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Optical Polarization Microscopy of the Electron Nematic Phase in $Sr_3Ru_2O_7$ COLIN HEIKES, DAVID MACNEILL, Cornell University, SAIKAT GHOSH, S N Bose National Centre for Basic Sciences, 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 submicron 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 mater 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 plan to detect this phase optically by analyzing the polarization rotation of the reflected light through the phase boundary, with the aim of imaging domain structure in the nematic phase.

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