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Matter-wave interference due to interactions MATTIAS GUSTAVSSON, ELMAR HALLER, MANFRED MARK, JOHANN DANZL, RUSSELL HART, HANNS-CHRISTOPH NÄGERL, University of Innsbruck — A BEC in a lattice potential undergoes Bloch oscillations when subject to an external force. If the force is strong enough, dynamical instabilities are suppressed and the interacting matter wave dephases in a coherent way, which we observe as a time-varying regular interference pattern in the first Brillouin zone. We further demonstrate the coherence through a reversal of the phase evolution analogous to spin-echo experiments, by switching the interaction strength to zero and applying an external potential. We also observe long-lived Bloch oscillations when the effect of interactions is balanced by a harmonic trapping potential. Furthermore, we explore the limit of vanishing interaction. In this regime we can follow more than 20000 oscillations over 12 s.

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