

Heuristic Approach to Non-Abelian Quantum Kinematics and Dynamics in Configuration Spacetime

J. Krause

Abstract

New plausible kinematic foundations of quantum dynamics are discussed in a heuristic manner in which the quantum rule stems directly from the non-Abelian configuration symmetries of a system. Upon quantizing the ‘complete’ configuration symmetry group itself, irreducible generalized configuration-state representations can be calculated, whose transition amplitudes yield the propagation kernel. These states result from solving a set of ‘generalized Schrödinger equations’ corresponding to the superselection rules dictated by the quantized group. The propagation kernel of the system is thus obtained as an invariant Hurwitz integral, defined over the manifold of the complete symmetry group. A heuristic argument is given in favor of this approach to non-Abelian quantum kinematics, in which sums over physical world lines are evaluated instead of sums over arbitrary paths, for obtaining the propagation kernel of quantum systems having a classical Lagrangian analog. The attained quantum kinematic formalism, however, is completely general and does not depend on this particular interpretation. Nevertheless, the heuristic argument strongly suggests that non-Abelian quantum kinematics contains the formalism of standard nonrelativistic quantum mechanics as a very special case. No examples of the issues involved are presented in this paper.