The Scattering positron-electron in Thermofield Dynamics using the Fock Space Structure

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Several experiments on positron scattering have been performed in recent years. In consequence theoretical studies of the differential and total cross section have been realized using different procedures. Usually these studies do not consider the influence of temperature; however, temperature may be an important factor in determining some properties of interest. In this context, the inclusion of temperature can be performed through the Thermofield Dynamics (TFD), a real-time quantum field theory developed by Umezawa and Takahashi; this theory considers a doubling of Hilbert space and a Bogoliubov transformation from which thermal operators are introduced; it has been used in several branches of physics, for example, condensed matter, quantum optics, quantum information, nuclear physics, non-commutative field theory models. In this work, we consider a systematic way of using Fock space structure to apply Thermofield Dynamics (TFD) in relativistic theory. We start from Dirac’s equation as describing a field of relativistic matter, the Fock space structure is applied to the original system and to its dual, and the Bogoliubov transformation is used to determine the expected value of quantum observables at the finite temperature. With this structure of Fock space and the second quantization method we have developed a relativistic finite temperature scattering theory: perturbation theory is developed, the scattering operator S in Fock space for the Dirac field is presented and the concepts of particle and antiparticle are introduced in the formulation in order to analyze the scattering positron-electron. (A S S: CNPq; C G R: CAPES)