

PG No. 5  $C_{2h}$   $2/m$  (b-axis setting) [ monoclinic ] (axial, internal polar quadrupole)

\* Harmonics for rank 0

\* Harmonics for rank 1

$$\vec{G}_1^{(2,1)}[q](A_g)$$

\*\* symmetry

$y$

\*\* expression

$$\frac{3\sqrt{10}Q_{uxz}}{10} - \frac{\sqrt{30}Q_vxz}{10} - \frac{\sqrt{30}Q_{xyyz}}{10} + \frac{\sqrt{30}Q_{xz}(x-z)(x+z)}{10} + \frac{\sqrt{30}Q_{yz}xy}{10}$$

$$\vec{G}_1^{(2,1)}[q](B_g, 1)$$

\*\* symmetry

$x$

\*\* expression

$$-\frac{3\sqrt{10}Q_{uyz}}{10} - \frac{\sqrt{30}Q_vyz}{10} + \frac{\sqrt{30}Q_{xyxz}}{10} - \frac{\sqrt{30}Q_{xz}xy}{10} - \frac{\sqrt{30}Q_{yz}(y-z)(y+z)}{10}$$

$$\vec{G}_1^{(2,1)}[q](B_g, 2)$$

\*\* symmetry

$z$

\*\* expression

$$\frac{\sqrt{30}Q_vxy}{5} - \frac{\sqrt{30}Q_{xy}(x-y)(x+y)}{10} + \frac{\sqrt{30}Q_{xz}yz}{10} - \frac{\sqrt{30}Q_{yz}xz}{10}$$

\* Harmonics for rank 2

$$\vec{G}_2^{(2,-1)}[q](A_u, 1)$$

\*\* symmetry

$$-\frac{x^2}{2} - \frac{y^2}{2} + z^2$$

\*\* expression

$$\frac{\sqrt{2}Q_{xz}y}{2} - \frac{\sqrt{2}Q_{yz}x}{2}$$

$$\vec{G}_2^{(2,-1)}[q](A_u, 2)$$

\*\* symmetry

$$\frac{\sqrt{3}(x-y)(x+y)}{2}$$

\*\* expression

$$\frac{\sqrt{6}Q_{xy}z}{3} - \frac{\sqrt{6}Q_{xz}y}{6} - \frac{\sqrt{6}Q_{yz}x}{6}$$

$$\vec{G}_2^{(2,-1)}[q](A_u, 3)$$

\*\* symmetry

$\sqrt{3}xz$

\*\* expression

$$-\frac{\sqrt{2}Q_uy}{2} + \frac{\sqrt{6}Q_vy}{6} - \frac{\sqrt{6}Q_{xy}x}{6} + \frac{\sqrt{6}Q_{yz}z}{6}$$

$$\vec{G}_2^{(2,1)}[q](A_u, 1)$$

\*\* symmetry

$$-\frac{x^2}{2} - \frac{y^2}{2} + z^2$$

\*\* expression

$$-\frac{5\sqrt{42}Q_vxyz}{14} - \frac{5\sqrt{42}Q_{xyz}(x-y)(x+y)}{28} - \frac{\sqrt{42}Q_{xz}y(x^2+y^2-4z^2)}{28} + \frac{\sqrt{42}Q_{yz}x(x^2+y^2-4z^2)}{28}$$

$$\vec{G}_2^{(2,1)}[q](A_u, 2)$$

\*\* symmetry

$$\frac{\sqrt{3}(x-y)(x+y)}{2}$$

\*\* expression

$$-\frac{5\sqrt{42}Q_{uxyz}}{14} + \frac{\sqrt{14}Q_{xyz}(3x^2 + 3y^2 - 2z^2)}{28} - \frac{\sqrt{14}Q_{xz}y(9x^2 - y^2 - 6z^2)}{28} + \frac{\sqrt{14}Q_{yz}x(x^2 - 9y^2 + 6z^2)}{28}$$

