Bound Vortex States and Exotic Lattices in Multi-Component Bose-Einstein Condensates: The role of Vortex-Vortex Interaction

Aristeu Rosendo PONTES LIMA
Universidade da Integracao Internacional da Lusofonia Afro-Brasileira
Instituto de Ciencias Exatas e da Naturez
Redencao, Brazil

Abstract:
We numerically study the vortex-vortex interaction in multi-component homogeneous Bose-Einstein condensates within the realm of the Gross-Pitaevskii theory. We provide strong evidences that pairwise vortex interaction captures the underlying mechanisms which determine the geometric configuration of the vortices, such as different lattices in many-vortex states, as well as the bound vortex states with two (dimer) or three (trimer) vortices. Specifically, we discuss and apply our theoretical approach to investigate intra- and inter-component vortex-vortex interactions in two- and three-component Bose-Einstein condensates, thereby shedding light on the formation of the exotic vortex configurations. These results correlate with current experimental efforts in multi-component Bose-Einstein condensates, and the understanding of the role of vortex interactions in multiband superconductors.