Collision between two chemically active particles

<u>Z. Eskandari</u>[1], M. N. Popescu[1], M. Tasinkevych[1], and S. Dietrich[1,2]

[1]*Max-Planck Institut für Intelligente Systeme, Stuttgart, Germany*
[2]*4. Institut für theoretische Physik, Universität Stuttgart, Germany*

A spherical micron-sized particle with catalytically active coating on part of its surface can move within a liquid solution by promoting chemical reactions in the solution. This produces gradients of chemical species around the surface of the particle, which gives rise to a “phoretic” slip due to interaction (attraction or repulsion) of the chemical solute with the surface of the particle. When two such active particles approach each other, the distributions of solutes in the vicinity of the particles overlap, which gives rise to effective interactions in addition to the purely hydrodynamic ones. Thus these particles effectively interact *via* a complex coupling between hydrodynamics and distribution of solute particles.

Here, we study numerically the binary collision of two identical chemically active particles. We present and discuss the outcome of such collisions as a function of the catalyst coverage and the relative separation between particles. For catalyst coverages above a certain threshold, we find that stable steady states emerge for the case of head-on collision, in which the self-propelling motion is balanced by the hydrodynamic repulsion. In this state, particles are motionless at a certain separation from each other, yet a steady state hydrodynamic flow is maintained. This stable configuration disappears if the phoretic slip at the surface of particles is clamped to the one corresponding to a particle in the bulk, revealing that only hydrodynamic interaction between two squirmers cannot sustain the stable configurations noted above.