Abstract Submitted
for the DFD15 Meeting of
The American Physical Society

The fluid dynamics of the ciliate *Pseudotontonia* sp. jumping by "tail" contraction HOUSHUO JIANG, Woods Hole Oceanographic Institution, Woods Hole, MA 02543, BRAD GEMMELL, EDWARD BUSKEY, University of Texas, Marine Science Institute, Port Aransas, TX 78373 — The marine planktonic ciliate *Pseudotontonia* sp. ($\sim 80\ \mu$m in cell size) possesses two sets of propulsive machinery: (1) an anteriorly located ciliary band that beats to let the cell swim backward, and (2) a long, contractile appendage (i.e. the 'tail') that at times contracts rapidly to pull the cell body backward, resulting in the tail contraction and body jumping motion being oppositely directed inwards towards the same location. We use high-speed microscale imaging and micro-particle image velocimetry techniques to measure the ciliate swimming and jumping kinematics and imposed flow fields. We show that the cilia-propelled swimming achieves a sustained swimming speed ~ 10 mm s^{-1} that can last more than 100 ms. The swimming imposed flow conforms to the steady stresslet flow field that decays spatially at r^{-2}. On the other hand, the tail contraction causes the cell to jump at a peak speed ~ 55 mm s^{-1} and cover a jumping distance 2-4 cell lengths within ~ 12 ms jumping time. The jumping imposed flow fits quite well to the unsteady impulsive stokeslet flow field that decays spatially at r^{-3}. Based on the measured jumping kinematics, we develop a fluid dynamics model to explain the thrust generation due to the tail contraction.

Houshuo Jiang
Woods Hole Oceanographic Institution

Date submitted: 21 Jul 2015 Electronic form version 1.4