Description of the Module “**probabilities**”

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The normalized Maxwell-Boltzmann distribution is [e.g. see http://mathworld.wolfram.com/MaxwellDistribution.html]:

. (1)

Using the auxiliary variable:

. (2)

one can simplify this result to:

. (3)

The cumulative probability function is given by:

. (4)

. (5)

. (6)

So:

. (7)

Lets compute the energy probability distribution function:

which agrees with the result here: <https://en.wikipedia.org/wiki/Maxwell%E2%80%93Boltzmann_distribution>

Also, lets compute the PDF in terms of energy:

So:

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So the normalized PDF is:

Consider a harmonic oscillator with a frequency of mode , . The HO can be in any vibrational state.

The fraction of the first N states [0,…N-1] in the total sum:

. (8)

Total number of states:

. (9)

The probability to be in the vibrational state n is given by:

. (10)

The probability to be in any of states below state N:

. (11)

The probability that any of the states above N (including it) are occupied is given by:

. (12)