Abstract Submitted
for the MAR15 Meeting of
The American Physical Society

**Confinement effect on Anderson-Higgs modes in superfluid $^3$He-B**

T. MIZUSHIMA, Osaka University, J.A. SAULS, Northwestern Univ — Superfluid $^3$He is a prototype to observe the spectrum of Anderson-Higgs (AH) modes associated with spontaneous symmetry breaking. In bulk superfluid $^3$He, AH modes have been observed experimentally through attenuation of zero sound, propagation of transverse sound and its acoustic Faraday rotation. Starting from a Lagrangian formulation, we examine the AH modes of $^3$He-B confined in a restricted geometry. For bulk $^3$He-B this formalism leads to the well known spectrum of bosonic collectives modes of the bulk B-phase labelled by the quantum numbers for total angular momentum, $J = 0, 1, 2, \ldots$, the projection along an axis, $J_z = -J, \ldots, +J$, and the parity under particle-hole conversion, $K = \pm 1$. For the equilibrium phases of $^3$He confinement induces pair breaking and leads to symmetry breaking, giving rise to a rich topological phase diagram. In terms of the bosonic excitations, we find that confinement induces symmetry breaking and leads to mixing of modes with different $J$, as well as to level splittings of the AH modes that are otherwise degenerate in bulk $^3$He-B. We find a new spectrum of Bosonic modes is generated that are bound to the surface of superfluid $^3$He in a restricted geometry. We also report on the coupling of the AH modes to ultra-sound.

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Date submitted: 13 Nov 2014 Electronic form version 1.4