Abstract Submitted
for the DFD14 Meeting of
The American Physical Society

The Hovering Hat YANGYANG HUANG, University of Southern California, MONIKA NITSCHE, University of New Mexico, EVA KANSO, University of Southern California — Birds and insects often flap their wings to hover and fly. Interestingly, recent experiments have shown that non-flapping rigid objects are also capable of stably hovering in an oscillatory background flow, given they possess particular geometric asymmetry in the vertical direction. The up-down asymmetry creates downwash vortex shedding and thus generates lift against gravity. Here, we use a two-dimensional vortex sheet model to study the motion of an inverted V-shaped object, moving passively in an oscillatory flow. We found that, depending on the fluid oscillation frequency, the hat descends, hovers or ascends. We also found an optimal opening angle of the hat for hovering that requires minimal energy from the background flow. We conclude by showing the passive stability of the hat and the role of the hydrodynamic forces and moments in preventing it from tipping over.

Yangyang Huang
University of Southern California

Date submitted: 01 Aug 2014 Electronic form version 1.4