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Yang-Lee Zeros and Phase Boundary From Net-Baryon Number Multiplicity Distribution

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Fluctuations of conserved charges provide us information on the state of matter at freeze-out temperature T and baryon chemical potential μ.
Since the underlying multiplicity distribution of the net-baryon number is related to the canonical partition function $Z(T,V,N)$, one can construct the partition function $\mathcal{Z}(T,V,\mu)$ as a series of fugacity [1], $\mathcal{Z}(T,V,\mu)=\sum_{N=-N^*}^{N^*} Z(T,V,N)e^{\mu N/T}$,where N^* is maximum baryon number the system can possess.
While one may be able to obtain thermodynamic quantities and fluctuations from the partition function in this way, this also enables us to study Yang-Lee zeros, which is the zeros of the partition functions in complex chemical potential and provides information on the phase boundary.

In this work, we show that the information on the phase boundary extracted from Yang-Lee zeros of the truncated partition function is stable under the truncation up to some orders, by making use of a chiral random matrix model [2].
We compare the zeros from the exact solution of the model with those from truncated partition function and from the corresponding Skellam partition function.
We also show that the behavior of the zeros in the model against the truncation has a significant difference compared to those from the Skellam partition function.
We also discuss statistics necessary for obtain such zeros in heavy ion experiments.

1. A.Nakamura and K.Nagata, Nucl.Phys.**A931**, 825 (2014).
2. K.Morita and A.Nakamura, arXiv:1505.05985.

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