Quantum theory of coherent transverse optical magnetism: erratum 2

Stephen C. Rand

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

Received June 6, 2011;
posted June 6, 2011 (Doc. ID 147618); published July 7, 2011

Ground state sublevels are assigned distinct labels to correct angular momentum matrix element notation.

OCIS codes: 190.0190, 190.4410, 190.7110, 270.1670.

Rotationally excited ground state 3 should be clearly distinguished from initial ground state sublevel 1 and electronically excited level 2 so that magnetic matrix elements in Eqs. (16)–(25) of [1] read

$$\mu_{12}^{(m)} \to \mu_{13}^{(m)}, \qquad \rho_{12}^{(m)} \to \rho_{13}^{(m)}, \qquad \Gamma_{12}^{(m)} \to \Gamma_{13}^{(m)},$$
$$\langle 1|L_y|2\rangle \to \langle 1|L_y|3\rangle,$$
$$\langle 2|V_{\pm}^{(m)}|1\rangle \to \langle 3|V_{\pm}^{(m)}|1\rangle$$
$$= (-)^{l_3-m_3}\frac{1}{2}\{B_{\pm}\langle \alpha_3 l_3 m_3\|\mu_{\mp}^{(m)}\|\alpha_1 l_1 m_1\rangle + c.c.\}\begin{pmatrix} l_3 & 1 & l_1 \\ -m_3 & q & m_1\end{pmatrix}.$$

Eqs. (16), (23), and (25) are thereby modified to read

$$\langle \bar{\mu}^{(m)}\rangle = -\hat{y}\langle 1|\mu^{(m)}|3\rangle\rho_{32'}^{(m)}(t)\tilde{\rho}_{21}^{(e)} + h.c.$$
$$= -\hat{y}\langle 1|\mu^{(m)}|3\rangle\rho_{31}^{(m)}(t)\tilde{\rho}_{21}^{(e)} + h.c.,$$
$$\rho_{13}(t) = \tilde{\rho}_{13}^{(m)^*}(\omega)\tilde{\rho}_{12}^{(e)}(\omega) + \tilde{\rho}_{13}^{(m)}(\omega)\tilde{\rho}_{12}^{(e)}(\omega)e^{2i\phi}$$
$$= \tilde{\rho}_{13}(\omega=0) + \tilde{\rho}_{13}(2\omega)e^{2i\phi},$$
$$\rho_{13}^{(m)} = \frac{1}{2}\left\{\frac{[\Omega_+^{\prime(m)} + \Omega_-^{\prime(m)}]_{13}}{(\omega_\varphi + i\Gamma_{13}^{(m)})}e^{-i\omega t} + \frac{[\Omega_+^{(m)} + \Omega_-^{(m)}]_{13}}{(\Delta_2 + i\Gamma_{13}^{(m)})}e^{i\omega t}\right\}(\rho_{11}^{(0)} - \rho_{22}^{(0)}).$$

State labels in Eqs. (27), (28), and (30)–(34) should be changed correspondingly to correct [1] and [2]:

$$\bar{M}(t) = -N\hat{y}\langle 3|\mu^{(m)}(t)|1\rangle\rho_{12}^{(e)}(t)\rho_{13}^{(m)}(t) + h.c.$$
$$= -\hat{y}\left(\frac{Ne}{2m}\right)\left\{\frac{1}{2}\left[\frac{\langle 3|L_y|1\rangle[\Omega_0^{(e)}]_{12}[\Omega_0^{(m)}]_{13}}{(\Delta_1 + i\Gamma_{12}^{(e)})(\Delta_2 + i\Gamma_{13}^{(m)})}e^{i\omega t} + \frac{\langle 3|L_y|1\rangle[\Omega_0^{(e)}]_{12}[\Omega_0^{\prime(m)}]_{13}}{(\Delta_1 + i\Gamma_{12}^{(e)})(\omega_\varphi + i\Gamma_{13}^{(m)})}e^{-i\omega t}\right] + h.c.\right\}(\rho_{11} - \rho_{22}),$$

where $\Delta_2 \equiv \omega_\varphi - 2\omega$. The second term is large if ω_φ is small. Similarly, Eq. (42) is

$$\bar{P}(t) = N\hat{z}(\mu_{31}^{(e)}\rho_{12}^{(e)}\rho_{13}^{(m)}(t) + h.c.)$$
$$= N\hat{z}\left\{\left(\frac{1}{2}\frac{\mu_{31}^{(e)}[\Omega_0^{(e)}]_{12}[\Omega_0^{\prime(m)}]_{13}}{(\Delta_1 + i\Gamma_{12}^{(e)})(\omega_\varphi + i\Gamma_{13}^{(m)})} + h.c.\right) + \left(\frac{1}{2}\frac{\mu_{31}^{(e)}[\Omega_0^{(e)}]_{12}[\Omega_0^{(m)}]_{13}}{(\Delta_1 + i\Gamma_{12}^{(e)})(\Delta_2 + i\Gamma_{13}^{(m)})}e^{2i\omega t} + h.c.\right)\right\}(\rho_{11} - \rho_{22}).$$

Matrix elements $\langle 3|L_y|1\rangle$ and $\langle 3|x|1\rangle$ in Eqs. (28) and (42) impose different parity requirements on states 1 and 3 determining $\bar{M}(t)$ or $\bar{P}(t)$, but selection rules for coherence in all three nonlinear effects are the same: $\Delta l_{12} = \pm 1$, $\Delta m_{12} = 0$, $\Delta l_{13} = 0$, and $\Delta m_{13} = \pm 1$.

REFERENCES

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