Erratum: Temporal decay of Néel order in the one-dimensional Fermi-Hubbard model [Phys. Rev. A **91**, 053628 (2015)]

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In our paper, we overlooked a closely related work by Enss and Sirker [1]. Using a time-dependent matrix-product state method designed for the thermodynamic limit and developed in Ref. [1], they studied the relaxation dynamics in the one-dimensional Hubbard model starting from the initial state that is a product state with an alternating sequence of either empty or doubly occupied sites. This initial state reads

$$|\psi^D\rangle = |2,0,2,0,\dots\rangle. \quad (1)$$

Due to symmetries of the model discussed in Ref. [1], the relaxation dynamics is related to the dynamics starting from the Néel state

$$|\psi^N\rangle = |\uparrow,\downarrow,\uparrow,\downarrow,\dots\rangle. \quad (2)$$

The latter was directly studied in our work.

For instance, the double occupancy $d^N(t)$ in the time evolution of $|\psi^N\rangle$ can be obtained from the time evolution of $|\psi^D\rangle$ from [1]

$$d^N(t) = 1/2 - d^D(t), \quad (3)$$

where the double occupancy is

$$d^{N/D}(t) = \frac{1}{L} \sum_{i=1}^L \langle n_{i\uparrow} n_{i\downarrow} \rangle \quad (4)$$

[L is the number of sites, $n_{i\uparrow}$ ($n_{i\downarrow}$) is the density of spin-up (down) fermions on site i].

Therefore, as a consequence of Eq. (3), results for the double occupancy [as shown in our Fig. 1(a)] were already obtained in Ref. [1] [see their Fig. 5(a)]. Our results for the double occupancy are in quantitative agreement with those of Ref. [1].

Moreover, the prefactor c_S (denoted a in Ref. [1]) in the linear increase of the entanglement entropy $S_{vN} \sim c_S t$ was also extracted in Ref. [1] and analyzed as a function of interaction strength U [compare their Fig. 5(b) to Fig. 5 in our paper]. We extended the analysis of S_{vN} insofar as we demonstrated the crossover from a U -independent to a U -dependent dynamics of $S_{vN}(t)$ and we provide a comparison of $c_S(U)$ to the spinon velocity known from the Bethe ansatz.

Both studies also carry out a comparison between steady-state values of the double occupancy and the thermal expectation from a canonical ensemble. Reference [1] used their infinite-system size methods for this purpose. While there are differences between steady-state values and the thermal expectation values even in the thermodynamic limit, these are small and Ref. [1] interprets this as evidence for thermalization. We focused on finite systems and an analysis of finite-size trends, in comparison to the infinite-system size steady-state values. Our analysis suggests that the difference between thermal and steady-state values remains nonzero as system size increases and thus indicates the absence of thermalization.

[1] T. Enss and J. Sirker, *New J. Phys.* **14**, 023008 (2012).