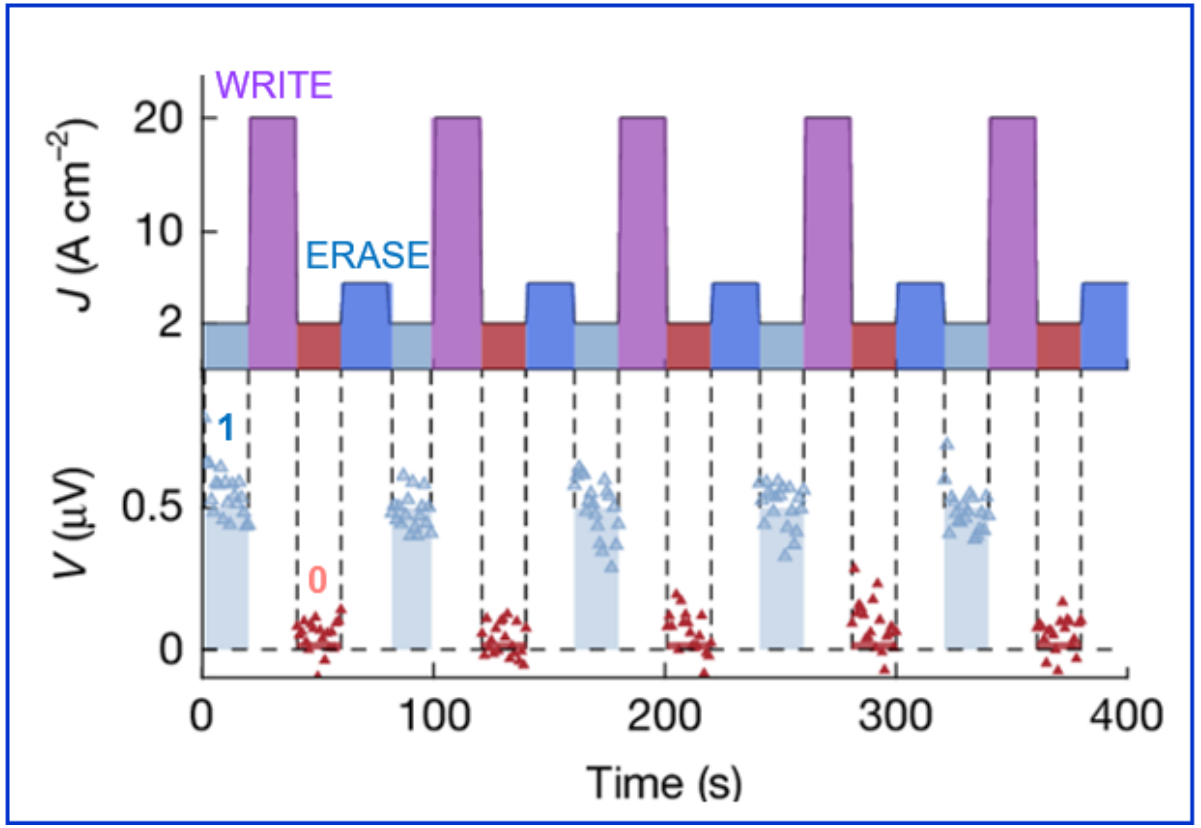
Extreme Fields Reveal Superconducting Memory

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Modern computing depends on **memory devices that store information reliably and efficiently**. While superconductors can carry electrical current without energy loss, creating a memory element that operates entirely within a superconducting state has remained a longstanding challenge. Researchers discovered that the ***unconventional superconductor UTe_2 can be switched between distinct long-lived states using electrical pulses***, allowing the material to **retain a memory of its history**.

The team investigated UTe_2 under extreme conditions where two superconducting phases coexist. Using ***high magnetic fields and millikelvin temperatures***, they found that electrical current pulses can drive the material into a metastable state with enhanced critical current. Once created, ***this state persists for hours and can be repeatedly written and erased***. High-field measurements at the National High Magnetic Field Laboratory were essential for accessing and mapping the narrow region where this phenomenon occurs.

The discovery establishes a **new form of intrinsic superconducting memory** that does not rely on magnetic layers or semiconductor interfaces. Beyond revealing previously unknown behavior in a quantum material, the work suggests a pathway toward ultralow-power memory technologies, cryogenic computing architectures, and future quantum information systems. It also demonstrates how extreme magnetic fields can uncover emergent states of matter inaccessible under conventional laboratory conditions.



Facilities and instrumentation used: NHMFL DC Field Facility; high-field transport measurements in resistive magnets; low-temperature measurements below 100 mK.
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