Erratum: Magic wavelengths for trapping the alkali-metal atoms with circularly polarized light **[Phys. Rev. A 87, 023402 (2013)]**

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In the above-named work, we had investigated magic wavelengths of some of the alkali-metal atoms using linearly and circularly polarized light. The magic wavelengths using linearly polarized light reported were very accurate, but they were not correct for the circularly polarized light due to a wrong formula given by Eq. (3) in our paper. The formula misses a factor of $\frac{1}{2}$ in the vector component contribution and assumes both $\cos(\theta_k)$ and $\cos(\theta_p)$ values to be equal to 1 for the weak magnetic field. The correct formula for the dynamic polarizability of a state with valence orbital v and angular frequency ω of the circularly polarized electric field [Eq. (3) of our work] is given as

$$\alpha_v(\omega) = \alpha_v^0(\omega) + \mathcal{A} \cos \theta_k \frac{m_j}{2j} \alpha_v^1(\omega) + \left\{ \frac{3 \cos^2 \theta_p - 1}{2} \right\} \frac{3m_j^2 - j(j+1)}{j(2j-1)} \alpha_v^2(\omega), \quad (3)$$

where $\mathcal{A} = 1$ for the right-handed and $\mathcal{A} = -1$ for the left-handed circularly polarized light. Other quantities in the above expression are defined in the original paper. In the absence of a magnetic field (or in a weak magnetic field), $\cos(\theta_k)$ and $\cos(\theta_p)$ are now chosen as 1 and 0, respectively. Corrected Figs. 4–6 for circularly polarized light are reproduced here. Similarly, Tables IV and VI are reproduced here. Apart from these changes, the rest of the contents of the original paper remain unchanged.

FIG. 4. Total dynamic polarizability for $2s$ and $2p_{3/2}$ states of a Li atom due to (a) linearly polarized light (b) circularly polarized light. Magic wavelength for the corresponding $2s$ - $2p_{3/2}$ transition are given by the crossing of two polarizability curves.

FIG. 5. Total dynamic polarizability for $3s$ and $3p_{3/2}$ states of a Na atom due to (a) linearly polarized light (b) circularly polarized light. Magic wavelength for the corresponding $3s$ - $3p_{3/2}$ transition are given by the crossing of two polarizability curves.

FIG. 6. Total dynamic polarizability for $4s$ and $4p_{3/2}$ states of a K atom due to (a) linearly polarized light (b) circularly polarized light. Magic wavelength for the corresponding $4s$ - $4p_{3/2}$ transition are given by the crossing of two polarizability curves.

TABLE IV. List of magic wavelengths for the circularly polarized light in Li, Na, and K atoms.

$m_j \rightarrow$	$np_{1/2} \rightarrow ns$		$np_{3/2} \rightarrow ns$			
	$-1/2$	$1/2$	$-3/2$	$-1/2$	$1/2$	$3/2$
Li						
$\alpha(\lambda_{\text{magic}})$	-292	-422	-292	-290	-340	-540
λ_{magic}	539(2)	571(1)	539(1)	538(2)	553(2)	588.7(6)
$\alpha(\lambda_{\text{magic}})$		272			368	223
λ_{magic}		1062(31)			899(5)	1298(66)
Na						
$\alpha(\lambda_{\text{magic}})$		-509			-516	-509
λ_{magic}		514.22(2)			515.08(1)	514.29(3)
$\alpha(\lambda_{\text{magic}})$	-1901	-1999	-1960	-1958	-2007	-2107
λ_{magic}	566.13(1)	567.22(1)	566.79(1)	566.78(1)	567.30(1)	568.30(1)
$\alpha(\lambda_{\text{magic}})$		1892			1874	1823
λ_{magic}		616.356(5)			616.629(3)	617.436(5)
$\alpha(\lambda_{\text{magic}})$		273			247	298
λ_{magic}		923.0(5)			1004.0(7)	872.1(3)
K						
$\alpha(\lambda_{\text{magic}})$	-205	-203	-206	-206	-206	-205
λ_{magic}	502.8(1)	502.33(4)	504.0(1)	504.0(1)	503.73(6)	503.29(6)
$\alpha(\lambda_{\text{magic}})$		-211			-215	-213
λ_{magic}		507.35(4)			509.41(4)	508.28(5)
$\alpha(\lambda_{\text{magic}})$	-214	-214	-217	-217	-217	-217
λ_{magic}	509.30(2)	509.50(2)	510.77(6)	510.8(7)	510.82(5)	510.84(2)
$\alpha(\lambda_{\text{magic}})$			-217	-217	-217	-218
λ_{magic}			511.2(1)	511.2(1)	511.23(1)	511.325(4)
$\alpha(\lambda_{\text{magic}})$		-251			-256	-253
λ_{magic}		530.73(5)			533.21(4)	531.56(7)
$\alpha(\lambda_{\text{magic}})$	-257	-258	-260	-260	-256	-261
λ_{magic}	533.87(2)	534.26(1)	535.51(1)	535.51(2)	535.78(1)	536.01(1)
$\alpha(\lambda_{\text{magic}})$		-355			-365	-356
λ_{magic}		575.58(5)			578.94(4)	576.13(8)
$\alpha(\lambda_{\text{magic}})$	-371	-372	-377	-377	-377	-378
λ_{magic}	581.03(1)	581.27(1)	582.97(1)	582.97(1)	583.14(1)	583.29(1)
$\alpha(\lambda_{\text{magic}})$		1134			-1213	-1156
λ_{magic}		688.08(5)			692.54(4)	689.38(4)
$\alpha(\lambda_{\text{magic}})$	-1236	-1237	-1293	-1293	-1293	-1293
λ_{magic}	693.740(3)	693.800(2)	696.60(1)	696(2)	696.60(5)	696.61(5)
$\alpha(\lambda_{\text{magic}})$	26080	-303			-327	-271
λ_{magic}	767.39(5)	767.84(1)			767.84(1)	767.84(1)
$\alpha(\lambda_{\text{magic}})$		485			472	489
λ_{magic}		1205.1(5)			1231.6(5)	1197(1)

TABLE VI. List of average magic wavelengths $\lambda_{\text{magic}}(\text{avg})$ for Li, Na, and K atoms for the left-circularly polarized light.

	$np_{1/2} \rightarrow ns$	$np_{3/2} \rightarrow ns$
Li	555(32)	555(51)
	1062(31)	
Na	514.22(2)	514.7(8)
	566.7(1)	567(2)
	616.356(5)	617(1)
	923.0(5)	938(132)
K	502.5(5)	504(1)
	507.35(4)	509(1)
	509.4(2)	510.8(1)
		511.2(1)
	534(1)	536(1)
	577.58(5)	577(3)
	688.08(5)	
	688(4)	691(4)
	767.6(4)	767.84(1)
	1205.1(5)	1214(34)