Global regularity for parabolic incompressible fluid interfaces

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In this talk we consider several scenarios involving the interaction among immiscible incompressible fluids of different nature. The main concern is the dynamics of the free boundary separating the fluids, which evolves with the velocity flow. The important question to address is whether the regularity is preserved in time or, on the other hand, the system develops singularities. We focus on parabolic models, where the viscosity of the fluids play a crucial role. At first showing recent results on global existence for 1996 P.L. Lions' conjecture for density patches evolving by inhomogeneous Navier-Stokes equations. Later discussing new results of global regularity for the Muskat problem with viscosity jump.