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Orientation of Spheroidal Swimmers in Turbulent Flows FILIPPO DE LILLO, MATTEO BORGNINO, GUIDO BOFFETTA, Dipartimento di Fisica and INFN, Università di Torino, Italy, KRISTIAN GUSTAVSSON, BERNHARD MEHLIG, Department of Physics, Gothenburg University, Sweden, MASSIMO CENCINI, Istituto dei Sistemi Complessi, CNR, Rome, Italy — We study the orientation statistics of spheroidal microswimmers in turburbulent and chaotic flows. This problem is relevant both for plankton ecology [1] and medical applications [2]. We use direct numerical simulations (DNS) to integrate the Lagrangian trajectories of particles swimming in turbulence with fixed speed and orientation governed by fluid gradients [3]. Swimmers elongated along their swimming axis, align with the local flow velocity, with preferential downstream swimming. By the perturbative solution of a statistical model [4], we show that the alignment is due to the peculiar correlation of fluid velocity and its gradients along particle paths caused by swimming. Numerical computation of the relevant correlations in DNS results shows that the theoretical prediction applies with remarkable precision to turbulent flows [5].

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