Abstract Submitted
for the DFD05 Meeting of
The American Physical Society

Sublaminar skin-friction drag in controlled channel flow SUNG KANG, TAEGEE MIN, JASON SPEYER, JOHN KIM, University of California, Los Angeles — We investigated the conjecture proposed by Bewley[1] that the lowest sustainable drag of an incompressible constant mass-flux channel flow, when controlled via a distribution of zero-net mass-flux blowing/suction over the no-slip channel walls, is exactly that of the laminar flow. Numerical experiments in a two-dimensional channel flow show that below-laminar drag could be sustained with surface blowing/suction in the form of upstream traveling waves. This open-loop control produces Reynolds shear stress opposite to its typical form in a channel flow, resulting in a sustained drag below the laminar value. A linear mechanism contributes to this favorable distribution, allowing the use of the linearized Navier-Stokes equations to relate the convection speed of the traveling wave and the reduction in drag. It shows that downstream traveling waves have the opposite effect, resulting in higher drag. Applied to a fully turbulent flow, an upstream traveling wave also reduces the drag below that of a laminar flow with the same mass flux. Details of the controlled flow field will be presented.

[1]Bewley *Prog. Aerospace Sci.*, **37**, 2001

John Kim
UCLA

Date submitted: 03 Aug 2005 Electronic form version 1.4