Abstract Submitted
for the DFD14 Meeting of
The American Physical Society

Wave-driven Frictionless Stick-Slip of a self-propelled drop VINCENT BACOT, MATTHIEU LABOUSSE, Institut Langevin ESPCI Paristech, STÉPHANE PERRARD, YVES COUDER, Laboratoire Matière et Systèmes Complexes, UMR 7057 CNRS et Université Paris Diderot, EMMANUEL FORT, Institut Langevin ESPCI Paristech — Mechanical parts often move not smoothly but in jerks. This well-known phenomenon, called Stick-Slip, is usually associated with friction, since sudden variations of the friction between solid objects, associated with microscopic shear storage, account for the stop and go motion. We report the observation of a similar phenomenon, not controlled by friction, but by propulsion, through the storage of propulsion sources in a surface wave. Our system is made of a liquid droplet, bouncing on a vibrated bath of the same liquid. The vibration of the bath both inhibits the drop coalescence and sustains standing waves on the bath surface around each bouncing spot, for a certain amount of time. These standing waves act as propulsion sources for the drop which thus moves in the horizontal plane. We show how the dynamic interferences of the standing waves created along the way lead to transitory jerks upon starting the motion of the drop. We show how the inhomogeneous dynamic storage of propulsion sources can lead to a steady stop and go motion. In this wave piloted stick-slip motion, the roles of the propulsion and friction are reversed and the spatio-temporal periodicity is tunable.

Vincent Bacot
Institut Langevin ESPCI Paristech

Date submitted: 01 Aug 2014 Electronic form version 1.4