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Nonequilibrium Partition Function in the Presence of Heat Flow

In the literature on extended thermodynamics, the nonequilibrium partition function in the presence of a heat flux appears in a divergent form, which has been usually evaluated by expanding the divergence causing exponential factor involving the heat flux and by arbitrarily truncating the resulting divergent series of the integrals. In this paper, we show how to cast the nonequilibrium partition function in the presence of a heat flux into a convergent form and then calculate such a convergent nonequilibrium partition function in the case of a nonequilibrium dilute monatomic gas. We have used three different methods of evaluation. Thus one of the nagging problems is resolved that arises in the 13 moment approximation to irreversible processes in the nonequilibrium statistical mechanics of extended thermodynamics.