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Title: Ternary and Binary Representation of Coordinate and Momentum in Quantum Mechanics

Abstract:

To simulate a quantum system with continuous degrees of freedom on a classical or quantum computer, it is necessary to reduce continuous observables (primarily coordinates and momenta) to discrete observables. We consider this problem based on expanding quantum observables in series in powers of two and three analogous to the binary and ternary representations of real numbers. The coefficients of the series (“digits”) are therefore Hermitian operators. We investigate the corresponding quantum mechanical operators and the relations between them and show that the binary and ternary expansions of quantum observables automatically leads to renormalization of some divergent integrals and series (giving them finite values).