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Rotational response of suspended particles to turbulent flow: laboratory and numerical synthesis[1] EVAN VARIANO, University of California, Berkeley, LIHAO ZHAO, Norwegian Technical National University, MARGARET BYRON, University of California, Berkeley, GABRIELE BELLANI, University of Bologna, YIHENG TAO, University of California, Berkeley, HELGE ANDERSSON, Norwegian Technical National University — Using laboratory and DNS measurements, we consider how aspherical and inertial particles suspended in a turbulent flow act to "filter" the fluid-phase vorticity. We use three approaches to predict the magnitude and structure of this filter. The first approach is based on Buckingham's Pi theorem, which shows a clear result for the relationship between filter strength and particle aspect ratio. Results are less clear for the dependence of filter strength on Stokes number; we briefly discuss some issues in the proper definition of Stokes number for use in this context. The second approach to predicting filter strength is based on a consideration of vorticity and enstrophy spectra in the fluid phase. This method has a useful feature: it can be used to predict the filter a priori, without need for measurements as input. We compare the results of this approach to measurements as a method of validation. The third and final approach to predicting filter strength is from the consideration of torques experienced by particles, and how the "angular slip" or "spin slip" evolves in an unsteady flow. We show results from our DNS that indicate different flow conditions in which the spin slip is more or less important in setting the particle rotation dynamics.

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