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Turbulent scaling in rotating spherical Couette flow DANIEL S. ZIMMERMAN, SANTIAGO ANDRÉS TRIANA, University of Maryland Physics/IREAP, DANIEL P. LATHROP, University of Maryland Physics/IREAP/Geology — We study the parameter dependence of torque and other flow quantities in rapidly rotating spherical Couette flow with radius ratio $\eta = r_{\mathrm{i}}/r_{\mathrm{o}} = 0.35$ using the University of Maryland 3m system. We examine the dependence of the dimensionless torque, $G = T/\rho\nu^2 L_{gap}$, on the Reynolds number, $Re = \Delta\Omega L_{gap}^2/\nu$, and Rossby number, $Ro = \Delta\Omega/\Omega_{\mathrm{o}}$, for $-5 < Ro < 90$ and $5 \times 10^5 < Re < 2 \times 10^7$. In this range, G is described well as a power law in Re multiplied by a Ro-dependent prefactor: $G \propto f(Ro)Re^{1.9}$. The turbulent flow exhibits several distinct transitions as Ro is varied; some of these exhibit bistability between adjacent states with significantly different torque demand. In the bistable ranges, the prefactor $f(Ro)$ is multi-valued. The complicated dependence on Ro and the simple dependence on Re may have important consequences for the prediction of turbulent transport in rapidly rotating, strongly turbulent flows like those found in planetary cores, oceans, and other geophysical and astrophysical objects.

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