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Direct numerical simulation of confined drops and bubbles at low capillary numbers SHAHRIAR AFKHAMI, NJIT, ALEX LESHANSKY, Technion - Israel Institute of Technology, YURIKO RENARDY, Virginia Tech — The technology of microfluidics and its recent advance in the use of droplets within microchannels lead to the need for the understanding of drop deformation and breakup as a function of flow strength, physical parameters and fluid properties. We perform a combined asymptotic and numerical study of a simplified model for a dispersion which is pumped through a T-junction. The numerical method is based on a height-function formulation for a volume-of-fluid representation of the two liquids. Both the Bretherton and the Richardson bubble are used for benchmarking our code, thus establishing the degree of accuracy and robustness. The viscosity ratio of the drop to matrix liquid is varied to investigate the range of behavior from the presence of a bubble to that of a highly viscous drop. We focus on small Reynolds numbers and the limit of small capillary numbers where prior asymptotic theory of Leshansky and Pismen [Phys. Fluids 21, 023303 (2009)] has yet to be ascertained with computational results. In this regime, very strong capillary forces combined with confinement contribute to the difficulty in the direct numerical simulations. In particular, more than one mode of drop breakup has been observed in experimental data [Phys. Fluids 21, 072001 (2009)] when a large drop goes through a T-junction.

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