$\tilde{\mathbb{G}}_2^{(2,1)}[q](A_u, 3)$

\*\* symmetry

$$\sqrt{3}xz$$

\*\* expression

$$\frac{\sqrt{42}Q_{uy}(x^2 + y^2 - 4z^2)}{28} + \frac{\sqrt{14}Q_{vy}(9x^2 - y^2 - 6z^2)}{28} - \frac{\sqrt{14}Q_{xy}x(2x^2 - 3y^2 - 3z^2)}{14} - \frac{\sqrt{14}Q_{yz}z(3x^2 + 3y^2 - 2z^2)}{14}$$

$\tilde{\mathbb{G}}_2^{(2,-1)}[q](B_u, 1)$

\*\* symmetry

$$\sqrt{3}yz$$

\*\* expression

$$\frac{\sqrt{2}Q_{ux}}{2} + \frac{\sqrt{6}Q_{vx}}{6} + \frac{\sqrt{6}Q_{xy}y}{6} - \frac{\sqrt{6}Q_{xz}z}{6}$$

$\tilde{\mathbb{G}}_2^{(2,-1)}[q](B_u, 2)$

\*\* symmetry

$$\sqrt{3}xy$$

\*\* expression

$$-\frac{\sqrt{6}Q_vz}{3} + \frac{\sqrt{6}Q_{xz}x}{6} - \frac{\sqrt{6}Q_{yz}y}{6}$$

$\tilde{\mathbb{G}}_2^{(2,1)}[q](B_u, 1)$

\*\* symmetry

$$\sqrt{3}yz$$

\*\* expression

$$-\frac{\sqrt{42}Q_{ux}(x^2 + y^2 - 4z^2)}{28} - \frac{\sqrt{14}Q_{vx}(x^2 - 9y^2 + 6z^2)}{28} - \frac{\sqrt{14}Q_{xy}y(3x^2 - 2y^2 + 3z^2)}{14} + \frac{\sqrt{14}Q_{xz}z(3x^2 + 3y^2 - 2z^2)}{14}$$

$\tilde{\mathbb{G}}_2^{(2,1)}[q](B_u, 2)$

\*\* symmetry

$$\sqrt{3}xy$$

\*\* expression

$$\frac{5\sqrt{42}Q_{uz}(x-y)(x+y)}{28} - \frac{\sqrt{14}Q_vz(3x^2 + 3y^2 - 2z^2)}{28} + \frac{\sqrt{14}Q_{xz}x(2x^2 - 3y^2 - 3z^2)}{14} + \frac{\sqrt{14}Q_{yz}y(3x^2 - 2y^2 + 3z^2)}{14}$$

\* Harmonics for rank 3

$\tilde{\mathbb{G}}_3^{(2,-1)}[q](A_g, 1)$

\*\* symmetry

$$\sqrt{15}xyz$$

\*\* expression

$$\frac{\sqrt{6}Q_u(x-y)(x+y)}{4} + \frac{\sqrt{2}Q_v(x^2 + y^2 - 2z^2)}{4}$$

$\tilde{\mathbb{G}}_3^{(2,-1)}[q](A_g, 2)$

\*\* symmetry

$$-\frac{y(3x^2 - 2y^2 + 3z^2)}{2}$$

\*\* expression

$$-\frac{3\sqrt{10}Q_{uz}xz}{20} + \frac{\sqrt{30}Q_vxz}{20} - \frac{\sqrt{30}Q_{xy}yz}{5} - \frac{\sqrt{30}Q_{xz}(x-z)(x+z)}{20} + \frac{\sqrt{30}Q_{yz}xy}{5}$$

$\tilde{\mathbb{G}}_3^{(2,-1)}[q](A_g, 3)$

\*\* symmetry

$$-\frac{\sqrt{15}y(x-z)(x+z)}{2}$$

\*\* expression

$$\frac{\sqrt{6}Q_uxz}{4} + \frac{3\sqrt{2}Q_vxz}{4} - \frac{\sqrt{2}Q_{xz}(x^2 - 2y^2 + z^2)}{4}$$

$\vec{\mathbb{G}}_3^{(2,1)}[q](A_g, 1)$

\*\* symmetry

$$\sqrt{15}xyz$$

\*\* expression

$$-\frac{\sqrt{3}Q_u(x-y)(x+y)(x^2 + y^2 - 6z^2)}{6} - \frac{Q_v(x^4 - 12x^2y^2 + 6x^2z^2 + y^4 + 6y^2z^2 - 2z^4)}{6} \\ - \frac{7Q_{xy}xy(x-y)(x+y)}{6} + \frac{7Q_{xz}xz(x-z)(x+z)}{6} - \frac{7Q_{yz}yz(y-z)(y+z)}{6}$$

