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Effect of hydrodynamic interactions on quasi two-dimensional reaction rates NAOMI OPPENHEIMER, Simons Foundation, HOWARD STONE, Department of Mechanical and Aerospace Engineering, Princeton University — The Brownian motion of two particles in three dimensions serves as a model for predicting the diffusion-limited reaction rate as first discussed by Smoluchowski (1916). Deutch and Felderhof (J. Chem. Phys., 1973) extended the calculation to account for hydrodynamic interactions between the particles and the target, which results in a reduction of the rate coefficient by about half. Many chemical reactions take place in quasi two-dimensional systems, such as on the membrane or surface of a cell. We perform a Smoluchowski-like calculation in a quasi two-dimensional geometry, i.e. a membrane surrounded by fluid, and account for hydrodynamic interactions between the particles. We show that rate coefficients are reduced relative to the case of no interactions. The reduction is more pronounced than the three-dimensional case due to the long range nature of two-dimensional flows.

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