I. $k \cdot p$ HAMILTONIAN

A. Hamiltonian

$$H_{11}^{kp} = a_1 + a_2 + c_1\left(k_x^2 + k_y^2\right) + c_2\left(k_x^2 + k_y^2\right) + c_3 k_z^2 + c_4 k_z^2 \tag{1}$$
$$H_{12}^{kp} = 0 \tag{2}$$
$$H_{13}^{kp} = -ib_2 k_z \tag{3}$$
$$H_{14}^{kp} = b_1\left(\left(-\frac{\sqrt{3}}{3} - i\right)k_x + \left(-1 + \frac{\sqrt{3}i}{3}\right)k_y\right) \tag{4}$$
$$H_{22}^{kp} = a_1 + a_2 + c_1\left(k_x^2 + k_y^2\right) + c_2\left(k_x^2 + k_y^2\right) + c_3 k_z^2 + c_4 k_z^2 \tag{5}$$
$$H_{23}^{kp} = b_1\left(\left(\frac{\sqrt{3}}{3} - i\right)k_x + \left(1 + \frac{\sqrt{3}i}{3}\right)k_y\right) \tag{6}$$
$$H_{24}^{kp} = ib_2 k_z \tag{7}$$
$$H_{33}^{kp} = a_1 - a_2 + c_1\left(k_x^2 + k_y^2\right) + c_2\left(-k_x^2 - k_y^2\right) + c_3 k_z^2 - c_4 k_z^2 \tag{8}$$
$$H_{34}^{kp} = 0 \tag{9}$$
$$H_{44}^{kp} = a_1 - a_2 + c_1\left(k_x^2 + k_y^2\right) + c_2\left(-k_x^2 - k_y^2\right) + c_3 k_z^2 - c_4 k_z^2 \tag{10}$$

B. Parameters

$a_1 = 4.8898$;
$a_2 = -0.2244$;
$b_1 = -3.238$;
$b_2 = 2.5562$;
$c_1 = 19.5842$;
$c_2 = 44.4746$;
$c_3 = 1.8117$;
$c_4 = 9.5034$;

II. ZEEMAN'S COUPLING

A. Hamiltonian

$$H_{11}^{Z}/(\mu_B/2) = g_3 B_z + g_4 B_z \tag{11}$$
$$H_{12}^{Z}/(\mu_B/2) = g_1\left(\left(1 - \frac{\sqrt{3}i}{3}\right)B_x + \left(-\frac{\sqrt{3}}{3} - i\right)B_y\right) + g_2\left(\left(1 - \frac{\sqrt{3}i}{3}\right)B_x + \left(-\frac{\sqrt{3}}{3} - i\right)B_y\right) \tag{12}$$
$$H_{13}^{Z}/(\mu_B/2) = 0 \tag{13}$$
$$H_{14}^{Z}/(\mu_B/2) = 0 \tag{14}$$
$$H_{22}^{Z}/(\mu_B/2) = -g_3 B_z - g_4 B_z \tag{15}$$
$$H_{23}^{Z}/(\mu_B/2) = 0 \tag{16}$$
$$H_{24}^{Z}/(\mu_B/2) = 0 \tag{17}$$
$$H_{33}^{Z}/(\mu_B/2) = g_3 B_z - g_4 B_z \tag{18}$$
$$H_{34}^{Z}/(\mu_B/2) = g_1\left(\left(1 - \frac{\sqrt{3}i}{3}\right)B_x + \left(-\frac{\sqrt{3}}{3} - i\right)B_y\right) + g_2\left(\left(-1 + \frac{\sqrt{3}i}{3}\right)B_x + \left(\frac{\sqrt{3}}{3} + i\right)B_y\right) \tag{19}$$
$$H_{44}^{Z}/(\mu_B/2) = -g_3 B_z + g_4 B_z \tag{20}$$

B. Parameters

$g_1 = -0.3244$;
$g_2 = 5.761$;
$g_3 = -7.8904$;
$g_4 = -13.0138$;