$\vec{\mathbb{G}}_3^{(2,1)}[q](A_g, 2)$

\*\* symmetry

$$-\frac{y(3x^2 - 2y^2 + 3z^2)}{2}$$

\*\* expression

$$-\frac{\sqrt{5}Q_uxz(x^2 - 6y^2 + z^2)}{4} + \frac{\sqrt{15}Q_vxz(x^2 - 6y^2 + z^2)}{12} + \frac{\sqrt{15}Q_{xy}yz(3x^2 - 4y^2 + 3z^2)}{12} \\ - \frac{\sqrt{15}Q_{xz}(x-z)(x+z)(x^2 - 6y^2 + z^2)}{12} - \frac{\sqrt{15}Q_{yz}xy(3x^2 - 4y^2 + 3z^2)}{12}$$

$\vec{\mathbb{G}}_3^{(2,1)}[q](A_g, 3)$

\*\* symmetry

$$-\frac{\sqrt{15}y(x-z)(x+z)}{2}$$

\*\* expression

$$-\frac{\sqrt{3}Q_uxz(9x^2 - 12y^2 - 5z^2)}{12} + \frac{Q_vxz(x^2 + 36y^2 - 13z^2)}{12} - \frac{7Q_{xy}yz(3x^2 - 2y^2 + z^2)}{12} \\ - \frac{Q_{xz}(5x^4 - 12x^2y^2 - 18x^2z^2 + 4y^4 - 12y^2z^2 + 5z^4)}{12} - \frac{7Q_{yz}xy(x^2 - 2y^2 + 3z^2)}{12}$$

$\vec{\mathbb{G}}_3^{(2,-1)}[q](B_g, 1)$

\*\* symmetry

$$\frac{x(2x^2 - 3y^2 - 3z^2)}{2}$$

\*\* expression

$$\frac{3\sqrt{10}Q_uyz}{20} + \frac{\sqrt{30}Q_vyz}{20} + \frac{\sqrt{30}Q_{xy}xz}{5} - \frac{\sqrt{30}Q_{xz}xy}{5} + \frac{\sqrt{30}Q_{yz}(y-z)(y+z)}{20}$$

$\vec{\mathbb{G}}_3^{(2,-1)}[q](B_g, 2)$

\*\* symmetry

$$-\frac{z(3x^2 + 3y^2 - 2z^2)}{2}$$

\*\* expression

$$-\frac{\sqrt{30}Q_{xy}xy}{10} + \frac{\sqrt{30}Q_{xy}(x-y)(x+y)}{20} + \frac{\sqrt{30}Q_{xz}yz}{5} - \frac{\sqrt{30}Q_{yz}xz}{5}$$

$\vec{\mathbb{G}}_3^{(2,-1)}[q](B_g, 3)$

\*\* symmetry

$$\frac{\sqrt{15}x(y-z)(y+z)}{2}$$

\*\* expression

$$\frac{\sqrt{6}Q_uyz}{4} - \frac{3\sqrt{2}Q_vyz}{4} + \frac{\sqrt{2}Q_{yz}(2x^2 - y^2 - z^2)}{4}$$

$$\vec{\mathbb{G}}_3^{(2,-1)}[q](B_g, 4)$$

\*\* symmetry

$$\frac{\sqrt{15}z(x-y)(x+y)}{2}$$

\*\* expression

$$-\frac{\sqrt{6}Q_u xy}{2} - \frac{\sqrt{2}Q_{xy}(x^2 + y^2 - 2z^2)}{4}$$

$$\vec{\mathbb{G}}_3^{(2,1)}[q](B_g, 1)$$

\*\* symmetry

$$\frac{x(2x^2 - 3y^2 - 3z^2)}{2}$$

\*\* expression

$$-\frac{\sqrt{5}Q_{uyz}(6x^2 - y^2 - z^2)}{4} - \frac{\sqrt{15}Q_{vyz}(6x^2 - y^2 - z^2)}{12} + \frac{\sqrt{15}Q_{xy}xz(4x^2 - 3y^2 - 3z^2)}{12} \\ - \frac{\sqrt{15}Q_{xz}xy(4x^2 - 3y^2 - 3z^2)}{12} - \frac{\sqrt{15}Q_{yz}(y-z)(y+z)(6x^2 - y^2 - z^2)}{12}$$

