Heat-transport measurement in a turbulent fluid above the critical point\textsuperscript{1} GUENTER AHLERS, JIN-QIANG ZHONG, UCSB — Below the critical point (CP) at $P_c, T_c$ liquid and vapor co-exist along a line $T_\phi(P)$ in the temperature-pressure plane. When a fluid at $P < P_c$ and in the presence of gravity is heated from below and the resulting temperature difference $\Delta T = T_b - T_t$ ($T_b$ and $T_t$ are the temperatures at the bottom and top of the sample respectively) straddles $T_\phi$, then liquid can condense at the top and drop to the bottom. By virtue of the latent heat of vaporization this process will contribute strongly to the effective conductivity $\lambda_{eff}$ of the sample. Since the latent heat vanishes at the CP, one would expect this enhancement to vanish as $P \to P_c$ from below. We measured $\lambda_{eff}$ using ethane close to but above the CP along various isobars using a constant $\Delta T$ and varying $T_m = (T_t + T_b)/2$. Contrary to our expectations, even for $P > P_c$ we found that $\lambda_{eff}$ had a maximum for $T_m$ close to the temperature corresponding to the critical isochore and reached values well above those expected for a single-phase Boussinesq fluid at the same Rayleigh numbers.

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