

Sigma-Decomposition in Semiclassical Physics

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Abstract

We derive a semiclassical approximation to the partition function of a one-dimensional quantum mechanical anharmonic oscillator using a path-integral representation. Given an inverse temperature β , the path-integral sums over closed paths parametrized by their coincident endpoints x_0 , and by their time of travel $\beta\hbar$. Each path is weighed by the exponential of minus its classical euclidean action. The semiclassical approximation is obtained by considering the minima of the action, and quantum statistical fluctuations around them. We show that the extrema of the action provide a sigma-decomposition [?] of the x_0 - β plane. We give a prescription [?] for taking the minima appropriately into account whenever we cross caustics separating regions of different number of extrema.

Keywords: Sigma-Decomposition ; Semiclassical Statistical Physics.

References

- [1] M. Peixoto and R. Thom, C. R. Acad. Sc. Paris I, **303**, 629 and 693 (1986); **307**, 197 (1988)
- [2] C. A. A. de Carvalho, R. M. Cavalcanti, E. S. Fraga, and S. E. Jorás, Physical Review E, **65**, 056112 (2002)