## Abstract Submitted for the DFD06 Meeting of The American Physical Society

The Structure of Transitional Wall-Bounded Microscale Flows VINAY NATRAJAN, KENNETH CHRISTENSEN, Department of Mechanical Science and Engineering, University of Illinois at Urbana-Champaign — Micro-PIV is used to study the structure of transitional wall- bounded flows at the microscale. High-resolution, instantaneous measurements of the velocity fields are obtained in the streamwise–wall-normal plane of a  $536 \,\mu\mathrm{m}$  glass capillary over a broad Reynoldsnumber range (1800 < Re < 3500). The mean velocity profiles show a deviation from laminar behavior at Re  $\sim 1900 - 2000$ , with fully-developed turbulence occurring at Re  $\sim 3400-3500$ . Examination of the instantaneous velocity fields for the transitional Reynolds numbers reveals the existence of isolated patches of turbulent flow that are interspersed within regions of flow displaying purely laminar behavior. These observations are similar to the observations of turbulent spots in macroscale transitional pipe flow. The progress of transition to turbulence is studied by comparing the instantaneous velocity profiles at all streamwise locations to the expected parabolic profile for laminar flow in order to estimate the fraction of the flow that displays laminar behavior. The "laminar fraction" of the flow as a function of the Reynolds number reveals a smooth transition to turbulence at the microscale. A similar trend is also noted in the energy distribution represented by the eigenvalue spectra of the POD modes.

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