Abstract Submitted
for the DFD06 Meeting of
The American Physical Society

The effect of unsteadiness on mixing and transport in microscale circulating cavity flows DEREK RINDERKNECHT, MORY GHARIB, Caltech — Micro mixers are an important category of functional units on microfluidic devices and have demonstrated their viability in applications such as protein crystallization, and DNA hybridization. Steady flows within micro cavities have been shown to produce controllable circulations capable of manipulating cells and biological molecules. Here we present experimental studies examining the effect of pulsatile free stream flow on mixing within microscale rectangular cavities. Pulsatile flow is provided upstream of the cavity by an impedance pump, a device which utilizes the pressure wave interactions to generate a pulsatile flow output. Micro cavities were analyzed under steady and pulsatile flow conditions for mean free stream Re spanning 0.01 to 100. Laser induced fluorescence was performed to activate caged fluorescein dye to visualize fluid interactions between the free stream and cavity region. Flow patterns emerging during a period of flow pulsation were observed using phase averaged PIV. Mixing was quantified by integrating the velocity fields to calculate an average residence time of a random distribution of fluid particles seeded in the cavity.

Derek Rinderknecht
Caltech

Date submitted: 07 Aug 2006 Electronic form version 1.4