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Rotating High Rayleigh Number Convection JOSEPH NIEMELA, SIMONE BABUIN, KATEPALLI SREENIVASAN, The Abdus Salam ICTP — Very high Rayleigh number convection with rotation is studied using cryogenic helium gas as the working fluid. Rayleigh and Taylor numbers were obtained up to maximum values of $Ra = 4 \times 10^{15}$ and $Ta = 3 \times 10^{15}$ under Boussinesq conditions. For these experiments the Rossby number was in the range $0.4 < \mathrm{Ro} < 1.6$ and Prandtl number varied as $0.7 < \mathrm{Pr} < 6$. Under all conditions, the effect of added steady rotation was to diminish the heat transfer. However, a sinusoidal time-variation of the rotation rate provided periodic spin-up which led to significant enhancement of the Nusselt number, presumably due to Ekman pumping, in the case when the Taylor number based on the modulation amplitude surpassed a critical value, roughly 10^{14}. Otherwise the periodic spin-up caused a reduction in the heat transfer as in the case when the rotation rate was held constant. The effect on heat transfer did not appear to be sensitive to the period of the modulation, which was nominally set to be comparable to the turn-over time of the large-scale mean wind.

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