Nuclear Theory

A Euclidean formulation of relativistic quantum mechanics

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In this paper we discuss a formulation of relativistic quantum mechanics that uses Euclidean Green functions or generating functionals as input. This formalism has a close relation to quantum field theory, but as a theory of linear operators on a Hilbert space, it has many of the advantages of quantum mechanics. One interesting feature of this approach is that matrix elements of operators in normalizable states on the physical Hilbert space can be calculated directly using the Euclidean Green functions without performing an analytic continuation. The formalism is summarized in this paper. We discuss the motivation, advantages and difficulties in using this formalism. We discuss how to compute bound states, scattering cross sections, and finite Poincare transformations without using analytic continuation. A toy model is used to demonstrate how matrix elements of exp(-beta H) in normalizable states can be used to construct-sharp momentum transition matrix elements.

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