Abstract Submitted
for the DFD05 Meeting of
The American Physical Society

Effect of superfluid to normal component transition on the flow of He II in confined geometries HOWARD SNYDER — When He II flows up a thermal gradient the transition of the superfluid component to the normal component causes several effects. The velocities of the superfluid and normal components vary with distance even when the area of the flow path is constant. The temperature, pressure and chemical potential may have maxima on the profiles along the flow channel. These effects are proportional to the length of the channel divided by the mean square of the diameter. Flow in a tube with diameter smaller than 10 microns and longer than about 1 cm has deviations from the constant property solutions that are significant. We present a method to include the superfluid transition in the analysis of flow through confined passages such as capillaries and porous materials. It uses a step function approach with convolution, similar to the Green's function formalism. The method is iterative on the pressure and temperature profiles. We formulate the method so that the transition effects are an additive series to the constant property solutions with each iteration adding a term. We derive analytic formulas for the terms of the series. We apply the formulas to flows through confined passages with particular attention to changes in the critical velocity for the onset of superfluid turbulence.

Howard Snyder
Universty of Colorado at Boulder

Date submitted: 26 Jul 2005 Electronic form version 1.4