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Coherent control in a driven Fermi-Hubbard system ANNE-SOPHIE WALTER, KONRAD VIEBAHN, JOAQUIN MINGUZZI, KILIAN SANDHOLZER, FREDERIK GOERG, TILMAN ESSLINGER, Institute for Quantum Electronics, ETH Zurich — Coherent control is a widely applied technique in fields ranging from chemistry to ultracold atoms. It aims at steering quantum dynamics by controlling the relative phase between external light fields. In the context of Floquet engineering in periodically driven optical lattices, the drive can resonantly couple to higher Bloch bands and subsequently lead to dissipation. To overcome this problem we report on a coherent control scheme which allows for a wider range of possible driving frequencies.
In our experiment, we periodically modulate the potential depth of a 3D optical lattice at a frequency that excites atoms to a higher band. We apply coherent control by tuning the phase of an additional drive at twice the fundamental frequency which destructively interferes with the first. Through this technique we preserve both the band population as well as the fraction of double occupancies for more than two orders of magnitude longer compared to the single-frequency case. We find this technique to be effective even at strong Hubbard interactions. Strikingly, the lifetime of spin correlations, which are highly susceptible to heating, is also improved by more than two orders of magnitude and comparable to the static value.

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