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Strain-tuning through a possible van Hove singularity in Sr_2RuO_4

CLIFFORD HICKS, Max Planck Institute for Chemical Physics of Solids

The superconducting transition temperature T_c of the tetragonal compound Sr_2RuO_4 was recently shown to be strongly sensitive to $\langle 100 \rangle$ orthorhombic distortion: T_c increases strongly both when Sr_2RuO_4 is tensioned and compressed along a $\langle 100 \rangle$ direction. This sensitivity was tentatively attributed to the proximity of one of its Fermi surface sheets to van Hove singularities (vHS): the sections of this sheet that pass closest to the Brillouin zone boundaries are also those perturbed most strongly by $\langle 100 \rangle$ orthorhombic distortion. By increasing the applied orthorhombic distortion to 0.5–1.0% — a uniaxial pressure almost certainly above 1 GPa — we have now been able to tune through a sharp peak in both T_c and the upper critical field, H_{c2} . At the peak, T_c more than doubles. The peak is at a strain value consistent with predictions for when the Fermi surface contacts the zone boundary, *i.e.* the van Hove singularity, although concrete verification will require further measurement. The strength of the enhancement of H_{c2} may have bearing on the symmetry of the order parameter. The large change in properties at this peak mean that it can almost be considered as a new, unexplored material, opening avenues for future research.