Abstract Submitted
for the MAR11 Meeting of
The American Physical Society

Signatures of Crystalline Phases and Domain Walls in Superfluid ^{3}He Thin Films[1] ANTON VORONTSOV, Montana State University, JAMES SAULS, Northwestern University — Thin films of superfluid ^{3}He may spontaneously break translation symmetry in the plane of the film.[2] Near a critical film thickness, $D_{c_1} \approx 13\,\xi_0$, a one-dimensional "stripe phase" develops as a periodic array of domain walls separating degenerate, but inequivalent B-phases, $(\Delta_{||}, \Delta_{||}, +\Delta_\perp)$ and $(\Delta_{||}, \Delta_{||}, -\Delta_\perp)$. These defects have a unique spectrum of topological excitations bound to the domain wall. We present results for the order parameter and Fermionic spectrum, and their observable signatures, for a single domain wall and for the stripe phase. The combination of particle-hole asymmetry and broken translational symmetry of the order parameter leads to a weak modulation of the density, $\delta n \sim \ln\left(E_f/k_BT_c\right)\left(k_BT_c/E_f\right)^2\,\bar{n}$, where $\bar{n}$ is the mean particle density. This leads to a modulation of the van der Walls attraction, and thus a small, static modulation of the film thickness. We report theoretical results for the density modulation, film thickness profile and optical reflectivity for the crystalline phases of superfluid ^{3}He.

[1]Supported by NSF Grants: DMR-0805277 and 0954342.
[2]Phys. Rev. Lett. 98,045301 (2007).

James Sauls
Northwestern University

Date submitted: 30 Nov 2010 Electronic form version 1.4