

EVOLUTION OF AN ISOLATED MONOPOLE IN A SPIN-1 BOSE-EINSTEIN CONDENSATE

K. Tiurev, P. Kuopanportti, A. M. Gunyhó, M. Ueda, and M. Möttönen

QCD Labs, COMP Centre of Excellence, Department of Applied Physics,
Aalto University, P. O. Box 13500, FI-00076 Aalto, Finland
email: konstantin.tiurev@aalto.fi

We simulate the decay dynamics of an isolated monopole defect in the nematic vector of a spin-1 Bose-Einstein condensate during the polar-to-ferromagnetic phase transition of the system[1]. Importantly, the decay of the monopole occurs in the absence of external magnetic fields and is driven principally by the dynamical instability due to the ferromagnetic spin-exchange interactions. An initial isolated monopole is observed to relax into a polar-core spin vortex, thus demonstrating the spontaneous transformation of a point defect of the polar order parameter manifold to a line defect of the ferromagnetic manifold. We also investigate the dynamics of an isolated monopole pierced by a quantum vortex line with winding number κ . It is shown to decay into a coreless Anderson-Toulouse vortex if $\kappa = 1$ and into a singular vortex with an empty core if $\kappa = 2$. In both cases, the resulting vortex is also encircled by a polar-core vortex ring.

- [1] K. Tiurev, P. Kuopanportti, A. M. Gunyhó, M. Ueda, and M. Möttönen
Phys. Rev. A 94, 053616 (2016).