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A theory on the spreading of droplets JOSE GORDILLO, GUILLAUME RIBOUX, ENRIQUE S. QUINTERO, Universidad de Sevilla — Here we provide a self-consistent analytical solution describing the unsteady flow in the slender thin film which is expelled radially outwards when a drop hits a dry solid wall. Thanks to the fact that the fluxes of mass and momentum entering into the toroidal rim bordering the expanding liquid sheet are calculated analytically, we show here that our theoretical results closely follow the experimentally measured time-varying position of the rim with independence of the wetting properties of the substrate. The particularization of the equations describing the rim dynamics at the instant the drop reaches its maximal extension which, in analogy with the case of Savart sheets, is characterized by a value of the local Weber number equal to one, provides an algebraic equation for the maximum spreading radius also in excellent agreement with all the experimental data available in the literature. The self-consistent theory presented here provides us with the time evolution of the thickness and of the velocity of the rim bordering the expanding sheet. We also test these predictions and show that our theory is also able to predict the splash threshold velocity when the substrate is superhydrophobic and also the velocities and the diameters of the droplets ejected.

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