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Direct measurements of vorticity with phosphorescence anisotropy in a free turbulent jet MARKUS JOHANN SCHMIDT, THOMAS ROESGEN, ETH Zurich — The utilization of phosphorescence anisotropy has recently been proposed for the direct measurement of vorticity. Dye-stained spherical nanoparticles in a fluid are illuminated with polarized light providing an orientation-sensitive excitation mechanism. The phosphorescence emission is polarized as well, and the observable polarization anisotropy can be related to the rotation of the particles during the phosphorescence lifetime. Integrating measurements were performed at first to overcome the low phosphorescence quantum yield. The signals could be acquired with a cooled CCD camera, integrating the signal over several pulsed laser excitations to analyze mean vorticity contributions. As an example for time resolved flow analysis, a free turbulent jet at Re 3000 was then investigated with an intensified sCMOS camera recording single shot signals, enabling statistical analysis of the flow regime with respect to vorticity. The talk will focus on an introduction of the measurement principle, followed by a presentation of single shot flow measurements and their analysis.

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