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Using Wagner theory to predict early-time jet properties in liquid-liquid impact problems MATTHEW MOORE, University of Oxford, RADU CIMPEANU, University of Warwick, University of Oxford — Droplet impact problems have a wide range of applications throughout real-world phenomena and industrial processes, ranging from inkjet printing to aerosol formation. Due to the violent displacement of liquid free surfaces and the associated topological changes on short timescales and disparate lengthscales, impacts are notoriously difficult to model. With access to ever more sophisticated technology, we have a wealth of resources at hand to investigate impact phenomena in greater detail. However, since impact problems are highly nonlinear, it is desirable to use mathematical modelling to help predict certain properties, such as the location of the root of the ejecta, enabling us to focus numerical or experimental investigations on a subset of the full problem. In this analysis, we employ an inviscid, incompressible fluid model to perform a comprehensive analysis of droplet impacts for general droplet radii and impact speeds. We derive leading order predictions for the location, thickness and velocity of the root of the high-speed ejecta, as well its leading-order thickness and velocity. We compare the predictions to direct numerical simulations performed in the open-source software package Gerris. We discuss what the theory predicts well, where it struggles and applications.

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