Abstract Submitted
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Rotating thermal convection at low Prandtl numbers[1] STEPHAN WEISS, GUENTER AHLERS, Department of Physics, University of California, Santa Barbara, USA — We present experimental results for rotating thermal convection in a cylindrical cell of aspect ratio $\Gamma \approx 1$ and Prandtl number $\mathrm{Pr} \approx 0.7$. This value of Pr is relevant to atmospheric convection. By using different compressed gases, we covered the Rayleigh-number range from 6×10^7 to 2×10^{10}. We investigated the transported heat, expressed in terms of the Nusselt number, as well as the sidewall temperature, as a function of the dimensionless rotation rate which we expressed in terms of the inverse Rossby number $1/Ro = 2\Omega/\sqrt{\alpha g \Delta T/L}$. For small Ra we found an increase of Nu with rotation that reached values about 1.5% larger than Nu without rotation. This heat-transport enhancement is significantly smaller than it is for larger Pr, since Ekman pumping cannot efficiently transport warm (cold) fluid from the bottom (top) boundary layer. Numerical simulations by Stevens et al. (NJP Vol. 12, 075005 (2010)) did not resolve any Nusselt-number enhancement for our Pr and Ra numbers. Optical access via shadowgraphy allowed us to study how cold plumes became twisted and formed vortices - a precondition for Ekman pumping.

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Stephan Weiss
Department of Physics, University of California, Santa Barbara, USA

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