Erratum: M_F-Dependent Lifetimes due to Hyperfine Induced Interference Effects [Phys. Rev. Lett. 97, 183001 (2006)]

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In the Letter Phys. Rev. Lett. **97**, 183001 (2006), expression (4) should be substituted by

$$A(FM_F, \hat{e}_\rho, \boldsymbol{n}) = \sum_q |\langle \Gamma'^1 S_0 I F' M'_F | \hat{e}_\rho \cdot \boldsymbol{Y}^{(0)}_{3q}(\boldsymbol{n}) \sqrt{K'_{M,3,\lambda}} M^{(3)}_q + \hat{e}_\rho \cdot \boldsymbol{Y}^{(1)}_{2q}(\boldsymbol{n}) \sqrt{K'_{E,2,\lambda}} E^{(2)}_q | \text{“}\Gamma^3_0 D_3 I F M_F\text{”}\rangle|^2 \quad (1)$$

for an oriented atom, where $\hat{e}_\rho$ is the polarization vector and the notation of $\boldsymbol{Y}^{(p)}_{kq}$ follows those in [1]. The square of the sum of the two terms in expression (1) leads to a cross term, which describes the interference between an $M3$ and an $E2$ transition. This modulates the transition rate not only on the M_F but also on the emission direction. Consequently, an M_F and angular dependent transition rate could be observed under the condition that a specific axis is defined, as in the case of an EBIT (Electron Beam Ion Trap), where an electron beam and magnetic field define a direction. Hence, a more appropriate title of the Letter should be “M_F and Angular Dependent Transition Rates due to Hyperfine Induced Interference Effects.” Considering the fact that transitions through emission in all directions contribute to the decay of the initial state, the lifetime of the initial state should be the inverse of the transition rate integrated over all emission angles, which was neglected in the original Letter. The integration of expression (1) will lead to a cancellation of the interference effect leading to an F-dependent lifetime. Hence, the expression (5) in the Letter for measurement at angle θ should be replaced by

$$I(\theta, t) = \sum_{i,F,M_F} w_i I_{iFM_F}(\theta, 0) \exp[-t/\tau(i, F)]. \quad (2)$$

The contributions to the F-dependent transition rates from the $M3$ and $E2$ decays, along with the total transition rates and the corresponding lifetimes, are listed in Table I. In Ref.[2], one can see from Fig. 6a that the starting point of the decay curve in Fig. 7 is taken at 3–5 ms after the electron beam was shut. To take this into account, we fitted our synthetic decay curve at $\theta = \pi/2$ with a single exponential, at three starting times: (I) 3 ms, (II) 4 ms, and (III) 5 ms and naturally abundant xenon. The results as listed in Table I are 10.85, 11.38, and 11.83 ms, respectively. These results are in better agreement with the experimental results presented in [2], comparing with the previous theoretical predictions (also in Table I), where hyperfine quenching was not included. We conclude that the original title is improper and misleading, and an M_F and angular dependent decay rate, instead of lifetime, is expected, while the latter would violate the rotational invariance. But the following conclusion remains the same, which is that the decay curves measured with EBIT at different angles would have different decay behavior because of the different amplitude $I_{iFM_F}(\theta, 0)$, which would provide a chance for studying polarization information of the M_F population.

TABLE I. Contributions to the F-dependent rates $A(\mathrm{s}^{-1})$ for the $3d^{10}\ {}^1S_0$— “$3d^9 4s\ {}^3D_3$” transitions and final lifetimes of “${}^3D_3$” sublevels of Xe^{26+}.

isotope	I	F	$A(M3)$	$\epsilon^2 A(E2)$	$A(\mathrm{tot})$	τ (ms)
Xe	0	⋯	66.15	0.0	66.15	15.12
^{129}Xe	1/2	7/2	66.15	0.0	66.15	15.12
		5/2	66.15	286.34	352.49	2.84
^{131}Xe	3/2	9/2	66.15	0.0	66.15	15.12
		7/2	66.15	96.36	162.51	6.15
		5/2	66.15	92.53	158.68	6.30
		3/2	66.15	45.95	112.10	8.92
Fitted Lifetime (ms):				(I) 10.85	(II) 11.38	(III) 11.83
Exp. [2]					87 ± 4	11.5 ± 0.5
Theo. [2]			71.30			14.03
Theo. [3]			53.70			18.62

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