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Environmental heat conversion as a relativistic quantum effect

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The starting point of this research was the importance of dissipation, always present in the practical cases. We obtained a quantum master equation with explicit coefficients for a system of Fermions interacting with a dissipative environment of other Fermions, Bosons, and the free electromagnetic field. When a semiconductor device, as a system of quantum injection dots interacting with an electromagnetic field mode, has been conceived as an application of this equation, we found that, with some conditions, this device behaves as a converter of the environmental heat into coherent electromagnetic energy. Although, at a first sight, this behavior could seem contradictory to the second law of thermodynamics, we found that this law, asserting the entropy increase in isolated systems, is valid only for molecular systems, while in a matter-field system the entropy may also decrease. More than that, in the conventional quantum theory, we found an important inconsistency with the basic equations of Hamilton, which can be removed only when the Hamiltonian of the Schrödinger equation is replaced by the Lagrangian. It is interesting that, while the conventional Schrödinger equation for low velocities remains practically unaltered, as should be, a Schrödinger type equation is obtained for high velocities. In this way, a quantum particle is described by a wave packet with invariant time dependent phases. Based on this invariance, as a fundamental physical principle, for a quantum particle we obtain the relativistic kinematics and dynamics. Taking the interaction with an electromagnetic field as a modification of the time dependent phase by a scalar potential conjugated to time, and a vector potential conjugated to the space coordinates, the Lorentz force and the Maxwell equations are obtained. The spin is obtained as a property of the dynamics of a quantum particle. In this framework, the time-space intervals do not refer any more to coordinates of classical particles as in the conventional theory of relativity, but to the coordinates of the quantum particle waves, which means that the relativistic theory becomes a part of the quantum theory. Considering waves in curvilinear coordinates, by a modification of the space-time metrics, the interaction of a quantum particle with a gravitational field is obtained. In this way, a matter-field system can be understood in the framework of a unitary theory, including the quantum dynamics, relativity, electromagnetic field, spin, and gravitation.

Biography

Eliade Stefanescu is known for a microscopic theory of open quantum systems, the invention and the microscopic theory of a semiconductor device for the conversion of environmental heat into usable energy, and a unitary relativistic quantum theory. He showed that a quantum particle is described by waves with invariant time dependent phases when the coordinates are arbitrarily changed. In this framework, he obtained a Schrödinger type equation for a relativistic system. More or less at the same time with other authors, he showed that the penetrability of a quantum barrier can be increased by dissipative coupling. He also showed that, while, according to the second law of thermodynamics, an isolated molecular system may evolve only with entropy increase, in some conditions, the entropy of some matter-field systems can also decrease. In this way, he opened a perspective for devices without external energy suppliers, and of cold engines, with efficiency

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