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Wave chaos of matter waves in periodic and disorder potentials IVA BREZINOVA, Institute for Theoretical Physics, Vienna University of Technology, LEE COLLINS, Theoretical Division, Los Alamos National Laboratory, KATHARINA LUDWIG, Institute for Theoretical Physics, Vienna University of Technology, BARRY SCHNEIDER, National Science Foundation, National Institute of Standards and Technology, JOACHIM BURGDOERFER, Institute for Theoretical Physics, Vienna University of Technology — For the description of the dynamics of Bose-Einstein condensates (BECs) the mean-field theory plays an important role. Within the mean-field theory the BEC is treated as a matter wave propagated via the Gross-Pitaevskii equation (GPE). We show that the GPE with repulsive interactions features chaotic wave dynamics for (a)periodic and disorder potentials. Chaos manifests itself through exponential divergence of initially nearby wavefunctions and results in random local fluctuations [1]. We discuss the implications of these observations for the limits of applicability of the GPE and the properties of the underlying many-body dynamics.

[1] I. Brezinova et al., arXiv:1101.4663 (2011).

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