Erratum: Effects of imperfections for Shor's factorization algorithm [Phys. Rev. A 75, 052311 (2007)]

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There is an error in the numerical implementation of the static imperfection model [Eq. (21) in the paper], which resulted in an effective reduction of the disorder strength ϵ by approximately a factor of 2 for the cases of generic and correlated imperfection models. However, there was no error for the correlated imperfection model with all qubits in the control and computational register coupled by interactions. After correction of the error the dependence of the inverse participation ratio (IPR) ξ on ϵ [see Fig. 1(a)] remains qualitatively the same as in Fig. 6 of the paper. Nevertheless, the values of ϵ_c fluctuate strongly depending on the arithmetic properties of x, r, and N. These fluctuations remain quite strong even after increasing the number of data points [see Table II in [1] and Fig. 1(b) as compared to Table I and Fig. 10 of the paper]. The algebraic fit $\epsilon_c = B/(\log_2 N)^\beta$ gives $\ln B = 0.068 \pm 0.105$, $\beta = 1.420 \pm 0.054$ for the generic imperfection model, $\ln B = 0.70 \pm 0.19$, $\beta = 1.897 \pm 0.097$ for the correlated imperfection model, and $\ln B = -1.22 \pm 0.13$, $\beta = 1.523 \pm 0.068$ for the correlated imperfection model with all qubits coupled. We attribute the deviations of the exponents β from the theoretical values to finite size effects in number of qubits and the significant arithmetic fluctuations of ϵ_c as a function of r, x, and N.

In addition after publication we realized there were two typos in Eqs. (22) and (26) which should read

$$\delta_i, J_i \in [-\sqrt{3}\epsilon, \sqrt{3}\epsilon]; \tag{22}$$

$$\xi = \left(\sum_c |W(c)|^2 \right)^{-1}. \tag{26}$$

This did not affect any of the calculations.

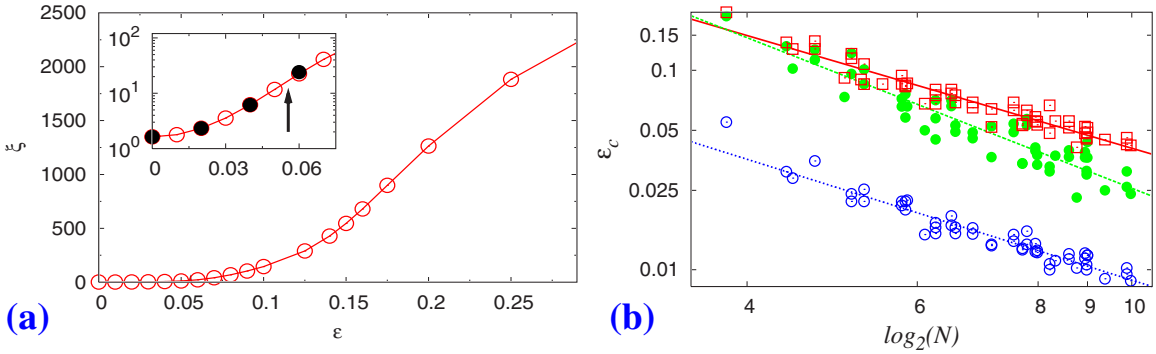

FIG. 1. (Color online) (a) The open circles (○) represent the averaged IPR ξ as a function of ϵ for $N=323$, $n_q=9$, $L=27$, $x=2$, the inset shows the dependence for small ϵ in log scale, the average is done over 20 disorder realizations. The full circles (●) show data obtained by a different numerical method [I. García-Mata, K. M. Frahm, and D. L. Shepelyansky (unpublished)]. The black arrow indicates ϵ_c defined by the criterion $\xi(\epsilon_c) = 10\xi(\epsilon = 0)$. (b) Dependence of ϵ_c on $\log_2 N$ in a logarithmic scale. The numerical data points correspond to the generic imperfection model (open squares), the correlation imperfection model (full circles), and the correlated imperfection model with all qubits coupled (open circles). The statistical error due to different disorder realizations is smaller than the symbol size. The straight lines show the fit $\epsilon_c = B/(\log_2 N)^\beta$ (see text).

[1] Find the corresponding data in the Appendix of the e-print, arXiv:quant-ph/0701169.

