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Environmental heat conversion into usable energy as a quantum effect of the matter-field dynamics

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Recently, we conceived a semiconductor structure converting environmental heat into electromagnetic energy and, further, into electric energy: while a current I is injected in the device, a super radiant field is generated by quantum transitions of electrons from the n-zones to the p-zones. We notice that this current enhances the lower states of the ohmic contacts between the n-p super radiant junctions, while the upper states of these contacts are depleted. This makes these contacts become colder, the current I traversing these contacts by thermal excitations of electrons, on the account of the heat absorption from the surrounding zones. This is a complex process based on the quantum dynamics of three coupled physical systems: (1) the active electrons in the quantum wells of the super radiant junctions, (2) the electromagnetic field in the device cavity, and (3) the optical vibrations of the crystal lattice, leading to an approximately 3 times variation of the field propagation velocity, according to the crystal refractive index. The dynamics of these systems includes an important dissipative component due to the couplings to the other electrons and to the mechanical vibrations of the crystal. We describe the dissipative quantum dynamics of the three systems by quantum master equations with explicit microscopic coefficients depending on the physical characteristics of the device. We understand the electron and electromagnetic field dynamics in the framework of a unitary relativistic quantum theory. In this theory, a quantum particle is described by wave packets in the two spaces of the coordinates and momenta, of a form providing the Hamilton equations as group velocities of the two wave packets, which include the Lagrangian instead of the Hamiltonian in the conventional wave functions. Unlike the classical relativistic principle of the light velocity consistency, we consider a relativistic quantum principle of invariance of the time dependent phase of a quantum particle.

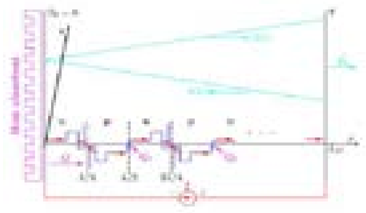

Figure.1: Semiconductor structure converting environmental heat into coherent electromagnetic energy. The electromagnetic field propagating in the cavity is amplified by transitions of quantum injection dots. An electromagnetic field E_0 is radiated through the output mirror.

Biography

Eliade Stefanescu graduated the Faculty of Electronics, Section of Physicist Engineers, in 1970, and obtained a PhD in Theoretical Physics in 1990. As a Scientist from 1976, a Senior Scientist III from 1978, he worked in physics and technology of semiconductor devices, and from 1978, he worked in physics of optoelectronic devices. From 1987, and from 1990 as a Senior Scientist II, he worked in the field of open quantum physics. In the years 1995-2000, he held a course called Dissipative Systems for the master degree. In 1991 he discovered that the penetrability of a potential barrier can be increased by coupling to a dissipative system, and described the decay spectrum of some cold fission modes. As a Senior Scientist I, from 1997 he developed a microscopic theory of open quantum systems, and discovered a physical principle for the heat conversion into usable energy. In 2014, he produced a unitary relativistic quantum theory. He received the Prize of the Romanian Academy for Physics in 1983, Diploma as Ordinary Member of the Academy of Romanian Scientists, Diploma and Golden Plate as Founder of the Academy of Romanian Scientists, and the Prize "Serban Titeica" (2014) for the book "Open Quantum Physics".

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