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Marangoni effects enabling interfacial singularities and topological changes in fluid flows ROUSLAN KRECHETNIKOV, University of Alberta — In this talk I will address two geometric effects of surface tension gradients: formation of interfacial singularities and change in the flow topology compared to the clean interface case. In the first part, I will focus on a necessary condition for the existence of geometric singularities – divergence of curvature at fluid interfaces – in the solutions of fluid dynamic equations. Besides establishing a relation to dynamic singularities – unboundedness of the velocity field – explicit asymptotic solutions of the Navier-Stokes equations are developed as well. Next, using as an example the phenomena of tip-streaming, with the help of asymptotic matching we resolve the associated Marangoni-driven singularities providing explicit asymptotic formulas for the scaling of the emitted droplets. In the second part, using the Landau-Levich problem of dip coating as a paradigm, we demonstrate how Marangoni stresses are capable of changing the flow topology by moving the stagnation point initially residing at the interface in absence of surfactants into the bulk once surfactants are added to the system. This finding not only explains thickening of the deposited film as induced by Marangoni effects, but also illustrates another geometric effect surface tension gradients may cause.

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