Abstract Submitted
for the MAR16 Meeting of
The American Physical Society

Equilibrium helical order in radially confined superfluid ^{3}He[1]

JOSHUA WIMAN, J A SAULS, Northwestern University — An exciting prediction of confined superfluid ^{3}He is the presence of spontaneously broken translational symmetry, resulting in a superfluid phase that has a different translational symmetry than that of the confining geometry. Such phases have been described theoretically in films, cylinders, and ribbons. We predict an inhomogeneous superfluid phase with helical order that is energetically stable within cylindrical channels of radius comparable to the Cooper pair coherence length. By incorporating extensions to standard Ginzburg-Landau (GL) strong-coupling theory that accurately reproduce the bulk phase diagram at high pressures and allow tuneable boundary conditions[2], we find this new phase to be stable at both high and low pressures and favored by boundary conditions with strong pairbreaking. We present superfluid phase diagrams as functions of pressure, temperature, and channel radius showing the regions of stability for this "spiral" phase relative to those phases previously predicted for the channel. Transverse NMR frequency shifts are a possible experimental signature of this phase, and we present calculations of these shifts as functions of rf pulse tipping angle, field orientation, and temperature.

[1]Supported by NSF Grant DMR-1508730.
[2]J. J. Wiman & J. A. Sauls, Phys. Rev. B 92, 144515 (2015)

Joshua Wiman
Northwestern University

Date submitted: 06 Nov 2015 Electronic form version 1.4