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Optimal Prandtl number for heat transfer in rotating Rayleigh-Bénard convection[1] RICHARD STEVENS, Twente University, HERMAN CLERCX, Eindhoven University, DETLEF LOHSE, Twente University — The heat transfer in Rayleigh-Bénard convection (RBC) is determined by the Rayleigh number Ra and the Prandtl number Pr [2]. In case of rotation about the vertical axis the third dimensionless control parameter is the Rossby number Ro. Here we present numerical data for the heat transfer in rotating RBC for $Ra = 10^8$ as a function of Pr and Ro. When Ro is fixed the heat transfer enhancement with respect to the non- rotating value as function of Pr shows a maximum. This maximum is due to the reduced efficiency of Ekman pumping when Pr becomes too small or too large. When Pr becomes too small the heat that is carried by the vertical vortices spreads out in the middle of the cell, i.e. it makes Ekman pumping less efficient, due to the larger thermal diffusivity [3]. For higher Pr the thermal boundary layers (BLs) are much thinner than the kinetic BLs and therefore the Ekman vortices do not reach the thermal BL. This means that the fluid that is sucked into the vertical vortices is colder than for lower Pr and this limits the efficiency of Ekman pumping at high Pr.

[1]Stichting Fundamenteel Onderzoek der Materie (FOM)
[2]Ahlers et al. *Rev. Mod. Phys.* **81**, 503 (2009)
[3]Zhong et al. *Phys. Rev. Lett.* **102**, 044502 (2009); Stevens et al. *Phys. Rev. Lett.* **103**, 024503 (2009)

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