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Decay of an isolated monopole into a Dirac monopole KONSTANTIN TIUREV, EMMI RUOKOKOSKI, HARRI MAKELA, MIKKO MÖTTÖNEN, QCD Labs, COMP Centre of Excellence, Department of Applied Physics, Aalto University, P.O. Box 13500, FI-00076 Aalto, Finland, DAVID HALL, Department of Physics, Amherst College, Amherst, Massachusetts 01002-5000, USA — Recently, we experimentally discovered topological point defects in the polar phase of spin-1 Bose-Einstein condensates of ⁸⁷Rb atoms. ¹ We numerically study the detailed decay dynamics of these isolated monopoles in experimentally realizable conditions. We find that the monopole decays by a dynamical quantum phase transition away from the polar phase. The resulting ferromagnetic order parameter is observed to exhibit a Dirac monopole in its synthetic magnetic field.² We furthermore show that the spin-spin interaction, quadratic Zeeman term and the three-body recombination seem to have no effect on the qualitative decay dynamics. These studies set the stage for the dynamics of topological point defects in quantum fields. Finding ways to extend the lifetime of the defect and thereafter to study the dynamics of multiple interacting point defects remains a future challenge.

¹M. W. Ray, E. Ruokokoski, K. Tiurev, M. Möttönen, and D. S. Hall. Observation of isolated monopoles in a quantum field. Unpublished, 2015
²M. W. Ray, E. Ruokokoski, S. Kandel, M. Möttönen, and D. S. Hall. Observation of Dirac monopoles in a synthetic magnetic field. Nature, 505:657-660, 2014.

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