The Abdus Salam International Centre for Theoretical Physics

International Conference on Multi-Condensate Superconductivity and Superfluidity in Solids and Ultra-Cold Gases
14 - 18 May 2018 (Trieste, Italy)

Vortices in Dipolar Bose-Einstein Condensates

Antun Balaž

Scientific Computing Laboratory, Center for the Study of Complex Systems, Institute of Physics Belgrade, University of Belgrade, Serbia

Effects of dipole-dipole interaction can significantly modify properties of Bose-Einstein condensates, as demonstrated in the recent experiment [1], where the Rosensweig instability was observed in a quantum ferrofluid of a strongly dipolar BEC, leading to a formation of atomic droplets. Here we extend previous theoretical description of such a system that takes into account only correction of the ground-state energy [2,3], and develop a full Bogoliubov-Popov theory, which also accounts for the condensate depletion. Using this approach, we study generation of vortices and their properties in strongly dipolar ^{164}Dy BEC, in particular the dependence of the critical velocity of a moving obstacle to shed vortex dipoles. We also use extensive numerical simulations to consider if quantum droplets [1] can emerge in fast rotating BECs.

References

[1] H. Kadau, et al., Nature **530**, 194 (2016).
[2] T. D. Lee, K. Huang, and C. N. Yang, Phys. Rev. **106**, 1135 (1957).
[3] A.R.P. Lima and A. Pelster, Phys. Rev. A **84**, 041604(R) (2011); Phys. Rev. A **86**, 063609 (2012).