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Optimal Taylor-Couette turbulence[1] SANDER G. HUISMAN, Physics of Fluids - University of Twente, DENNIS P.M. VAN GILS, SIEGFRIED GROSSMANN, CHAO SUN, DETLEF LOHSE — Strongly turbulent Taylor-Couette flow with independently rotating inner and outer cylinder with a radius ratio of $\eta = 0.716$ is experimentally analysed. From global torque measurements, the maximum in the angular velocity transport from the inner to the outer cylinder is found at slight counter-rotation, namely at an angular velocity ratio of $a_{opt} = -(\omega_o/\omega_i)_{opt} \approx 0.37$. This value is theoretically interpreted and predictions for general η are made. With the help of laser Doppler anemometry, we in addition provide angular velocity profiles. The ratio $a_{opt} \approx 0.37$ is distinguished by zero angular velocity gradient $\partial \langle\omega\rangle_t / \partial r = 0$ in the bulk. For stronger counter- rotation $|\omega_o| > 0.37\omega_i$ the probability distribution function of the bulk angular velocity becomes bi-modal, reflecting intermittent bursts of turbulent structures beyond the neutral line into the outer flow domain, which otherwise is stabilized by the counter-rotating outer cylinder.

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