Droplets spreading under contact line friction

Maria Chiricotto*[1] and Lorenzo Giacomelli[2]

[1]Institut für Angewandte Mathematik [Heidelberg] – Im Neuenheimer Feld 294 D-69120 Heidelberg, Germany

[2]Università degli Studi di Roma "La Sapienza" [Rome] – Piazzale Aldo Moro 5, 00185 Roma, Italy

Abstract

The lubrication approximation for a liquid droplet spreading on a plane solid surface leads to a class of free boundary problems for fourth order degenerate parabolic equations. The focus here is on effective conditions which relate the speed of the contact line (where liquid, solid and vapor meet) to the microscopic contact angle. One such condition has been recently proposed by Weiqing Ren and Weinan E (Physics of Fluids 19 (2007), 022101): it includes into the model the effect of frictional forces which arise at the contact line from unbalanced components of the Young's stress, leading to an additional dissipation term in the energy balance. We are interested in the well-posedness of weak solutions as well as for a class of traveling-wave solutions. For speed-dependent contact angle conditions of rather general form, a matched asymptotic study is worked out, relating the macroscopic contact angle to the speed of the contact line. This is joint work with Lorenzo Giacomelli (La Sapienza - University of Rome).

*Speaker