

Erratum: Contrasting exchange-field and spin-transfer torque driving mechanisms in all-electric electron spin resonance [Phys. Rev. B **112, 245408 (2025)]**

Jose Reina-Gálvez , Matyas Nachtigall , Nicolás Lorente, Jan Martinek , and Christoph Wolf



(Received 7 July 2026; published 27 July 2026)

DOI: [10.1103/dym9-wwmh](https://doi.org/10.1103/dym9-wwmh)

In the published paper, several expressions and explanatory statements require correction or clarification. The corrections do not affect the numerical results, figures, or main conclusions of the paper.

(1) In Sec. II C, page 245408-5, immediately after Eq. (11), the sentence beginning “This expression corresponds to the lowest order in the coupling (sequential tunneling) and is therefore expected to decrease rapidly in the CB regime, while remaining large and constant outside of it.” should be replaced by

“This expression is general. Its perturbative order is set by the order retained in the rates. In the present work, we retain the lowest order in the coupling, corresponding to sequential tunneling. Within this approximation, the current is expected to decrease rapidly in the CB regime while remaining large and constant outside it.”

(2) In Sec. II D, page 245408-6, Eq. (17b) should read

$$\begin{aligned}\hbar\dot{\rho}_0 &= 2\operatorname{Re}(\Gamma_{g0,0g}^{P_\alpha=0}(t))(1-\rho_0-\rho_2)-4\operatorname{Re}(\Gamma_{0g,g0}^{P_\alpha=0}(t))\rho_0+4\sum_{\alpha}\operatorname{Re}(\Gamma_{g0,0g,\alpha}^{P_\alpha=0}(t))P_{\alpha}\langle s_z\rangle/\hbar, \\ \hbar\dot{\rho}_2 &= 2\operatorname{Re}(\Gamma_{g2,2g}^{P_\alpha=0}(t))(1-\rho_0-\rho_2)-4\operatorname{Re}(\Gamma_{2g,g2}^{P_\alpha=0}(t))\rho_2-4\sum_{\alpha}\operatorname{Re}(\Gamma_{g2,2g,\alpha}^{P_\alpha=0}(t))P_{\alpha}\langle s_z\rangle/\hbar.\end{aligned}$$

The corrected terms are $\Gamma_{0g,g0}^{P_\alpha=0}(t)$ and $\Gamma_{2g,g2}^{P_\alpha=0}(t)$.

(3) In Sec. IV B, page 245408-13, the $\mathbf{s}\times\mathbf{B}$ product should be replaced by $\langle\mathbf{s}\rangle\times\mathbf{B}$.

(4) In Appendix C, page 245408-21, right after Eq. (C2), “Expression that gives” should be replaced by

“This expression is suitable for analytical purposes, although the transient populations should be retained in numerical calculations. Equation (C2) gives”

(5) In Appendix E, page 245408-24, the last paragraph should be updated as follows:

“By considering that $\sum_{\alpha}P_{\alpha}[\operatorname{Re}(\Gamma_{g0,0g,\alpha}^{P_\alpha=0}(t)-\Gamma_{g2,2g,\alpha}^{P_\alpha=0}(t))]\sin\theta=\sum_{v=0,2}\operatorname{Re}(\Gamma_{ev,vg}(t))$, valid in the limit of $\hbar\omega\ll|\varepsilon|,\varepsilon+U$, the polarization-dependent terms in the $\langle s_x\rangle$ equation cancel, while the $\langle s_z\rangle$ equation yields the nonequilibrium spin accumulation. The same approximation simplifies the transient-occupation equations and, together with the corresponding imaginary-part relation $\sum_{\alpha}P_{\alpha}[\operatorname{Im}(\Gamma_{g0,0g,\alpha}^{P_\alpha=0}(t)-\Gamma_{g2,2g,\alpha}^{P_\alpha=0}(t))]\sin\theta=\sum_{v=0,2}\operatorname{Im}(\Gamma_{ev,vg}(t))$, leads to Eqs. (17a) and (17b).”

This corrects the previous statement by referring to the real part of the rates in the first relation and to the imaginary part in the second.

We also clarify that the term “homodyne detection” should not be understood as being exclusive to the FLT regime. In our model, purely FLT-driven and purely STT-driven responses produce predominantly symmetric signals. The asymmetric component arises from FLT-induced and STT-induced spin dynamics coexisting. These two spin responses acquire different dynamical phase shifts relative to the driving voltage, generating phase-sensitive mixed terms in the time-averaged current and

spin. This clarification corrects an interpretation in the original text, while leaving unchanged the numerical results and the distinction between exchange-field and spin-transfer-torque driving mechanisms. This corrected interpretation is consistent with Ref. [1], which was not available at the time of the original submission.

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- [1] D. Ruckert, S. Kovarik, R. Schlitz, M. Grellmann, A. Vishwakarma, P. Gambardella, and S. Stepanow, Coherent and dissipative spin torques in quantum dots: A unified framework for quantum spin dynamics, [Phys. Rev. Res. **8**, 023121 \(2026\)](#).