Abstract Submitted
for the DFD14 Meeting of
The American Physical Society

New drag laws for flapping flight NATALIE AGRE, New York University, Department of Mathematics and Department of Physics, JUN ZHANG, New York University, Courant Institute and Department of Physics, LEIF RISTROPH, New York University, Courant Institute — Classical aerodynamic theory predicts that a steadily-moving wing experiences fluid forces proportional to the square of its speed. For bird and insect flight, however, there is currently no model for how drag is affected by flapping motions of the wings. By considering simple wings driven to oscillate while progressing through the air, we discover that flapping significantly changes the magnitude of drag and fundamentally alters its scaling with speed. These measurements motivate a new aerodynamic force law that could help to understand the free-flight dynamics, control, and stability of insects and flapping-wing robots.

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Date submitted: 31 Jul 2014 Electronic form version 1.4