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Phase-Sensitive Bogoliubov Quasi-Particle Interference Spectroscopy in $CeCoIn_5$ JOHN VAN DYKE, Univ of Illinois - Chicago, FREEK MASSEE, Cornell University, MILAN ALLAN, ETH Zurich, J.C. DAVIS, Cornell University, CEDOMIR PETROVIC, Brookhaven National Laboratory, DIRK MORR, University of Illinois at Chicago — Recent scanning tunneling spectroscopy experiments [1] have provided unprecedented insight into the momentum structure of the superconducting gap in $CeCoIn_5$ using quasi-particle interference (QPI) spectroscopy. In this talk, we demonstrate that the symmetry of the superconducting gap in $CeCoIn_5$ can be determined via phase-sensitive quasi-particle interference (PQPI) spectroscopy. This method is based on the insight that the intensity of the QPI spectrum is different for potential and magnetic defects. Using this idea, we present a theory for phase-sensitive QPI spectroscopy in heavy fermion materials. We demonstrate that a variation in the phase of the superconducting gap along the Fermi surface can be identified by comparing QPI spectra in zero and finite magnetic fields. Analysing recent experimental QPI results on $CeCoIn_5$ in $H = 0$ and 3 Tesla magnetic fields, we show that the resulting PQPI spectrum provides strong evidence for a $d_{x^2-y^2}$ symmetry of the superconducting gap [2]. [1] M.P. Allan et al., Nature Physics 9, 468-473 (2013) [2] J. Van Dyke, F. Massee, M.P. Allan, J.C. Davis, C. Petrovic, D.K. Morr, submitted.

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