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Interaction-induced dephasing of Bloch oscillations - experiments and simulations MATTIAS GUSTAVSSON, ELMAR HALLER, MANFRED MARK, JOHANN DANZL, RUSSELL HART, HANNS-CHRISTOPH NÄGERL, University of Innsbruck — A BEC in an optical lattice undergoes Bloch oscillations when subject to an external force. However, interactions lead to dephasing, limiting the number of oscillations one can observe. We quantitatively characterize this dephasing by tuning the interaction strength using a Feshbach resonance. If the external force is strong enough that tunneling between lattice sites is negligible, the dephasing process leads to a regular structure in momentum space on momentum scales much smaller than the Brillouin zone. We can reproduce this structure through simulations of discrete 1D Gross-Pitaevskii equations and with a simple model of interfering Wannier-Stark states. The zero crossing of the scattering length can be determined precisely by minimizing the dephasing and we demonstrate control of the scattering length over four orders of magnitude. In the weakly interacting limit, we can follow more than 20000 oscillations over 12 s. By adding an additional harmonic potential, collapse and revival of the oscillations can be observed.

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