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Optical Polarization Microscopy of the Electron Nematic Phase in $Sr_3Ru_2O_7$ COLIN HEIKES, Cornell University, S. GHOSH, S. N. Bose National Centre for Basic Sciences, D. MACNEILL, Cornell University, R. PERRY, J.F. MERCURE, St. Andrews University, E.A. KIM, Cornell University, A. MACKENZIE, St. Andrews University, D.C. RALPH, Cornell University — We report the implementation of a fiber-based optical microscope, capable of operating at temperatures below 100 mK and in magnetic fields in excess of 9 Tesla, with sub-micron spatial resolution. This microscope is integrated into the bore of a dilution refrigerator with an optical fiber coupling light to an external optical table. Bench-top optical elements allow for polarization analysis of the reflected light from a surface and thus the detection of magnetic or other polarization-sensitive properties of matter at low temperature and high fields. As a first application of the instrument, we are studying the proposed electron nematic phase of the n=2 Ruddlesden-Popper material $Sr_3Ru_2O_7$, which exhibits a low-temperature phase transition in the form of an in-plane conduction anisotropy. We report initial results from polarization analysis and polarization microscopy with sample temperatures below 150 mK and applied magnetic fields from 0 T to 9 T.

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