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Numerical study of thermal transfer in Rayleigh-Benard convection under rarefied gas conditions GIANLUCA DI STASO, BIJAN GOSHAYESHI, FEDERICO TOSCHI, HERMAN CLERCX, Eindhoven University of Technology — The Rayleigh-Bénard problem has been analyzed in depth theoretically, experimentally and numerically under a broad range of conditions such as small and large Prandtl number, high Rayleigh number turbulent convection, non-negligible compressibility effects, as well as under rotation. The large majority of these studies have in common the underlying assumption of a continuum flow, i.e. the molecular mean free path is much smaller than any characteristic macroscopic spatial scale of the flow. In this contribution, we depart from this assumption and we numerically study the final state of a 2D Rayleigh-Bénard system under rarefied gas conditions using the Direct Simulation Monte Carlo method (DSMC), the standard particle-based numerical method for simulating rarefied gas flows. By collecting a large number of statistical samples, we quantitatively measure the heat flux enhancement when convection is present and we determine the influence of rarefaction conditions on the maximum attainable heat flux. Finally, we show that onset of convection is found only for a limited range of Rayleigh number and this range is reduced as the degree of rarefaction increases.

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