Abstract Submitted
for the DFD19 Meeting of
The American Physical Society

Flow field near Contact Lines : Role of Inertia[1] ANJISHNU CHOUDHURY, CHARUL GUPTA, HARISH N. DIXIT, Indian Institute of Technology Hyderabad — The dynamics of contact line involves the movement of two immiscible fluids in contact with a solid surface. An analytical solution for Stokes flow near a moving contact line was solved by Huh & Scriven (JCIS, 1971) which suggests a simple classification of the flow field based on viscosity ratio, R and contact angle, θ. But experiments by Savelski et al. (JCIS, 1995) and Ito et al. (Tran. Vis. Soc. Japan, 2009) find flow fields which differ from predictions of Huh & Scrivens theory. Our work is an attempt to resolve this contradiction by exploring the kinematics near the contact line through accurate simulations and scaling laws. We focus our attention on flow fields in a region of $O(l_c)$, the capillary length. Excellent agreement between simulations and theory is found in the viscous limit. A careful examination of the parameters used in the reported experiments suggests that Re based on l_c is not small, hence inertial effects may not be negligible. We observe a stagnation point on the interface at length l_i for moderate Re and at $O(1)$ We. The obtained flow field potentially resolves the contradiction between theory and experiments. Experiments are underway to validate these flow fields and will be discussed during the meeting.

[1]ECR/2015/000086, SERB, Dept. of Sci. and Tech., India

Anjishnu Choudhury
Indian Institute of Technology Hyderabad

Date submitted: 02 Aug 2019 Electronic form version 1.4