Abstract Submitted
for the TSF05 Meeting of
The American Physical Society

Self-Trapping at the Critical Point TERRENCE REESE, Southern University, BRUCE MILLER, Texas Christian University — Measurements of the properties of an excess low mass particle equilibrated in a fluid suggest that self-trapping occurs in a neighborhood of the liquid vapor critical point. Typical experiments performed to date include the mobility of the electron, and the annihilation rate of the positron and positronium. In particular, the enhanced annhilation rate for positron decay suggests that a "microdroplet" of the fluid nucleates around the particle while, in the case of positronium, there is a corresponding dimunition of the pick-off decay rate suggesting the nucleation of a droplet. In earlier work we used both mean field theory and the Feynman path integral to model both processes. Using recent, numerically exact, Lennard-Jones parameters for the host fluid, here we report on the first path integral studies of self-trapping at the critical point. In this preliminary study we investigate local structural changes in the fluid in the neighborhood of the quantum particle for a repulsive hard sphere particle-atom potential. By varying the hard sphere radius we are able to determine the conditions for maximum structural deformation. Using a crude estimator we can also approximate the pick –off decay rate for psoitronium. This permits a comparison with similar computations at neighboring temperatures and densities, and provides a rough idea of how the decay rate depends on the range of the repulsive Ps-atom interaction potential.

Terrence Reese
Southern University

Date submitted: 15 Sep 2005 Electronic form version 1.4