Abstract Submitted
for the DFD20 Meeting of
The American Physical Society

Interfacial flow around thermally forced colloids measured by correlated displacement velocimetry MEHDI MOLAEI, University of Chicago, NICHOLAS CHISHOLM, JIAYI DENG, JOHN CROCKER, KATHLEEN STEBE, University of Pennsylvania — We have developed a method to measure nanoscale flow field around interfacially trapped colloidal particles undergoing Brownian motion. By this method, we map the flow field generated by particle displacements, which are decomposed into interfacial hydrodynamic multipoles, including thermally induced force monopole and dipole flows, whose forms differ significantly from their bulk fluid counterparts. Analysis of the detailed flow structures provide key insights essential to understanding the interfacial response. Importantly, the flow structure around micron size colloids shows that the interface is incompressible for scant surfactant near the ideal gaseous state with surface pressures smaller than 0.1 mN m. Furthermore, the measured flow fields also contain information about the mechanical properties of the interface in a range that is inaccessible with other measurement techniques, e.g., surface viscosities less than 10^{-10} Pa m s. This measurement reveals flow reorganization for nearly surfactant-free systems, and can be applied to probe interfacial flows in systems to which surface active substances are deliberately added.

Mehdi Molaei
University of Chicago

Date submitted: 10 Aug 2020 Electronic form version 1.4