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Do Liquid Drops on Inclined Surfaces Slide or Roll? SUMESH PT, Jawaharlal Nehru Centre for Advanced Scientific Research, Bangalore, IGNACIO PAGONABARRAGA, Department de Fisica Fonamental, Universitat de Barcelona, RONOJOY ADHIKARI, The Institute of Mathematical Sciences, Chennai, RAMA GOVINDARAJAN, Jawaharlal Nehru Centre for Advanced Scientific Research, Bangalore — A solid sphere is likely to roll, while a rectangular box is likely to slide, on an inclined surface. Instead, a liquid drop can exhibit a variety of shapes and complex but interesting dynamics. We obtain global minimum energy static shapes first, for two realistic bases of potential energy, front and back-pinned. We find that the free end always assumes Young's equilibrium angle. Using this clue, simple equations describing the angles and the maximum volume may be derived. Combining the lattice Boltzmann method for hydrodynamics and method of lines for a Cahn-Hilliard equation, a hybrid numerical scheme is developed to study the dynamics of binary fluids on an inclined plate. The contribution of pure translation, and the vorticities associated with rolling and shearing motion are distinguished, using which the motion of the drop can be split into roll and slip. Surprisingly, as gravity increases, the fraction of motion due to roll decreases significantly for certain contact angles. The rolling motion is strongly dependent on the slip length which is in contrast to predictions by the lubrication approximation, where all dependence on the slip length is generally logarithamic.

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