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Hydrodynamic interaction between a pair of bubbles rising in a shear-thinning viscoelastic fluid MITHUN RAVISANKAR, YUNXING SU, ROBERTO ZENIT, Brown University — Bubbles ascending in non-Newtonian fluids have significantly different characteristics from their Newtonian counterparts: deformed shapes, negative wake, and clustering are a few. To improve our understanding on bubble clustering, the hydrodynamic interactions between a pair of bubbles were experimentally studied. Viscoelastic fluid with shear-dependent viscosity, prepared from water-glycerin mixtures and polyacrylamide, was used. For a single bubble in such viscoelastic fluids, there is an abrupt discontinuity in the bubble velocity beyond a critical volume. We conducted experiments for bubbles before and after the critical size. Important differences on the interaction dynamics were identified, when compared to the Newtonian fluid case: for both cases, the trailing bubble was observed to catch up with the leading one (drafting). Specifically, before the critical volume, bubbles remain close to each other after reaching each other, forming a stable chain. After the critical volume, however, the bubble pairs do not reach a steady configuration but do not drift apart either, instead, both the leading and trailing bubble stay close, alternatingly switching the leading-trailing position in time in the race to the free surface. These results are compared and contrasted with the Newtonian benchmark fluid. We discuss a possible mechanism to explain these observations.

Mithun Ravisankar
Brown University

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