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Decaying grid-generated turbulence in a rotating frame CYPRIEN MORIZE, FRÉDÉRIC MOISY, MARC RABAUD, FAST - Bât 502 - Campus Universitaire - 91405 Orsay Cedex - France — Decaying turbulence in a rotating frame is experimentally investigated. Turbulence is generated by rapidly towing a grid in a rotating water tank, and the velocity field in a plane perpendicular to the rotation axis is measured by means of particle image velocimetry. A power-law decay of energy is observed up to the Ekman timescale, above which the friction from the Ekman layers become dominant. The value of the decay exponent is found to decreases continuously from $n \simeq 2$ to 1 as the rotation rate is increased. We show that these values can be understood from dimensional analysis, neglecting the anisotropy but including the effect of the confinement. The energy spectrum perpendicular to the rotation axis becomes steeper as the micro Rossby number $Ro_\omega = \omega'/2\Omega$ (where Ω is the rotation rate and ω' the vorticity r.m.s.) decreases below 2, with an exponent that increases from its classical Kolmogorov value 5/3 up to 2.3 ± 0.1. Below the same Ro_ω threshold, the velocity derivative skewness decreases as $|S| \propto Ro_\omega$, reflecting the inhibition of the energy transfers by the background rotation, with an inverse energy cascade that develops at large scales.

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