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Particle shape and orientation impact on the modulation of isotropic turbulence by Kolmogorov-scale size particles LENNART SCHNEIDERS[1], California Institute of Technology, KONSTANTIN FRHLICH, Institute of Aerodynamics of RWTH Aachen University, WOLFGANG SCHRDER, Institute of Aerodynamics of RWTH Aachen University; JARA Center for Simulation and Data Science — The modulation of decaying isotropic turbulence by non-spherical particles of Kolmogorov-scale size is investigated via direct particle-fluid simulations. A Cartesian cut-cell method with dynamic mesh refinement and dynamic load balancing is applied to explicitly resolve the stresses acting on the fluid-particle interfaces. Up to 60 000 ellipsoids are fully resolved, requiring $O(10^{10})$ mesh points. The decay rates of the fluid and particle kinetic energy are found to increase with the particle aspect ratio. This is due to the particle-induced dissipation rate and the direct transfer of kinetic energy, both of which can be substantially larger than for spherical particles depending on the particle orientation. The extra dissipation rate resulting from the translational and rotational particle motion is quantified using a recently derived analytical model. This generic expression describes the impact of individual inertial particles on the local energy balance independent of the particle shape and enables to quantify the share of the rotational particle motion in the kinetic energy budget.

[1]Membership Pending

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