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Probing Kibble-Zurek Mechanism in Quenched Elongated Bose Gases[1] I-KANG LIU, SHIH-CHUAN GOU, Dept of Phys, Natl Chang Hua Univ of Ed, Taiwan, GIACOMO LAMPORESI, SIMONE DONADELLO, FRANCO DALFOVO, GABRIELE FERRARI, INO-CNR BEC Center and Dipartimento di Fisica, Universita di Trento, 38123 Povo, Italy, NIKOLAOS PROUKAKIS, Joint Quantun Centre (JQC) Durham-Newcastle, Newcastle Univ, UK — We report our numerical findings on the statistics and dynamics of spontaneous formation of defects during a gradual quench of an initially thermal atomic gas to below the critical temperature. Our study focuses on the Trento experiments [Nat. Phys. 9, 656 (2013) and Phys. Rev. Lett. 113, 065302 (2014)], which showed the appearance of a few long-lived solitonic vortices [Phys. Rev. A 65, 043612 (2002)], as measured sometime after the system crossed the transition temperature. Our simulations access both the initial quench-driven turbulent regime where a large number of randomly-distributed defects emerge during the condensation, and the subsequent relaxation of such defects towards a few long-lived solitonic vortices, similar to those observed experimentally. We analyze our findings in the context of the Kibble-Zurek scaling law [J. Phys. A 9, 1387 (1976) and Nature 317, 505 (1985)], highlighting various subtle issues associated with this dynamical process, and characterize the transition through the critical region, by studying the corresponding first-order spatial correlation functions. Our simulations are based on the 3D stochastic projected Gross-Pitaevskii equation subjected to a linear temperature and chemical potential quench [arXiv:1408.08 (Phys. Rev. A in press)].

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