Abstract Submitted
for the MAR06 Meeting of
The American Physical Society

Convection onset in a supercritical pure fluid HORST MEYER, Duke University — The convection onset of a pure supercritical fluid -^{3}He - in a Rayleigh-Bénard cell has been investigated along the critical isochore by measuring the temperature drop $\Delta T(t)$ across the fluid layer as a function of time t after starting the heat current q. The measurements showed after the initial sharp rise in $\Delta T(t)$ a first maximum at the time t_p, which indicates that the convection has developed and that plumes have reached the upper plate. It was found empirically that t_p, scaled by the thermal diffusion relaxation time τ_D, could be expressed as $t_p/\tau_D = F([Ra - Ra_c])$, where Ra_c is the critical Rayleigh number[1]. A model is proposed which reproduces this observed scaled representation. It uses the instability criterion of the bottom (hot) boundary fluid layer and the calculated Nusselt and Ra numbers for the steady-state convection. The perturbations leading to the convection development, after the fluid instability point has been reached, are unknown. Therefore t_p/τ_D is determined within a constant multiplicative factor, the only fit parameter of this model. There is then good agreement over more than four orders of magnitude of $[Ra - Ra_c]$ between the calculations and the experiments. The fit parameter is a phenomenological measure for the effectiveness of the perturbations, and will be discussed. 1. A. Furukawa et al. Phys. Rev. **E 68, 056309 (2003), Fig.5a.**

Horst Meyer
Duke University

Date submitted: 10 Nov 2005 Electronic form version 1.4