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Heat transport and flow structure in rotating Rayleigh-Bénard convection

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Here we summarize the results from our direct numerical simulations (DNS) and experimental measurements on rotating Rayleigh-B\'enard (RB) convection. Our experiments and simulations are performed in a cylindrical samples with aspect ratio of $0.5 \leq \Gamma\leq 2.0$. Here \Gamma=D/L with D and L are the diameter and height of the sample, respectively. When the rotation rate is increased, while a fixed temperature difference between the hot bottom and cold top plate is maintained, a sharp increase in the heat transfer is observed before the heat transfer drops drastically at stronger rotation rates. Here we focus on the question of how the heat transfer enhancement with respect to the non-rotating case depends on the Rayleigh number Ra, the Prandtl number Pr, and the rotation rate, indicated by the Rossby number Ro. Special attention will be given to influence of the aspect ratio on rotation rate that is required to get heat transport enhancement. In addition, we will discuss the relation between the heat transfer and the large scale flow structures that are formed in the different regimes of rotating RB convection and how the different regimes can be identified in experiments and simulations.

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