

# Exercises on computational methods for active matter

Rodrigo Soto

*Departamento de Física, FCFM, Universidad de Chile, Santiago, Chile.*

## I. DIFFUSION AS A FUNCTION OF PERSISTENCE

Take the code for ABP particles in 2D, ABP-Simulation-v5 (note that there was a small error in the force calculation in v4), or the code for the lattice mode, LatticeModel-v5.

Download them from

<https://www.dropbox.com/scl/fo/qtuqh7isbyxqhwtltzlr/AL-bzzWsOWVoFAfZ43M07zk?rlkey=7m4tfad0190wjgxf24ndjqt18>

Here, the idea is to study the mean square displacement for different persistences. Probably, it is easier to do it in the lattice model, which is faster and the method for the MSD is already implemented in the lattice model.

1. Run simulations for different values of the tumble rate  $\alpha$  and obtain the mean square displacements. Note that the range of  $\alpha$  is  $[0, 1]$ . If possible, obtain the diffusion coefficients by fitting the last part of the MSD to a straight line,  $\text{MSD}(t) = 4Dt + a$ .
2. Compare the results. Interpret the results by looking at the  $x - t$  diagrams.