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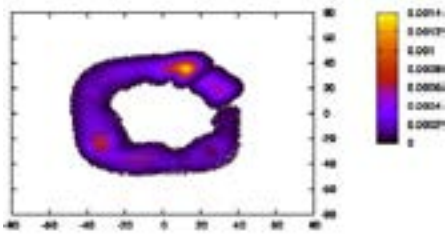
Time-dependent quantum mechanics in particle and nuclear physics

Time-dependent non-relativistic and relativistic quantum mechanics has been extensively used in atomic physics. It also allows for detailed studies of the development of systems in particle and nuclear physics not only for asymptotically-free states but also for states in the non-perturbative regime. It reveals rich phenomena that are not accessible with time-independent calculations. Some examples are the non-exponential decay of quantum systems including atomic and nuclear, survival probabilities of quarkonia in heavy-ion collisions, relativistic quantum interference and the Aharonov-Bohm effect, relativistic dynamic mass renormalization and others. It can also be used to calculate bound states by introducing imaginary-time propagation as well as the time-evolution of coupled fermion systems such as quarks bound in heavy and light mesons. In this talk several examples of non-relativistic and relativistic systems will be presented using analytical calculations when possible and numerical calculations for more complex problems. The computational challenges, especially those related to non-linear equations, will be discussed together with some very effective solutions. The time-dependent methods are very efficient in solving complex problems without the need of obtaining eigenvalues and eigenstates for interacting systems and the use of relatively small computational facilities. The relativistic, time-dependent Aharonov-Bohm effect. The electron probability density propagating diagonally is asymmetrically diffracted around aa very long, impenetrable solenoid that is placed perpendicularly to the plane at the center.



Biography

Dr. Athanasios Petridis completed his Ph.D. degree in Theoretical Particle Physics at Iowa State University in 1992. He was a member for the PHENIX collaboration which produced the first evidence for Quark-Gluon Plasma for eight years. He is currently a faculty member and Chairman of the Department of Physics and Astronomy at Drake University in Des Moines, Iowa where he teaches and is engaged in research on theoretical particle and nuclear physics together with his students. He is the author or co-author of many papers in reputed journals. His work has been cited many thousands of times. He is also an academic editor of the Current Journal of Applied Science and Technology.

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