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Dynamics of small flexible fibers in turbulent channel flow CRISTIAN MARCHIOLI, DIEGO DOTTO, University of Udine, ALFREDO SOLDATI, TU Wien — In this paper we investigate the dynamics of small flexible fibers in turbulent channel flow. Our aim is to examine the effect of local shear and turbulence anisotropy on the translation and rotation of fibers with different elongation and inertia. To these aims, we use a Eulerian-Lagrangian approach based on direct numerical simulation of turbulence in the dilute regime, and we model fibers, which are longer than the Kolmogorov scale, as chains of sub-Kolmogorov rods connected through ball-and-socket joints that enable bending and twisting. Velocity, orientation and concentration statistics, extracted from simulations at $Re_\tau = 300$, are presented to give insights into the complex fibers-turbulence interactions that arise when non-sphericity and deformability add to inertial bias. Compared to fibers that translate and rotate as rigid bodies relative to the surrounding fluid, flexible fibers exhibit a stronger tendency to accumulate in the near-wall region, where they are trapped by the same mechanisms that govern preferential concentration of spherical particles. In such region, the mean shear is strong enough to reduce bending and stretch the fibers. Preferential segregation into low-speed streaks and preferential orientation in the mean flow direction are also observed.

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