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The effect of centrifugal buoyancy on the heat transport in rotating Rayleigh-Bénard convection[1] SUSANNE HORN, JONATHAN AURNOU, UCLA — In a rapidly rotating and differentially heated fluid, the centrifugal acceleration can play a similar role to that of gravity in generating convective motion. However, in the paradigm system of rotating Rayleigh-Bénard convection, centrifugal buoyancy is typically not considered in theoretical studies and, thus, usually undesired in laboratory experiments, despite being unavoidable. How centrifugal buoyancy affects the turbulent flow, including the heat transport, is still largely unknown, in particular, when it can be considered negligible. We study this problem by means of direct numerical simulations. Unlike in experiments, we are able to systematically vary the Froude number Fr (ratio of centrifugal to gravitational acceleration) and the Rossby number Ro (dimensionless rotation rate) independently, and even set each to zero exactly. We show that the centrifugal acceleration simultaneously leads to contending phenomena, e.g. reflected by an increase and a decrease of the center temperature, or a suppression and an enhancement of the heat transfer efficiency. Which one prevails as net effect strongly depends on the combination of Fr and Ro. Furthermore, we discuss implications for experiments of rapidly rotating convection.

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