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Cusps and cuspidal edges at fluid interfaces: existence and application ROUSLAN KRECHETNIKOV, University of Alberta — One of the intriguing questions in fluid dynamics is on the interrelation between dynamic singularities in the solutions of fluid dynamic equations – unboundedness of the velocity field in an appropriate norm – and the geometric ones – divergence of curvature at fluid interfaces. The present talk focuses on two generic interfacial singularities – genuine cusps and cuspidal edges – found here in both two and three dimensions thus establishing a relation between real fluid interfaces and geometric singularity theory. The key new finding is the necessary condition for the existence of geometric singularities, which is a variation of surface tension. It is also established here that the dynamic and geometric singularities entail each other only in the case of three-dimensional cusps. Explicit asymptotic solutions for the flow field and interface shape near steady-state singularities at fluid interfaces are developed as well. The practical motivation for the present study comes from the fundamental role interfacial singularities play in sustaining self-driven conversion of chemical into mechanical energy.

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