$$\vec{\mathbb{G}}_3^{(2,1)}[q](B_g, 2)$$

\*\* symmetry

$$-\frac{z(3x^2 + 3y^2 - 2z^2)}{2}$$

\*\* expression

$$-\frac{\sqrt{15}Q_vxy(x^2 + y^2 - 6z^2)}{6} + \frac{\sqrt{15}Q_{xy}(x-y)(x+y)(x^2 + y^2 - 6z^2)}{12} - \frac{\sqrt{15}Q_{xz}yz(3x^2 + 3y^2 - 4z^2)}{12} + \frac{\sqrt{15}Q_{yz}xz(3x^2 + 3y^2 - 4z^2)}{12}$$

$$\vec{\mathbb{G}}_3^{(2,1)}[q](B_g, 3)$$

\*\* symmetry

$$\frac{\sqrt{15}x(y-z)(y+z)}{2}$$

\*\* expression

$$\frac{\sqrt{3}Q_{uyz}(12x^2 - 9y^2 + 5z^2)}{12} - \frac{Q_{vyz}(36x^2 + y^2 - 13z^2)}{12} + \frac{7Q_{xy}xz(2x^2 - 3y^2 - z^2)}{12} \\ + \frac{7Q_{xz}xy(2x^2 - y^2 - 3z^2)}{12} - \frac{Q_{yz}(4x^4 - 12x^2y^2 - 12x^2z^2 + 5y^4 - 18y^2z^2 + 5z^4)}{12}$$

$$\vec{\mathbb{G}}_3^{(2,1)}[q](B_g, 4)$$

\*\* symmetry

$$\frac{\sqrt{15}z(x-y)(x+y)}{2}$$

\*\* expression

$$\frac{\sqrt{3}Q_{u}xy(x^2 + y^2 - 6z^2)}{3} + \frac{7Q_{v}xy(x-y)(x+y)}{6} - \frac{Q_{xy}(5x^4 - 18x^2y^2 - 12x^2z^2 + 5y^4 - 12y^2z^2 + 4z^4)}{12} \\ - \frac{7Q_{xz}yz(3x^2 + y^2 - 2z^2)}{12} - \frac{7Q_{yz}xz(x^2 + 3y^2 - 2z^2)}{12}$$

\* Harmonics for rank 4

$$\vec{\mathbb{G}}_4^{(2,-1)}[q](A_u, 1)$$

\*\* symmetry

$$\frac{\sqrt{21}(x^4 - 3x^2y^2 - 3x^2z^2 + y^4 - 3y^2z^2 + z^4)}{6}$$

\*\* expression

$$\frac{\sqrt{5}Q_{xy}z(x-y)(x+y)}{2} - \frac{\sqrt{5}Q_{xz}y(x-z)(x+z)}{2} + \frac{\sqrt{5}Q_{yz}x(y-z)(y+z)}{2}$$

$$\vec{\mathbb{G}}_4^{(2,-1)}[q](A_u, 2)$$

\*\* symmetry

$$-\frac{\sqrt{15}(x^4 - 12x^2y^2 + 6x^2z^2 + y^4 + 6y^2z^2 - 2z^4)}{12}$$

\*\* expression

$$-\frac{6\sqrt{7}Q_{u}xyz}{7} - \frac{\sqrt{7}Q_{xy}z(x-y)(x+y)}{14} + \frac{\sqrt{7}Q_{xz}y(4x^2 - 3y^2 + 5z^2)}{14} + \frac{\sqrt{7}Q_{yz}x(3x^2 - 4y^2 - 5z^2)}{14}$$

