Hawking radiation, the logarithmic phase singularity, and the inverted harmonic oscillator

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Some of the most intriguing, but unobserved quantum effects are Hawking [1] and Unruh [2] radiation. At the very heart of both phenomena lies a logarithmic phase singularity that manifests itself at a horizon in spacetime. A very similar singularity is present in the elementary quantum system of an inverted harmonic oscillator when viewed in rotated quadratures of phase space [3,4].

In this talk, we establish the astonishing resemblance [5] between these systems on a theoretical level. Moreover, we demonstrate that the Fourier transform of a logarithmic phase is the key element that governs both the Bose-Einstein and the Fermi-Dirac statistics. This feature determines not only the spectrum of the emitted particles at an event horizon in spacetime, but also the transmission and reflection coefficients of the inverted harmonic oscillator.

Finally, we present different possible ways to reveal the logarithmic phase singularity intrinsic to the energy eigenstates of the inverted harmonic oscillator by applying appropriate transformations in phase space.

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