

Non-linear phenomena in polar gases and quasi-relativistic spinor condensates

Luis Santos

Institut für Theoretische Physik, Leibniz Universität Hannover, Appelstr. 2, 30167
Hannover, Germany

Abstract:

In this talk I will overview some of our recent results on non-linear phenomena in two different physical scenarios: polar gases and quantum gases in the presence of artificial electromagnetism. In the first part I will discuss novel phenomena in polar gases, including the peculiar nature of Faraday patterns in dipolar condensates, the formation of Schrödinger cats in three-well systems, and novel physics in polar gases in optical lattices, including filamentation and enhanced instability. In the second part of this talk, I will briefly comment on the non-linear physics of spinor condensates in the presence of artificial electromagnetic fields, and most specifically spin-orbit coupling. I will show how the system may be described by a nonlinear Dirac equation, which may present self-localized solutions similar to those encountered in high-energy physics in the context of the massive Thirring model. These self-localized condensates which may exist as well in 2D and 3D present a rather peculiar dependence on interactions which largely depends on dimensionality.