$$\vec{\mathbb{G}}_4^{(2,-1)}[q](A_u, 3)$$

\*\* symmetry

$$\frac{\sqrt{5} (x-y) (x+y) (x^2+y^2-6 z^2)}{4}$$

\*\* expression

$$\frac{6 \sqrt{7} Q_u x y z}{7} + \frac{\sqrt{21} Q_{xy} z (3 x^2 + 3 y^2 - 2 z^2)}{14} - \frac{\sqrt{21} Q_{xz} y (2 x^2 - y^2 + z^2)}{14} + \frac{\sqrt{21} Q_{yz} x (x^2 - 2 y^2 - z^2)}{14}$$

$$\vec{\mathbb{G}}_4^{(2,-1)}[q](A_u, 4)$$

\*\* symmetry

$$-\frac{\sqrt{35} x z (x-z) (x+z)}{2}$$

\*\* expression

$$\frac{3 Q_u y (x-z) (x+z)}{4} - \frac{\sqrt{3} Q_v y (x-z) (x+z)}{4} + \frac{\sqrt{3} Q_{xy} x (x^2 - 3 z^2)}{4} + \sqrt{3} Q_{xz} x y z - \frac{\sqrt{3} Q_{yz} z (3 x^2 - z^2)}{4}$$

$$\vec{\mathbb{G}}_4^{(2,-1)}[q](A_u, 5)$$

\*\* symmetry

$$-\frac{\sqrt{5} x z (x^2 - 6 y^2 + z^2)}{2}$$

\*\* expression

$$\frac{3 \sqrt{7} Q_u y (5 x^2 - 2 y^2 + z^2)}{28} + \frac{\sqrt{21} Q_v y (3 x^2 + 2 y^2 - 9 z^2)}{28} + \frac{\sqrt{21} Q_{xy} x (x^2 + 2 y^2 - 5 z^2)}{28} + \frac{\sqrt{21} Q_{yz} z (5 x^2 - 2 y^2 - z^2)}{28}$$

$$\vec{\mathbb{G}}_4^{(2,1)}[q](A_u, 1)$$

\*\* symmetry

$$\frac{\sqrt{21} (x^4 - 3 x^2 y^2 - 3 x^2 z^2 + y^4 - 3 y^2 z^2 + z^4)}{6}$$

\*\* expression

$$\begin{aligned} & -\frac{3 \sqrt{2310} Q_u x y z (x-y) (x+y)}{44} - \frac{3 \sqrt{770} Q_v x y z (x^2 + y^2 - 2 z^2)}{44} + \frac{\sqrt{770} Q_{xy} z (x-y) (x+y) (x^2 + y^2 - 2 z^2)}{22} \\ & - \frac{\sqrt{770} Q_{xz} y (x-z) (x+z) (x^2 - 2 y^2 + z^2)}{22} - \frac{\sqrt{770} Q_{yz} x (y-z) (y+z) (2 x^2 - y^2 - z^2)}{22} \end{aligned}$$

$$\vec{\mathbb{G}}_4^{(2,1)}[q](A_u, 2)$$

\*\* symmetry

$$-\frac{\sqrt{15} (x^4 - 12 x^2 y^2 + 6 x^2 z^2 + y^4 + 6 y^2 z^2 - 2 z^4)}{12}$$

\*\* expression

$$\begin{aligned} & \frac{21 \sqrt{66} Q_u x y z (x-y) (x+y)}{44} - \frac{21 \sqrt{22} Q_v x y z (x^2 + y^2 - 2 z^2)}{44} + \frac{7 \sqrt{22} Q_{xy} z (x-y) (x+y) (x^2 + y^2 - 2 z^2)}{44} \\ & + \frac{\sqrt{22} Q_{xz} y (17 x^4 - 22 x^2 y^2 - 36 x^2 z^2 + 3 y^4 - 8 y^2 z^2 + 10 z^4)}{44} - \frac{\sqrt{22} Q_{yz} x (3 x^4 - 22 x^2 y^2 - 8 x^2 z^2 + 17 y^4 - 36 y^2 z^2 + 10 z^4)}{44} \end{aligned}$$

