School of Applied Mathematical & Physical Sciences

N.E. Mavromatos, MA, DPhil (Oxon), FInstP
Professor of Theoretical Particle Physics

Department of Physics

Tel: 00302107721747
e-mail: mavroman@mail.ntua.gr ,

National Technical University of Athens
9 Iroon Polytechniou,
Zografou Campus,
15780 Athens

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REVIEW of Ph.D. Thesis of Mr. Andrea BEVILACQUA

The Ph D dissertation deals with a formulation and study of properties (including those of potential phenomenological interest) of a κ-deformed complex scalar field under discrete transformations C, P, and T. An important innovative aspect of the Thesis is the formal study of two-particle states under deformed boosts. This sheds light in the combination of momenta of multiparticle states, which is an open issue in the κ-deformed Minkowski formalism and, more generally, of deformed Lorentz symmetries/special relativities. The author finds highly non trivial interactions between discrete and continuous symmetries, the phenomenological aspects of which, in particular differences in the life time of decaying particles, as compared to those in the standard model, are discussed in detail in this Thesis (in particular on pages 29-31 and figs. 1.1 and 1.2, with an application to the decays of flavoured neutral Φ mesons to neutral pairs of neutral mesons/antimesons (such as Kaons and neutral D-mesons, or (in the case of Y decays) neutral B-mesons). There are very interesting phenomenological predictions coming from the κ-deformed boosts, which can lead to novel tests of modified Lorentz symmetries, and in particular of κ-Minkowski. These results, which are discussed in the first two chapters of the Thesis, are based on research published in highly reputable journals (Phys. Rev. D).

In the third chapter of the Thesis, the κ-deformed propagator of the complex scalar field is derived, along with a non-trivial imaginary part of the corresponding one-loop correction, which also carries some consequences of potential phenomenological interest. The regularization in the κ-deformed case, and the role of an Ultraviolet (UV) cutoff are discussed in detail, and lead to novel results, compared to the non deformed case, as a consequence of the modified ``addition of momenta'' that characterise the loop corrections due to the exchange of a virtual pair

of κ-deformed scalar field quanta. This research constitutes original unpublished work (The thesis appears as an arXive preprint arXiv:2311.00014 [hep-th]).

In my opinion, the quality of the thesis is high at an international level. The dissertation is well written and the pertinent calculations are given in a clear and sufficiently detailed way, which makes the dissertation an easy one to follow by the readers. The results are very interesting, and timely, in view of the increasing interest in quantum gravity phenomenology these days. The author demonstrates a thorough knowledge of the material discussed and its associated background. He also distinguishes in a clear way, the original works, which he (co-)authored, from the ones by other authors, available in the pertinent literature.

The dissertation certainly meets the high standards of a Ph D degree in any internationally reputable University, such as yours. I fully recommend acceptance of this interesting and timely Ph D Thesis.

Sincerely Yours