



Tuning Topological Properties of TaSe₃ Using Strain

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Under ambient conditions, TaSe₃ 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 TaSe₃ crystal.

Theoretical calculations suggest that the topological properties of TaSe₃ are controllable by strain. This was tested experimentally by bending ribbon-like TaSe₃ 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 [$\theta = 90^\circ$; 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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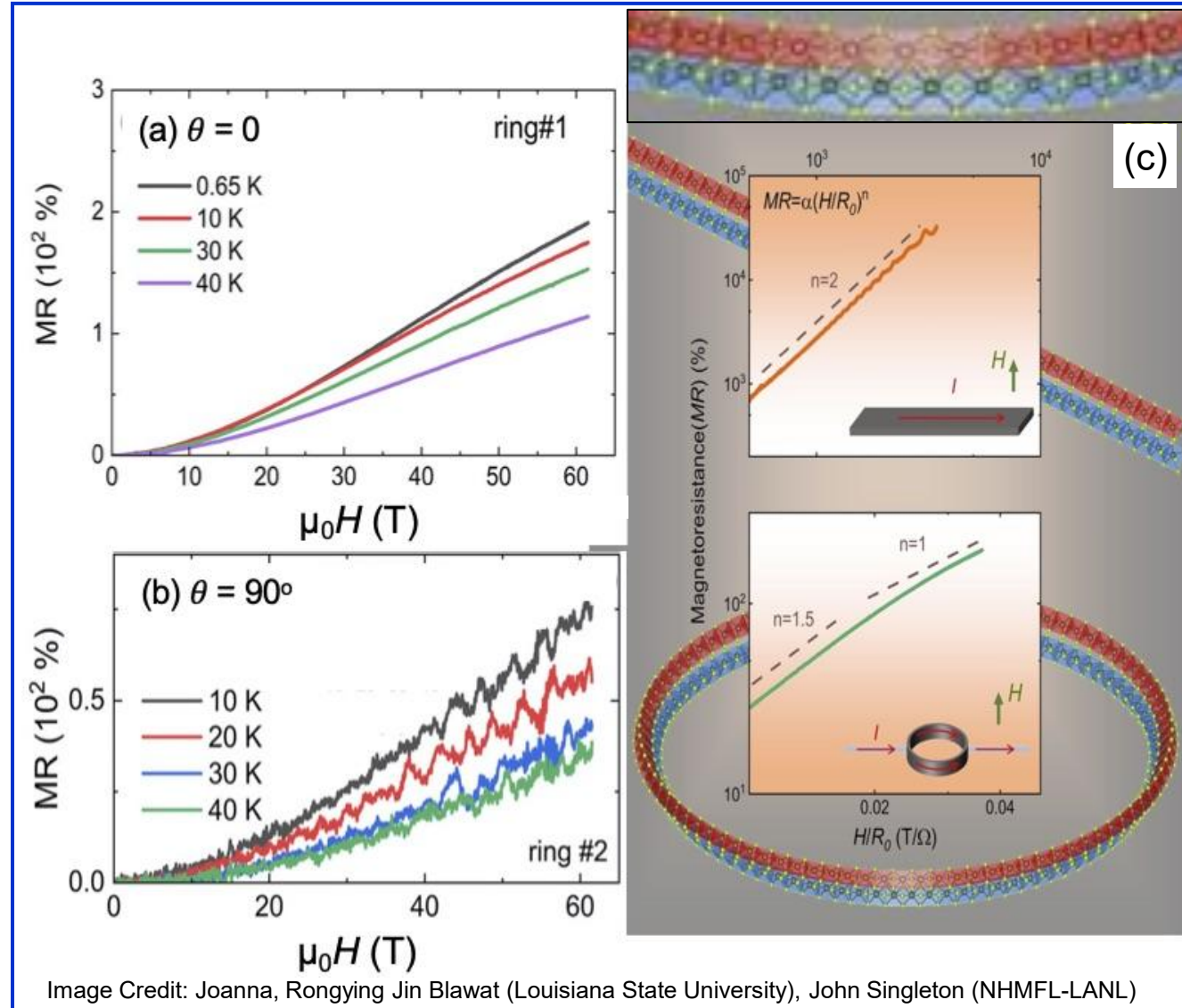


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