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Turbulent Rayleigh-Bénard convection of a nematic liquid crystal[1] STEPHAN WEISS, GUENTER AHLERS, University of California, Santa Barbara — While studying Rayleigh-Bénard convection (RBC) of Newtonian fluids is a challenging and interesting topic on its own, we want to expand this field by including anisotropic fluids such as liquid crystals. In these liquids certain fluid properties, such as for example the heat conductivity λ and the diamagnetic susceptibility χ, depend on the average orientation of the molecules (the director). We present results from experiments where the nematic liquid crystal 4-n-pentyl-4'-cyanobiphenyl (5CB) was used as a working fluid in turbulent RBC. Since χ is anisotropic, one can alter the director orientation, and thus λ, by applying a magnetic field H. Our measurements show that the effective heat conductivity $\lambda_{eff} = q/\Delta T$ of the turbulent sample increases quadratically with H (ΔT is the temperature difference between top and bottom plate and q the corresponding heat flux). We suggest a simple model that considers the interplay between the director-aligning magnetic field and the vigorous fluid motion that randomize the director orientations inside the thermal boundary layers at the top and bottom plates.

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