Erratum: Quenching of low-lying Rydberg states of Na colliding with ground-state He: A semiclassical approach [Phys. Rev. A 39, 1020 (1989)]

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Our semiclassical n-changing cross sections [1] for collisions of low-lying excited Na(9s) and Na(6s) atoms with ground-state He at thermal energies were obtained numerically by solving the coupled equations only to $R=30a_0$, because we believed the coupling to be negligible at larger R. Recently, we refined the calculations by extending the solution to $R=120a_0$ and by correcting an error in one of the radial coupling matrix elements at small R. The present results are qualitatively similar to what we reported earlier. However, the results for particular transitions differ in detail. The total quenching cross sections for Na(9s) agree very well with the earlier results, in the narrow velocity region considered in the earlier calculations, but the Na(6s) cross sections, which are very small and sensitive to all aspects of the calculation, are quite different. The present rate coefficients, calculated by integrating over all velocities, are 0.14 a.u. for Na(9s) and 4.6×10^{-4} a.u. for Na(6s) at $T=425$ K.

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[1] A. Kumar, N. F. Lane, and M. Kimura, Phys. Rev. A **39**, 1020 (1989).

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Erratum: Near–dipole-dipole effects in dense media: Generalized Maxwell-Bloch equations [Phys. Rev. A 47, 1247 (1993)]

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The following changes are in order.

In Eq. (4), R_{ab} should be $\mathcal{R}_{ab}$.

In Eq. (14a), $\mathbf{P}(\mathbf{x},t')$ should be replaced by $\mathbf{P}(\mathbf{x}',t)$.

In Eq. (14a), the expression should read $\varphi(\mathbf{x},t)=+4\pi\int d^3x' \ldots$ and not $\varphi(\mathbf{x},t)=-4\pi\int d^3x' \ldots$.

The expression for Eq. (14b) should read

$$\mathbf{A}(\mathbf{x},t)=\mathbf{A}^{\perp}(\mathbf{x},t)=\frac{2}{3c}\int_{v\ll\lambda^3} d^3x' \frac{\mathbf{J}^{\perp}(\mathbf{x}',t)}{|\mathbf{x}-\mathbf{x}'|} ,$$

where we have neglected a retardation factor of e^{ikR}, a good approximation in the sphere where $v\ll\lambda^3$. This result is derived by taking the k-space representation of the transverse Green's function from Ref. [10] and performing the k integration in a similar fashion as carried our in Sec. 12.11 of Jackson [1]. The factor of $\frac{2}{3}$ arises from the transverse nature of this contribution to the local field, and is the same as the leading $\frac{2}{3}$ in Eq. (19) for $\overleftrightarrow{\delta}^{\perp}(\mathbf{x})$.

Equation (15b) should be

$$\mathbf{E}^{\perp}+4\pi\mathbf{P}^{\perp}=\frac{i}{k}\nabla\times\nabla\times\mathbf{A} .$$

Equation (16) for the longitudinal field $\mathbf{E}^{\parallel}_{P}$ should read

$$\mathbf{E}^{\parallel}_{P}=+\frac{4\pi}{3}\mathbf{P}-\int_{v/\{\mathbf{x}\}} d^3x' \frac{\eta(R)}{R^3}(3\hat{\mathbf{R}}\hat{\mathbf{R}}-\overleftrightarrow{\mathbf{1}})\cdot\mathbf{P}(\mathbf{x}',t)$$

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instead of $\mathbf{E}_P^{\parallel}=-4\pi\mathbf{P}$. Note that both $\delta(\mathbf{x})$ [Eq. (17)] *and* $\delta^{\perp}(\mathbf{x})$ [Eq. (18)] are needed to arrive at this result. We have taken a surface term Σ to be zero:

$$|\Sigma|=\left|\int_S d\mathbf{S}\cdot\mathbf{P}^{\parallel}(\mathbf{x}',t)e^{i\mathbf{k}\cdot(\mathbf{x}-\mathbf{x}')}\right| \le A\max_{\mathbf{x}'\in S}|\mathbf{P}^{\parallel}(\mathbf{x}')| ,$$

where A is the surface area of our spherical region of volume v. Since v can be chosen to be arbitrarily small, as long as $d^3 \ll v \ll \lambda^3$, A can be made arbitrarily small, so $|\Sigma|=0$. Notice that the sphere of volume v is a virtual object and does not require additional boundary conditions on the fields at the surface interface. Also, it is well known that the contribution from the integral term in the revised Eq. (16) above vanishes over angular integration for a homogeneous medium (see Ref. [11]). Equation (16) constitutes a new proof of the Lorentz-Lorenz relation for static fields from a field-theoretic approach. This occurs since the longitudinal field φ acts instantaneously at a distance in the Coulomb gauge and so goes over directly into the static electric potential in the limit $k\rightarrow\infty$ or $\omega\rightarrow 0$.

The result in Eq. (21) should be

$$\mathbf{E}_P^{\perp}(\mathbf{x},t)=-\frac{4\pi}{3}\mathbf{P}^{\perp}(\mathbf{x},t)$$

instead of $\mathbf{E}^{\perp}=+(8\pi/3)\mathbf{P}+\cdots$. This expression is derived in a straightforward manner using the corrected Eqs. (14b) and (15b) and also by recalling that $\nabla^2(1/R)=-4\pi\delta(\mathbf{R})$.

Equation (22) should then read

$$\begin{aligned}\mathbf{E}_P&=\mathbf{E}_P^{\parallel}+\mathbf{E}_P^{\perp}\\&=\frac{4\pi}{3}\mathbf{P}^{\parallel}-\frac{4\pi}{3}\mathbf{P}^{\perp}\\&=-\frac{4\pi}{3}\mathbf{P} ,\end{aligned}$$

our primary result.

Finally, in Eq. (26), R_{ab} should be $\mathcal{R}_{ab}$.

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