Quantum theory of coherent transverse optical magnetism: erratum

Stephen C. Rand

Division of Applied Physics, University of Michigan, Ann Arbor, Michigan 48109, USA (scr@umich.edu)

Received July 27, 2010 (Doc. ID 132358); published September 16, 2010

Several corrections of detail are made to an earlier paper. The main results and conclusions are unchanged.

OCIS codes: 190.0190, 190.4410, 190.7110, 320.7120.

For irreducible field components to be represented consistently throughout Ref. [1], the conjugation of some Rabi frequencies must be corrected in Eqs. (20), (21), (24), and (25).

$$V_{12}^{(e)} \equiv \langle 1|V^{(e)}|2\rangle = -\frac{1}{2}\hbar\langle 1|[\Omega_{+}^{(e)} + \Omega_{-}^{(e)}]e^{i\varphi} + h.c.|2\rangle, \quad (20)$$

$$V_{12}^{(m)} \equiv \langle 1|V^{(m)}|2\rangle = -\frac{1}{2}\hbar\langle 1|[\Omega_{+}^{*(m)} + \Omega_{-}^{*(m)}] + h.c.|2\rangle - \frac{1}{2}\hbar\langle 1|[\Omega_{+}^{(m)} + \Omega_{-}^{(m)}]e^{2i\varphi} + h.c.|2\rangle, \quad (21)$$

$$\rho_{12}^{(e)} = \frac{1}{2}\left\{\frac{[\Omega_{+}^{(e)} + \Omega_{-}^{(e)}]_{12}}{(\Delta_1 + i\Gamma_{12})}e^{i\omega t}\right\}(\rho_{11} - \rho_{22}), \quad (24)$$

$$\rho_{12}^{(m)} = \frac{1}{2}\left\{\frac{[\Omega_{+}'^{(m)} + \Omega_{-}'^{(m)}]_{12}}{(\omega_\varphi + i\Gamma_{12}^{(m)})}e^{-i\omega t} + \frac{[\Omega_{+}^{(m)} + \Omega_{-}^{(m)}]_{12}}{(\Delta_2 + i\Gamma_{12}^{(m)})}e^{i\omega t}\right\}(\rho_{11}^{(0)} - \rho_{22}^{(0)}). \quad (25)$$

The asterisk in Eq. (26) should be dropped. The same notational correction is needed in the sentence, "Hence the specific replacement $\Omega_0^{(m)} = [\Omega_+^{(m)} + \Omega_-^{(m)}]$ has been made for the magnetic term, and $\Omega_0^{(e)} = \frac{1}{2}[\Omega_+^{(e)} + \Omega_-^{(e)}]$ for the electric term."

The subscript on resonant frequency ω_0 in Eqs. (25), (28), (30), and (42) should be φ, not 0, to denote the *ground state* resonant frequency ω_φ of magnetically induced torsional vibrations that are azimuthal with respect to the optical B field:

$$\bar{M}(t) = -\hat{y}\left(\frac{Ne}{2m}\right)\left\{\frac{1}{2}\left[\frac{\langle 2|L_y|1\rangle[\Omega_0^{(e)}]_{12}[\Omega_0^{(m)}]_{12}}{(\Delta_1 + i\Gamma_{12}^{(e)})(\Delta_2 + i\Gamma_{12}^{(m)})}e^{i\omega t} + \frac{\langle 2|L_y|1\rangle[\Omega_0^{(e)}]_{12}[\Omega_0'^{(m)}]_{12}}{(\omega_\varphi + i\Gamma_{12}^{(m)})(\Delta_2 + i\Gamma_{12}^{(m)})}e^{-i\omega t}\right] + h.c.\right\}(\rho_{11} - \rho_{22}), \quad (28)$$

$$\tilde{M} = -\hat{y}\left(\frac{Ne}{m}\right)\frac{1}{2}\left[\frac{\langle 2|L_y|1\rangle[\Omega_0^{(e)}]_{12}[\Omega_0^{(m)}]_{12}}{(\Delta_1 + i\Gamma_{12}^{(e)})(\Delta_2 + i\Gamma_{12}^{(m)})} + \frac{\langle 2|L_y|1\rangle^*[\Omega_0^{*(e)}]_{12}[\Omega_0'^{(m)*}]_{12}}{(\omega_\varphi - i\Gamma_{12}^{(m)})(\Delta_2 - i\Gamma_{12}^{(m)})}\right](\rho_{11} - \rho_{22}). \quad (30)$$

Similarly, ω_0 should be ω_φ in the sentence, "We also note that the second term in Eq. (30) is much smaller than the first due to the ω_φ factor in the denominator (unless ω_φ is small compared to Δ_1)."

The exponential time factors were interchanged in Eq. (42). It should read

$$\bar{P}(t) = N\hat{z}(\mu_{21}^{(e)}\rho_{12}^{(m)}(t)\rho_{12}^{(e)} + h.c.) = N\hat{z}\left\{\left(\frac{1}{2}\frac{\mu_{21}^{(e)}[\Omega_0'^{(m)}]_{12}[\Omega_0^{(e)}]_{12}}{(\Delta_1 + i\Gamma_{12}^{(e)})(\omega_\varphi + i\Gamma_{12}^{(m)})} + h.c.\right) + \left(\frac{1}{2}\frac{\mu_{21}^{(e)}[\Omega_0^{(m)}]_{12}[\Omega_0^{(e)}]_{12}}{(\Delta_1 + i\Gamma_{12}^{(e)})(\Delta_2 + i\Gamma_{12}^{(m)})}e^{2i\omega t} + h.c.\right)\right\}. \quad (42)$$

The conclusions from Eq. (42) regarding frequency-dependent enhancement of magnetic effects were similarly interchanged. The discussion should state, ″Just like the magnetization at frequency ω in Eq. (31), the second harmonic signal is longitudinally polarized and contains the parametric resonance factor $[\Delta_2+i\Gamma_{12}^{(m)}]^{-1}$. The first term is a zero frequency interaction that predicts a static charge separation induced in dielectric media by moderately intense light. Since it is inversely proportional to ω_φ, its magnitude may be strongly enhanced when this quantity is small." All other results and conclusions of the paper are unchanged.

REFERENCES

1. S. C. Rand, "Quantum theory of coherent transverse optical magnetism," J. Opt. Soc. Am. B **26**, B120–B129 (2009).