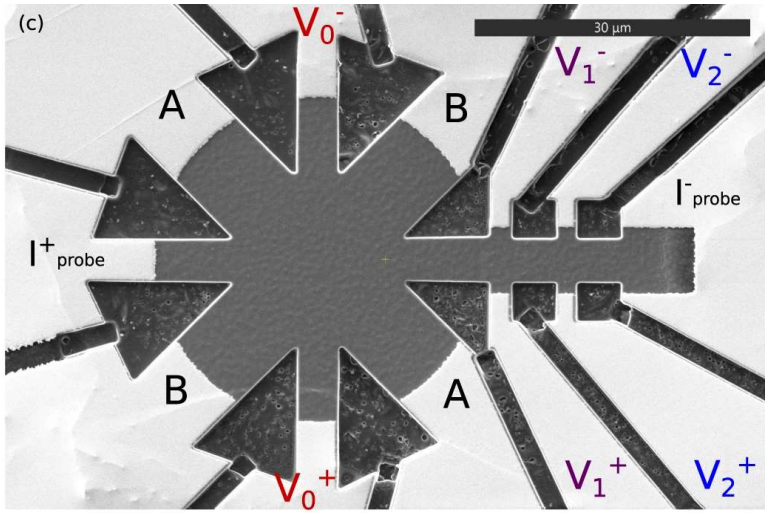

A switching device made from a bulk Fe_xNbS_2 crystal. The two pulse bars are marked A *and* B*. The AC probe current is applied along the path marked* I_{probe}*. The local signal is measured using the contacts labeled V0, and the non-local signals are measured using the contacts labeled* V_1 *and* V_2*.*

*S.C. Haley, E. Maniv, S. Wu, T. Cookmeyer, S. Torres-Londano, M. Aravinth, N. Maksimovic, J. Moore, R.J. Birgeneau, J.G. Analytis. Nat Commun **14**, 4961 (2023)*

This work was performed in part at NSLS-II

National Synchrotron Light Source II

Scientific Achievement

Scientists show that electron spin information can be transported and stored "non-locally" in the Fe_xNbS_2 materials.

Significance and Impact

These exotic magnetic materials could be candidates for the emerging field of antiferromagnet spintronics, a branch of quantum technology that could be the future of electronics.

Research Details

- Fe_xNbS_2 are antiferromagnets with rich magnetic and electronic behaviors, including switching resistance states when current pulses are applied in perpendicular directions.
- The group created a test device with a single Fe_xNbS_2 crystal; crystal quality was verified with x-ray diffraction at the PDF beamline at NSLS-II.
- Results show that, in response to the pulses, spin information can be manipulated as far as tens of microns away.
- Researchers propose that collective modes push the pattern of electron spins away from the flowing current, an effect amplified by the coupling between the material's magnetism and applied external strain.

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