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Unitary Phase Operator in Quantum Mechanics

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Abstract

The difficulties in formulating a natural and simple operator description of the phase of a quantum oscillator or single-mode electromagnetic field have been known for some time. We present a unitary phase operator whose eigenstates are well-defined phase states and whose properties coincide with those normally associated with a phase. The corresponding phase eigenvalues form only a dense subset of the real numbers. A natural extension to the definition of a time-measurement operator yields a corresponding countable infinity of eigenvalues.
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