Erratum: Nonlinear cavity feeding and unconventional photon statistics in solid-state cavity QED revealed by many-level real-time path-integral calculations **[Phys. Rev. B *96*, 201201(R) (2017)]**

M. Cygorek, A. M. Barth, F. Ungar, A. Vagov, and V. M. Axt

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In our article, we have studied phonon effects on the cavity feeding in a quantum-dot (QD) microcavity system. To this end, we have formulated a numerically exact real-time path-integral (PI) method that is able to efficiently treat a large class of multilevel systems. As a side aspect, we have compared the results obtained from the PI calculations with the results of polaron master equations (PMEs). Upon closer inspection of the numerical results obtained by solving the PME, we have found an error in our numerical implementation of these equations. The error occurs in a subroutine which is only called during the numerical evaluation of the PME and is thus neither present in the phonon free nor in the PI simulations. We have checked our corrected implementation of the PME against results obtained by an independent Runge-Kutta approach and find a perfect agreement between the two results.

Since the resulting changes only affect calculations using the PME, we limit the updated calculations to the results presented in Figs. 2(a) and 2(b) of the original paper.

In contrast to the previously published results where a difference of up to 60% between the PME results and the PI results for the average photon number was claimed, we now find a perfect agreement of the two theoretical approaches for the parameters chosen in the original paper (cf. Fig. 1). Thus, we have to conclude that the 41-level system with simultaneously strong driving and strong coupling is equally well described by the PME and a PI approach for these specific parameters. Apart from the discussed changes regarding the implementation of the PME, all other results in the paper are not affected and do not change.

It should be pointed out that the agreement between the PI simulations and the PME does not hold for arbitrary system parameters. As an example, doubling the radius of

FIG. 1. Time evolution (a) of the average photon number and (b) of the exciton occupation for a detuning $\delta = 20 \mu\text{eV}$ at $T = 10$ K calculated using the path-integral theory (black dashed curve), Markovian polaron master equations (green), and without phonons (violet) for a QD with a radius of 3 nm.

FIG. 2. Same as Fig. 1 but with an increased QD radius of 6 nm and higher temperatures of 50 and 80 K, respectively.

the InGaAs QD from 3 to 6 nm, which is still typical for self-assembled QDs, and increasing the temperature results in an underestimation of the phonon influence by the PME approach as can be seen in Fig. 2. Note that the difference between the PI and the PME calculations is larger for the average photon number compared with the exciton occupation. Since the phonon-free calculation does not change as it does not depend on the size of the dot, it is omitted in the figure. In

the long-time limit, we find differences of about 5% and 7% between the prediction for the average photon number by the PI and the PME simulations for temperatures of 50 and 80 K, respectively.

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