

Erratum: Landé g -factor measurements for the $5d6s\ ^3D_2$ hyperfine levels of $^{176}\text{Lu}^+$ [Phys. Rev. A **112, 032808 (2025)]**

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In the original paper, higher-order Zeeman corrections were not considered. Upon reanalysis we find that the third-order corrections contribute to the reported ratios of Zeeman splittings and subsequent evaluation of the hyperfine mediated quadrupole moment for $^3D_2$. Here we provide the corrected values of all relevant quantities.

The Zeeman shift, ν_{F,m_F} , on the $|F, m_F\rangle$ state is evaluated by perturbative expansion as

$$\nu_{F,m_F} = m_F \lambda_0 g_F B + \alpha_{F,m_F} B^2 + \lambda_{F,m_F} B^3 + O(4), \quad (1)$$

where $\lambda_0 = \mu_B/h$. In the original paper, Zeeman splittings ν_F are measured as half of the measured frequency difference between $|F, +1\rangle$ and $|F, -1\rangle$ states, leaving only odd powers of B contributing to the difference:

$$\nu_F = \frac{1}{2}(\nu_{F,+1} - \nu_{F,-1}) = g_F \lambda_0 B + \lambda_{F,1} B^3 + O(5). \quad (2)$$

We evaluate the third-order perturbation coefficients to be (in Hz/mT³)

$$\lambda_{F,1} = [21.729, -10.149, -6.9205, -3.2872, -1.3716]$$

for $F = 5, \dots, 9$, respectively. The corrected g_F factors are then given by

$$g_F = \bar{g}_6 r_F \left(1 + \frac{\bar{\lambda}_{6,1} - \lambda_{F,1}/r_F}{\lambda_0 \bar{g}_6} B^2 \right), \quad (3)$$

where r_F are the measured ratios given in the report, $\bar{\lambda}_{6,1} = 0.224 \text{ Hz/mT}^3$ is the cubic coefficient for $|^3D_1, 6, 1\rangle$, and

$$\bar{g}_6 = -0.071\,662\,546(33) \quad (4)$$

is the corrected g factor for the $F = 6$ hyperfine level of $^3D_1$. For evaluation of the corrections, it is sufficient to use the mean value of the magnetic field throughout each measurement, which was consistently $2.570(1) \text{ mT}$, and $\lambda_{F,1}$ calculated using $g_J = 1.156\,239$ consistent with Eq. 7(a).

The corrected g_F values are

$$g_5 = -0.385\,757\,50(19), \quad (5a)$$

$$g_6 = -0.110\,204\,760(53), \quad (5b)$$

$$g_7 = 0.061\,914\,212(31), \quad (5c)$$

$$g_8 = 0.176\,567\,084(86), \quad (5d)$$

$$g_9 = 0.256\,741\,67(12). \quad (5e)$$

Values given in the original paper Eq. (11) are then

$$\bar{g}_J = 1.156\,570\,08(54), \quad (6a)$$

$$\bar{g}_I = -1.478\,58(15) \times 10^{-4}, \quad (6b)$$

$$\bar{\beta}_1^{(1)} = 5.783\,70(93) \times 10^{-4}, \quad (6c)$$

$$\beta_1^{(2)} = -2.505\,0(77) \times 10^{-5}, \quad (6d)$$

$$\beta = -3.3(1.9) \times 10^{-8}, \quad (6e)$$

with the subsequent changes to the values in the original paper Eq. (13) given by

$$g_J = 1.156\,239(12), \quad (7a)$$

$$\beta_{2,1}^{(1)} = 8.6(1.6) \times 10^{-4}, \quad (7b)$$

$$\beta_{2,S}^{(1)} = 0.0(9) \times 10^{-4}, \quad (7c)$$

$$\beta_{2,3}^{(1)} = -1.5(2.5) \times 10^{-4}, \quad (7d)$$

$$\beta_{2,1}^{(2)} = -3.1(3) \times 10^{-5}, \quad (7e)$$

$$\beta_{2,S}^{(2)} = 0.0(3) \times 10^{-5}, \quad (7f)$$

$$\beta_{2,3}^{(2)} = 0.4(2.1) \times 10^{-5}. \quad (7g)$$

The resulting change to the estimated residual quadrupole moment is then

$$\langle \delta \Theta(^3D_2, F, m) \rangle_F = 0.85(30) \times 10^{-4} e a_0^2. \quad (8)$$

The change of $\approx 2\sigma$ arises from the correlated nature of the corrections.