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Bouncing behaviors of an oil droplet in a stratified liquid[1] YANSHEN LI, CHRISTIAN DIDDENS, LIJUN THAYYIL RAJU, University of Twente, XUEHUA ZHANG, University of Alberta, KAI LEONG CHONG, University of Twente, ANDREA PROSPERETTI, University of Houston, DETLEF LOHSE, University of Twente — As we had found in Li et al, *Phys. Rev. Lett.* (2019), an oil droplet is able to repeatedly first sink and then bounce up in a vertically stratified ethanol-water mixture. The Marangoni flow at the droplet-liquid interface, caused by the solute (ethanol) gradient, provides the propulsion for the upwards jump. We now further elucidate the mechanism and explore the phase space. Specifically, we find that as the droplet jumps up to the lighter ethanol-rich region, it gets harder for the propelling droplet to overcome its own weight, until finally it stops. At this maximum height, the Marangoni flow continues to propel, homogenizing its surrounding liquid, thus decreasing the propulsion itself, until it ceases. The droplet then sinks while dragging down this uniform liquid layer with it. We find that this uniform "shielding" layer eventually vanishes, mainly because of diffusion, so that the droplet bounces up again, continuing the cycle. It is also found that the maximum height increases with decreasing the droplet size.

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