Abstract Submitted
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Finite-size effects lead to supercritical bifurcations in turbulent rotating Rayleigh-Bénard convection[1] STEPHAN WEISS, U. California, Santa Barbara, RICHARD STEVENS, U. Twente, NL, JIN-QIANG ZHONG, U. California, Santa Barbara, HERMAN CLERCX, DETLEF LOHSE, U. Twente, NL, GUENTER AHLERS, U. California, Santa Barbara — Discontinuous transitions between different turbulent states are rare, since turbulence is expected to sample all of phase space over wide parameter ranges. However, it was found[2] in turbulent rotating thermal convection of a fluid between two parallel horizontal plates that the Nusselt number Nu is strongly enhanced when the inverse Rossby number 1/Ro, which is proportional to the rotation rate Ω, exceeds a critical value $1/\mathrm{Ro}_c$. The enhancement is due to the formation of Ekman vorticies that extract additional fluid out of the thermal boundary layers at the sample top and bottom. As found in experiments and numerical simulations in cylindrical systems, $1/\mathrm{Ro}_c$ is proportional to $1/\Gamma$ where $\Gamma \equiv D/L$ (with D being the cell diameter and L the cell height). We present a Ginzburg-Landau like model that explains the existence of a bifurcation at finite $1/\mathrm{Ro}_c$ as a finite-size effect, and yields the proportionality between $1/\mathrm{Ro}_c$ and $1/\Gamma$.

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[2]R.J.A.M. Stevens, J.-Q. Zhong, H.J.H. Clercx, G. Ahlers, and D. Lohse, Phys. Rev. Lett. 103, 024503 (2009).

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