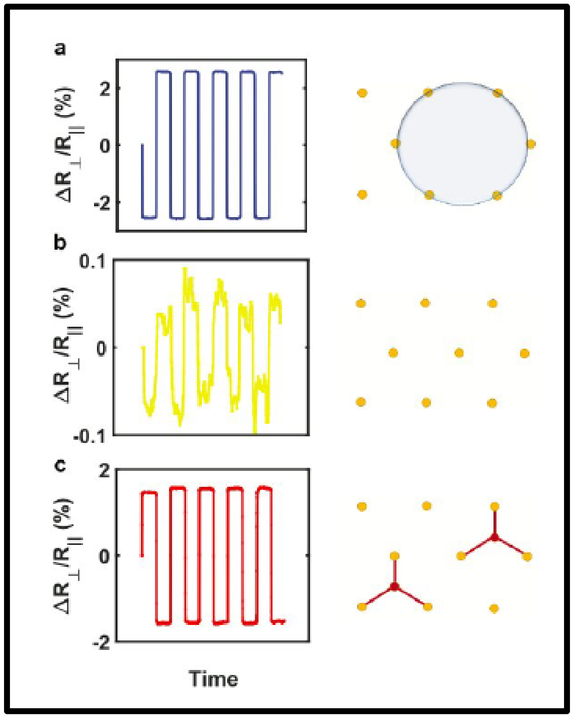
Antiferromagnetic switching driven by the collective dynamics of a coexisting spin glass

Scientific Achievement

A novel antiferromagnet switching mechanism arises from a coexisting correlated spin glass.

Significance and Impact

Manipulating antiferromagnetic spin textures using a spin glass' collective dynamics opens the field of antiferromagnetic spintronics to new material platforms with complex magnetic textures.



Low temperature switching for x = 0.31 (a), 0.34 (b), and 0.35 (c) illustrates the stability and enhanced response while departing x = 1/3 value. An illustration of the iron lattice is presented for the relevant regimes: vacancies (a), stoichiometric (b), and interstitials (c).

Research Details

- Ultra-low current densities enable highly stable antiferromagnetic electrical switching in Fe_xNbS_2.
- Fe_xNbS_2 is characterized to be an antiferromagnet with a varying coexisting spin glass phase (intercalation depended).
- The switching is pronounced only when the antiferromagnetic and spin glass phases coexist and is significantly suppressed when the spin glass phase is absent. This phenomenon occurs because of the correlated nature of the glassy phase, which allows the frozen spins to rotate in unison without any additional energy cost.
- The collective motion of the spin glass can impart spin torque on the coexisting antiferromagnetic phase, which ultimately rotates the spins of an antiferromagnet, so that their domains predominantly point in one direction.

E. Maniv et al. Sci. Adv. **7**, eabd8452 (2021)

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