Abstract Submitted
for the MAR15 Meeting of
The American Physical Society

Asymmetric oscillation and dynamic clustering of water-in-oil droplets by hydrodynamic interactions TAKUYA OHMURA, Department of Physics, Kyoto University, KEN-ICHIRO KAMEI, iCeMS, Kyoto University, MASATOSHI ICHIKAWA, Department of Physics, Kyoto University, YUSUKE MAEDA, Department of Physics, The Hakubi Center, Kyoto University, JST PRESTO — Ordered motion or patterns are widely observed in many body systems far from equilibrium. Microfluidic droplet crystal that is the ensemble of water-in-oil droplet moving in immiscible fluid in a microchannel is known to exhibit normal vibrational mode due to inter-droplet hydrodynamic interactions. In this study we study dynamic ordering in the ensemble of different-sized droplets in order to investigate the effect of heterogeneity in the droplet crystal. We find asymmetric back-and-forth motion of single small droplet of 20 μm, which is placed between two droplets of 140 μm, is emerged. As a group of small droplets comes in the middle of larger droplets, their motion turns dynamic clustering from oscillation. Numerical analysis indicates that hydrodynamic interactions with boundary wall and large droplets break symmetry of flow field and results in closed streamlines sustaining asymmetric oscillation.

Takuya Ohmura
Department of Physics, Kyoto University

Date submitted: 14 Nov 2014 Electronic form version 1.4