Tuning Topological Properties of $TaSe_3$ Using Strain

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Under ambient conditions, $TaSe_3$ is a topological semimetal with potential technological applications in future electronic devices. Its ribbon-like crystals are built up from two inequivalent chains [the red and blue chains shown at the **top of Figure (c)**]. The interactions between these two chains determine the macroscopic physical properties of the $TaSe_3$ crystal.

Theoretical calculations suggest that the topological properties of $TaSe_3$ are controllable by strain. This was tested experimentally by bending ribbon-like $TaSe_3$ single crystals into ring-shaped devices (**lower part of Figure (c)**). The magnetoresistance (MR) of the ring-shaped devices was measured using magnetic fields up to 60T [**Figures (a) and (b)].**

Linear MR (MR $\propto H^n$, with n = 1) is observed above 20T in ring-shaped samples [**lower panel in Figure (c)**], while it has a quadratic field dependence (n = 2) in the pristine samples [**upper panel in Figure (c)**]. The field dependence of magnetoresistance is a key indicator of underlying topology. Moreover, in contrast to the pristine crystals, quantum oscillations periodic in magnetic field are seen when the field is applied parallel to the rings [θ = 90°; **Figure (b)].** Such oscillations can only be explained by quantum interference around defects (the Altshuler-Aronov-Spivak effect) or inversion of the lowest Landau level beyond the quantum limit.

This work demonstrates that strain can be used to controllably tune the topological properties of low-dimensional materials.

Facilities and instrumentation used: 65 T magnets, digital lock-in and 3D printed rotator at the MagLab's Pulsed-Field Facility, Los Alamos.

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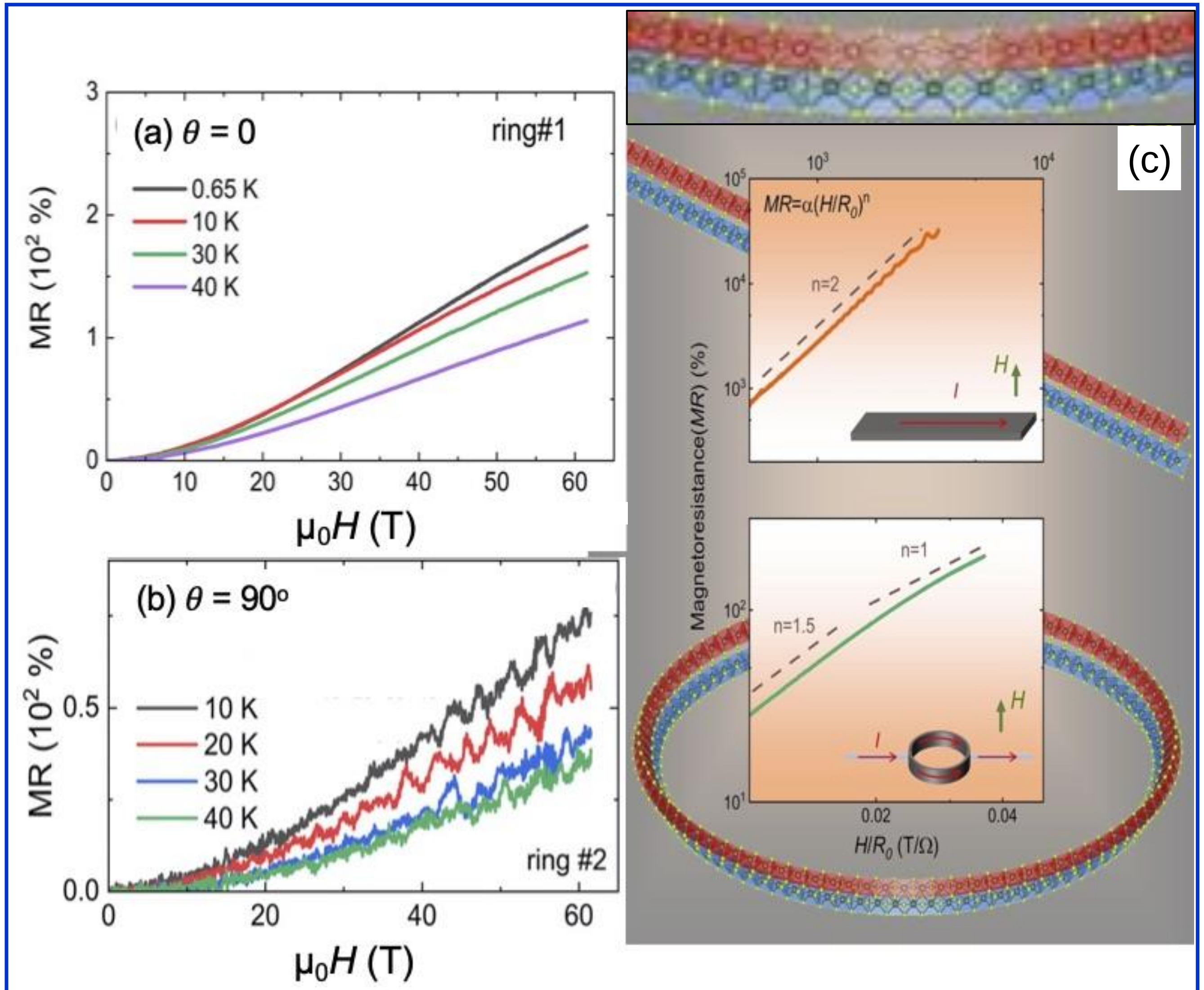

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