

CONTINUOUS VS DISCRETE PROCESSES: THE PROBABILISTIC EVOLUTION OF SINGLE TRAPPED IONS

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Abstract

The evolution of a single trapped ion exhibiting intermittent fluorescence and dark periods may be described either as a continuous process, using differential rate equations, or discretely, as a Markov process. The latter models the atom as making instantaneous transitions from one energy eigenstate to another, and is open to the objection that superpositions of energy states will form which are not covered by the Markov process. The superposition objection is replied to, and two new mathematical elements, Markov vectors and Markov matrices, are proposed as additions to quantum theory. The paper concludes by attributing the cause of dark periods in the ion's history to instantaneous transitions in the ion itself, rather than to photon detection or other components of measurement.

Keywords: quantum evolution, atomic transitions, continuity vs discreteness, Markov processes

Subjects: [Specific Sciences: Physics: Quantum Mechanics](#)

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