Six remarkable properties of capillary surfaces

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This will be a survey lecture on recent developments in the mathematical theory of capillary free surface interfaces. The close interactions between the formal mathematics and physical reality will be emphasized, and results from NASA and Mir space experiments on mathematically predicted behavior will be discussed. The material will include global estimates on configuration of interfaces, discontinuous dependence of configurations on the boundary data, symmetry breaking, failure of existence of regular solutions under physical conditions, failure of uniqueness under conditions for which regular solutions exist, unusual comparison properties, and characterization of isolated singularities of solutions of the equations.