Asymptotic behaviour of the run and tumble equation for bacterial chemotaxis

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In this talk, I will present a recent work (arXiv:2103.16524) on the long-time behaviour of the run and tumble equation which is a kinetic-transport equation modelling the bacteria movement under the effect of chemical stimulus. The movement of bacteria is a combination of a transport with a constant velocity, run, and a random change in the direction of the movement, tumble. We show the exponential convergence to unique stationary state for the linear run and tumble equation. This result is an improvement of a recent work by Mischler and Weng (Kinet. Relat. Models, 10 (3), 799-822 (2017)). We also consider a weakly nonlinear equation with a nonlocal coupling on the chemoattractant concentration. We construct a unique stationary solution for the weakly non-linear equation and show the exponential convergence towards it. I will also mention how this result give insights of tackling the higher nonlinearities with more physically relevant couplings. The last part is a subject of an ongoing work. This talk is based on joint works with Josephine Evans (University of Warwick).