Mathematical Physics

Nearest Neighbor Distances on a Circle: Multidimensional Case

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We study the distances, called spacings, between pairs of neighboring energy levels for the quantum harmonic oscillator. Specifically, we consider all energy levels falling between E and E+1, and study how the spacings between these levels change for various choices of E, particularly when E goes to infinity. Primarily, we study the case in which the spring constant is a badly approximable vector. We first give the proof by Boshernitzan-Dyson that the number of distinct spacings has a uniform bound independent of E. Then, if the spring constant has components forming a basis of an algebraic number field, we show that, when normalized up to a unit, the spacings are from a finite set. Moreover, in the specific case that the field has one fundamental unit, the probability distribution of these spacings behaves quasiperiodically in log E. We conclude by studying the spacings in the case that the spring constant is not badly approximable, providing examples for which the number of distinct spacings is unbounded.

Comments:	Version 2 is updated to include more discussion of previous works. 17 pages with five figures. To appear in the Journal of Statistical Physics
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