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On the electromagnetic interactions of dirac and weyl particles

Abstract:

This presentation focuses on the electromagnetic interactions of Dirac and Weyl particles, showing that under special conditions they can exhibit extraordinary behavior. Specifically, we have shown that all Weyl particles, and under certain conditions Dirac particles, can exist in the same quantum state under a wide variety of electromagnetic 4-potentials and fields, infinite in number, which are explicitly calculated. We have also shown that Weyl particles can exist in different states in zero electromagnetic field, either as free particles, or in localized states. The localization, as well as the energy, of the particles can be fully controlled using simple electric fields, which can be easily realized in practice. Obviously, these results are particularly important regarding possible practical applications of Weyl particles, both considering solid-state physics in materials supporting these particles, as well as laser physics, using ions trapped by laser beams, which can simulate the behavior of Weyl particles. Some other results of particular importance, especially regarding practical applications, are the following: We have shown that the state of free Weyl or massless Dirac particles is not affected by the presence of a spatially constant, but with arbitrary time-dependence, electric field applied along their direction of motion, or a plane electromagnetic wave, e.g., a laser beam, of arbitrary polarization, propagating along the direction of motion of the particles. These results are expected to find interesting applications in several fields of science and technology, such as nanoelectronics, nanophotonics, solid state physics, etc., providing new pathways for further development in these fields, both in theory and applications

Biography

Georgios N. Tsigaridas has completed his PhD on nonlinear optics at the Department of Physics, University of Patras, and he is currently assistant professor at the Department of Physics, National Technical University of Athens, Greece. He has published more than 35 papers in reputable journals, covering several fields of laser physics and nonlinear optics. He is currently working on the electromagnetic interactions of Dirac and Weyl particles. This research has produced some exciting and unexpected results, leading to seven publications in reputable journals. The most important of these results will be presented in this conference