Erratum: Matrix product state formulation of frequency-space dynamics at finite temperatures [Phys. Rev. B **90**, 060406(R) (2014)]

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The Gaussian resolution broadening η of the zero-temperature spectral functions shown in Figs. 2(a), 2(b), and 3 of our original paper is frequency dependent and therefore not uniform as incorrectly stated. In this Erratum, we correct the resolution of these zero-temperature results by displaying them at a uniform broadening for all frequencies. Most importantly, the resolution of the spectral functions at both $T = 0$ and $T > 0$ are now the same in the revised Figs. 2 and 3 presented here.

The reason is that, besides the order N of the Chebyshev expansions and the bandwidth W , the resolution of the spectral function also depends on the frequency ω [1],

$$\eta(\omega) = \frac{\pi}{N} \frac{W}{2W'} \sqrt{1 - \omega'^2}. \quad (1)$$

Here ω' denotes the linearly rescaled frequency which is a function of ω . This dependence can be neglected for the studied finite-temperature spectral functions since within the Liouville-space formulation $|\omega'| \ll 1$. However, at $T = 0$ the linear rescaling maps the support of the spectral function onto the lower part of the interval $[-W', W']$, where ω' is only slightly larger than -1 . Thus, the broadening $\eta(\omega)$ varies strongly as a function of frequency. This has been erroneously ignored by specifying a uniform broadening η for the zero-temperature results in Figs. 2(a), 2(b), and 3 in our original paper. In fact, the $T = 0$ resolution in the original paper is better than stated there, especially towards low frequency.

FIG. 2. Longitudinal spin structure factor $S_{zz}(k, \omega)$ of an isotropic Heisenberg chain ($J = 1$) in a magnetic field of $h_z = 1$ obtained by the Chebyshev matrix product state (MPS) method with approximate Gaussian broadening η . Left column: $h_x = 0$ ($\eta \approx 0.13$). Right column: $h_x = 0.3$ ($\eta \approx 0.14$).

^{*}Deceased.

FIG. 3. MPS results for the frequency dependence of $S_{zz}(k, \omega)$ at $k = 49\pi/51$ of an isotropic Heisenberg chain ($J = 1$) with $L = 50$ sites in a uniform magnetic field of $h_z = 1$ and an additional staggered field $h_x = 0.3$ at temperatures of $T = 0, 0.25, 0.5, 1$, and ∞ .

The revised Fig. 2 allows for a direct comparison between $T = 0$ and $T > 0$ results by choosing the same broadening for all frequencies. In order to introduce a frequency-independent broadening at $T = 0$, the expansion order N of the respective spectral functions is adapted as a function of frequency.

The results in the revised Fig. 3 have been obtained at an enhanced resolution ($\eta \approx 0.05$ instead of 0.14) in comparison to the original paper. The corrected resolution broadening of the zero-temperature spectral function is now frequency independent and corresponds with that of the finite-temperature results. Note that, after this correction, there is only slight thermal line-shape broadening of the main feature between $T = 0$ and $T = 0.25$ in the revised Fig. 3, whereas it is still present at higher T . The correction of the zero-temperature resolution has no further impact on the main results and conclusions of our paper.

[1] A. Weiße, G. Wellein, A. Alvermann, and H. Fehske, *Rev. Mod. Phys.* **78**, 275 (2006).