Abstract Submitted
for the DFD08 Meeting of
The American Physical Society

Entrainment mechanisms in a two-fluid channel flow SIINA HAAPANEN, Stanford University — The temporal evolution of an initially laminar two-fluid channel flow is investigated using linear stability analysis and direct numerical simulation. The two fluids are miscible with dissimilar densities and viscosities. The thickness of one of the fluid layers is much smaller than that of the other, with the denser and more viscous fluid comprising the thin layer. Two distinct entrainment mechanisms are observed in the DNS calculations, one of which results in significantly more entrainment and mixing between the two fluids as well as a greater degree of vorticity generation in the flow. These two mechanisms are a result of different initial conditions. The initial conditions are supplied by an Orr-Sommerfeld-type linear stability analysis. The observed entrainment mechanisms correspond to the two least stable modes present in the two-fluid channel flow, with the perturbations applied at a finite amplitude. In the range of parameters investigated, changes in viscosity and density ratios are found to affect the flow only in a quantitative sense without altering the basic entrainment mechanisms.

Siina Haapanen
Stanford University

Date submitted: 04 Aug 2008 Electronic form version 1.4