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Lubrication Analysis of Flow and Mixing in a 3D Translating Sessile Drop CECILY KEPPEL, Harvey Mudd College, AMANDA CLEMM, Scripps College, MICHAEL DAVIS, Claremont Graduate University, DYLAN MARRINER, ANDREW BERNOFF, Harvey Mudd College, ALI NADIM, Claremont Graduate University — We consider the flow within a sessile drop that translates along a surface. The drop height is taken to be small compared to the radius of its wetted base allowing a lubrication approximation. The drop is also assumed to maintain its static shape (i.e., spherical cap approximated by a paraboloid) during translation, which requires vanishingly small capillary and Bond numbers. The 3D flow and pressure field in the drop are obtained and the form of the singularity in pressure and stress at the contact line is determined. The closed streamlines of the flow are seen to correspond to the intersection between a family of axisymmetric shell-like surfaces and another family of sheets that are flat in the direction of translation but curved in the plane perpendicular to that direction. Mixing within the drop is investigated when the direction of translation is periodically switched by 90°. With such switching, a passive scalar is found to become well mixed on the 2D surfaces of the axisymmetric shells identified in the steady flow, but no mixing occurs across the shells. Addition of small diffusion, however, enables the passive scalars to cross to neighboring shells and get well mixed within the drop volume. [Supported by Fletcher Jones Fellowships/CCMS]

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