Abstract Submitted
for the DFD17 Meeting of
The American Physical Society

Flight in hairy and sticky situations ARVIND SANTHANAKRISHNAN, Oklahoma State University — The smallest flying insects such as thrips and fairyflies have body lengths less than 1 mm. Despite their ecological importance, the fluid dynamic mechanisms that enable very tiny insects to generate lift at Reynolds number (Re) on the order of 10 remain unclear. Flapping motion in tiny insects is often characterized by 'clap and fling' wing-wing interaction. Further, these insects possess wings consisting of a thin solid membrane with long bristles on the fringes. Why is there a noted biological preference in almost all tiny insects to employ interacting bristled wings under highly viscous conditions that would require large forces to peel the wings apart? In this talk, I will present numerical and experimental studies examining the role of bristled wings in clap and fling aerodynamics. At Re=10, bristled wings are observed to reduce both lift and drag forces as compared to geometrically equivalent solid (non-bristled) wings. Recirculating flow through the bristles leads to disproportionally larger drag reduction by bristled wings, as compared to lift reduction between bristled and solid wings. The impact of alterations to bristled wing design variables, including spacing between bristles and ratio of solid membrane to total wing areas, on aerodynamic force coefficients and scalability with Re will be discussed.

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Date submitted: 01 Aug 2017 Electronic form version 1.4