Scanning SQUID Microscopy of Sr$_2$RuO$_4$ Under Uniaxial Pressure$^1$ CHRISTOPHER A. WATSON, HILARY NOAD, Stanford Institute for Materials and Energy Sciences, SLAC National Accelerator Laboratory, Menlo Park, CA, USA, ALEXANDRA GIBBS, ANDREW P. MACKENZIE, CLIFFORD W. HICKS, Max Planck Institute for Chemical Physics of Solids, Dresden, Germany, KATHRYN A. MOLER, Stanford Institute for Materials and Energy Sciences, SLAC National Accelerator Laboratory, Menlo Park, CA, USA — The superconducting order parameter of Sr$_2$RuO$_4$ is thought to be $p_x \pm ip_y$ in the absence of a symmetry breaking field, owing to a degeneracy of the $p_x$ and $p_y$ components that results from tetragonal lattice symmetry. This order parameter would manifest as a cusp in the superconducting critical temperature, $T_c$, as a function of orthorhombic lattice distortion, applied through uniaxial pressure. $T_c$ has been found to respond sensitively to uniaxial pressure; however, the strain resolution of bulk measurements so far appears to be limited by inhomogeneity of the applied strain field and/or intrinsic sample inhomogeneity, such that the expected cusp might not have been observable. Here, we use scanning SQUID microscopy to resolve the low pressure response of $T_c$ on micron length scales, rendering the measurement insensitive to longer range spatial inhomogeneity. Furthermore, we report the dependence of $T_c$ on uniaxial strain to temperature and strain resolution sufficient to resolve the predicted cusp, thereby demonstrating the extent to which the symmetry protected degeneracy is lifted locally.

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