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New Bounds on Convective Heat Transport in Internally Heated Convection ALI ARSLAN, ANDREW WYNN, GIOVANNI FANTUZZI, JOHN CRASKE, Imperial College London — We use quadratic auxiliary functions, which are equivalent to the classical background method, to prove bounds on the mean convective heat transport <wT>in internally heated (IH) convection. Bounds for Rayleigh-Bénard convection have been extensively studied, yet an extension of the same analysis to IH convection is not complete. The change in mechanism driving convection presents a unique problem, which is of importance in geophysical and astrophysical applications such as convection in the mantle. Bounds that depend explicitly on the Rayleigh number Ra have not yet been proved for IH convection. This talk will demonstrate that such Ra-dependent bound on <wT>can be obtained using quadratic auxiliary functions. Our bound grows as $\mathrm{Ra}^{1/5}$ and improves the previously known uniform bound <wT>$\leq 1/2$ over a finite range of Rayleigh numbers. Our bounds exceeds 1/2 when the corresponding critical temperature field violates the physical constraint of pointwise positivity. When this constraint is enforced by means of a Lagrange multiplier, numerical bounds appear to approach the value of 1/2 asymptotically.

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