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Vesicle dynamics in external flows KONSTANTIN TURITSYN, University of Chicago, SERGEI VERGELES, VLADIMIR LEBEDEV, Landau Institute for Theoretical Physics — A vesicle can exhibit a variety of different dynamical behaviors when placed in an external flow. At least three qualitative different motions have been observed in recent experiments: tumbling, tank-treading, trembling. We present a theoretical investigation of this effect, resulting in a phase-diagram which predicts the type of the vesicle motion. For planar external flows, the character of the vesicle dynamics is determined by two dimensionless parameters, which are formed out of viscosities of inner and outer fluids, external velocity gradient matrix and vesicle excess area. Transitions between different types of motions are analyzed separately. The tank-treading to tumbling transition is described by a saddle-node bifurcation whereas the tank-treading to trembling transition occurs via a Hopf bifurcation. In the vicinity of the transition lines the vesicle experiences critical slowing down, which can be described universal scaling exponents.

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