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Surface tension induced translational and rotational motion of a droplet with viscosity variation GAOJIN LI, Cornell University, DONALD KOCH, Cornell univeristy — A droplet releasing oil into a micellar solution can undergo spontaneous translational motion due to Marangoni flows. Recent experiments with two-component oil droplet emulsions show that the oil droplet exhibits transition between ballistic and spiraling motions depending on the relative size of coexisting (low viscosity) isotropic and (higher viscosity) liquid crystalline phases. This transition could be used to engineer programmed active drops to effectively search a desired portion of a fluid domain in applications such as targeted drug delivery or pollutant harvesting. To understand the mechanisms behind this phenomenon, we analyze the translational and rotational instabilities of a two-dimensional drop with two compartments of different viscosity. Using both linear stability analysis and direct numerical simulation, we show that the viscosity variation inside the drop leads to earlier transitions from quiescent state to spontaneous translational motion and coupled translational and rotational motion than predicted for a single-phase drop.

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