First-Passage Properties of Active Particles with Position-Dependent Persistency

Kevin Klein1, Ludger Santen and M. Reza Shaebani

1Department of Theoretical Physics, Saarland University, Saarbrücken, Germany

We consider an active motion with a single-state of motility in confined geometries. We first investigate the mean first-passage time (MFPT) of a random walk with constant activity on a two-dimensional lattice and verify that the MFPT admits a minimum as a function of the activity. The optimal activity varies with the system size and the boundary conditions. We also study the MFPTs of random walks with position-dependent activity. We consider linearly increasing or decreasing activities versus the distance to the target, as well as nonmonotonic functions. It turns out that these search strategies can be even more efficient than the optimal constant activity choice, for some parameter values. Our results help to better understand the chemokinesis of biological organisms and enables us to propose more efficient search strategies by adapting the particle activity to the local available information about the target.