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Active particle penetration through a planar elastic membrane¹ ABDALLAH DADDI-MOUSSA-IDER, BENNO LIEBCHEN, ANDREAS M. MEN-ZEL, HARTMUT LOEWEN, Institut fuer Theoretische Physik II: Weiche Materie, Heinrich-Heine-Universitate Duesseldorf, Germany — Active penetration of nanoparticles through cell membranes is a fascinating phenomenon that may have important implications in various biomedical and clinical applications. Using particle-based computer simulations and theory, the penetration mechanism of an active particle through a planar elastic membrane is studied. The membrane is modeled as a self-assembled sheet of particles embedded in a Newtonian viscous fluid. A coarse-grained model is introduced to describe the mutual interactions between the membrane particles. Three distinct scenarios are identified, including trapping of the active particle, penetration through the membrane with subsequent self-healing, in addition to penetration with permanent disruption of the membrane. The latter scenario may be accompanied by a partial fragmentation of the membrane into bunches of isolated or clustered particles. Our approach might be helpful for the prediction of the transition threshold between the trapping and penetration in realspace experiments involving motile swimming bacteria or artificial active particles. Reference: A. Daddi-Moussa-Ider, B. Liebchen, A. M. Menzel, and H. Lwen, Theory of active particle penetration through a planar elastic membrane, New J. Phys. in press (2019).

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