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Review text:

Quantum mechanics working with systems of a finite number of degrees of freedom is usually considered incompatible with relativistic kinematics. In particular, the free Klein-Gordon equation is usually understood as one of the building blocks of a relativistic quantum field theory rather than as an eligible quantum-mechanical candidate for a sufficiently consistent description of a relativistic motion of a single spinless particle. One of the most immediate reasons lies in the non-Hermitian (in fact, in the present language, σ_3-pseudo-Hermitian) character of the corresponding one-particle time-evolution generator H (i.e., energy operator, usually called Feshbach-Villars Hamiltonian). Obviously, some states (one usually calls them antiparticles) may have negative norm so that, formally, the metric in Hilbert space does not exist (or, in the other words, σ_3 remains indefinite and may merely be called a pseudo-metric). In the language of physics one simply cannot avoid a spontaneous creation of indefinitely many particle-antiparticle pairs in some sufficiently strong external fields.

Putting main emphasis on the author's own contribution to the recent intensive development of the possible alternative physical interpretation of all the similar pseudo-Hermitian quantum-mechanical systems (also known as PT- or CPT-symmetric quantum mechanics, see, e.g., Czechoslovak J. Phys. 54 (2004), pp. 1 - 156 and pp. 1005 - 1148 for complementary reading), this review tries to throw new light on many of the above-mentioned 75 years old questions. A. Mostafazadeh describes an alternative interpretation of the free one-particle Klein-Gordon system with real spectrum (i.e., in the absence of any strong external field). His proposal (with details available in some of his recent publications) is based on an introduction of a new scalar product (= the only

formula in his text) reflecting the existence of a nontrivial positively-definite metric $\eta_+ \neq I$ (factorized as CP in a major portion of the literature) in Hilbert space. This makes the Feshbach-Villars Hamiltonian H (quasi-)Hermitian and endows Klein-Gordon states with a new eligible consistent probabilistic interpretation.