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THEORETICAL PHYSICS

Foundations of Quantum Theory

Uncertainty Relations Over Compact Spaces and Lattices

New uncertainty relations are obtained and their consequences for Number-Phase Uncertainty relations for photons analysed. (H. Agrawal, D. Dhar, S.M. Roy, B.S. Shastry of I.I.Sc., Bangalore and V. Singh)

A Quantum Anti-Zeno Paradox

An exact differential equation for the operator describing time-dependent measurements continuous in time is etablished and a series solution obtained. A quantum anti-Zeno paradox follows. If a projection operator $E(t)$ with a smooth dependence on time is measured continuously from t=0 upto time T and if E(0) leaves the density operator for the initial state unaltered, then the probability of always finding $E(t) = 1$ from $t = 0$ to T is unity. A watched kettle is sure to "boil" (change its state) for generic ways of watching. For time-independent $E(t)$ one recovers the usual Zeno-paradox. (A.P. Balachandran of Syracuse University, U.S.A. and S.M. Roy)

Double Slit Trajectories In A Maximally Realistic Quantum Mechanics

Recently S.M. Roy and Virendra Singh have developed a maximally realistic quantum mechanics with a positive phase space density whose marginals reproduce simultaneously quantum probabilities for $n + 1$ complete commuting sets of observables (n= dimension of configuration space). Generalising this phase space density it is shown that it is possible to obtain double slit trajectories such that the particles initially located at the centres of the wave packets going through the two slits have classical motion. This is in contrast to the drastically non-classical trajectories obtained in the de Broglie-Bohm theory. (Felix Nagel of Heidelberg University and S.M. Roy)

Exact Solutions of the Caldeira-Leggett Master Equation

Exact solutions of the Caldeira-Leggett Master equation for the reduced density matrix for a free particle and for a harmonic oscillator system coupled to a heat bath of oscillators are obtained for arbitrary initial conditions. The solutions prove a factorization property of

the initial state dependence of the density matrix and yield eventual diagonalization in the energy basis for arbitrary initial conditions. (S.M. Roy and Anu Venugopalan, of P.R.L., Ahmedabad)