$$\vec{\mathbb{G}}_4^{(2,1)}[q](A_u, 3)$$

\*\* symmetry

$$\frac{\sqrt{5} (x-y) (x+y) (x^2 + y^2 - 6 z^2)}{4}$$

\*\* expression

$$\begin{aligned} & -\frac{21 \sqrt{22} Q_u x y z (x^2 + y^2 - 2 z^2)}{44} - \frac{21 \sqrt{66} Q_v x y z (x-y) (x+y)}{44} + \frac{\sqrt{66} Q_{xy} z (9 x^4 - 24 x^2 y^2 - 10 x^2 z^2 + 9 y^4 - 10 y^2 z^2 + 2 z^4)}{44} \\ & - \frac{\sqrt{66} Q_{xz} y (x^4 + 2 x^2 y^2 - 12 x^2 z^2 + y^4 - 12 y^2 z^2 + 8 z^4)}{44} - \frac{\sqrt{66} Q_{yz} x (x^4 + 2 x^2 y^2 - 12 x^2 z^2 + y^4 - 12 y^2 z^2 + 8 z^4)}{44} \end{aligned}$$

$$\vec{\mathbb{G}}_4^{(2,1)}[q](A_u, 4)$$

\*\* symmetry

$$-\frac{\sqrt{35} x z (x-z) (x+z)}{2}$$

\*\* expression

$$-\frac{3\sqrt{154}Q_{uy}(x^4 + x^2y^2 - 9x^2z^2 - y^2z^2 + 2z^4)}{88} - \frac{\sqrt{462}Q_{vy}(5x^4 - x^2y^2 - 27x^2z^2 + y^2z^2 + 4z^4)}{88} \\ + \frac{\sqrt{462}Q_{xy}x(x^4 - 2x^2y^2 - 8x^2z^2 + 6y^2z^2 + 3z^4)}{44} + \frac{\sqrt{462}Q_{xz}xyz(x^2 - 2y^2 + z^2)}{44} + \frac{\sqrt{462}Q_{yz}z(3x^4 + 6x^2y^2 - 8x^2z^2 - 2y^2z^2 + z^4)}{44}$$

$\vec{\mathbb{G}}_4^{(2,1)}[q](A_u, 5)$

\*\* symmetry

$$-\frac{\sqrt{5}xz(x^2 - 6y^2 + z^2)}{2}$$

\*\* expression

$$-\frac{3\sqrt{22}Q_{uy}(5x^4 + 3x^2y^2 - 39x^2z^2 - 2y^4 + 17y^2z^2 - 2z^4)}{88} - \frac{\sqrt{66}Q_{vy}(9x^4 - 31x^2y^2 + 39x^2z^2 + 2y^4 + 11y^2z^2 - 12z^4)}{88} \\ + \frac{\sqrt{66}Q_{xy}x(x^4 - 12x^2y^2 + 2x^2z^2 + 8y^4 - 12y^2z^2 + z^4)}{44} + \frac{21\sqrt{66}Q_{xz}xyz(x - z)(x + z)}{44} - \frac{\sqrt{66}Q_{yz}z(x^4 - 12x^2y^2 + 2x^2z^2 + 8y^4 - 12y^2z^2 + z^4)}{44}$$

$\vec{\mathbb{G}}_4^{(2,-1)}[q](B_u, 1)$

\*\* symmetry

$$\frac{\sqrt{35}yz(y - z)(y + z)}{2}$$

\*\* expression

$$\frac{3Q_{ux}(y - z)(y + z)}{4} + \frac{\sqrt{3}Q_{vx}(y - z)(y + z)}{4} + \frac{\sqrt{3}Q_{xy}y(y^2 - 3z^2)}{4} - \frac{\sqrt{3}Q_{xz}z(3y^2 - z^2)}{4} + \sqrt{3}Q_{yz}xyz$$

$\vec{\mathbb{G}}_4^{(2,-1)}[q](B_u, 2)$

\*\* symmetry

$$\frac{\sqrt{35}xy(x - y)(x + y)}{2}$$

\*\* expression

$$-\frac{\sqrt{3}Q_{vz}(x - y)(x + y)}{2} + \sqrt{3}Q_{xy}xyz + \frac{\sqrt{3}Q_{xz}x(x^2 - 3y^2)}{4} - \frac{\sqrt{3}Q_{yz}y(3x^2 - y^2)}{4}$$

$\vec{\mathbb{G}}_4^{(2,-1)}[q](B_u, 3)$

\*\* symmetry

$$\frac{\sqrt{5}yz(6x^2 - y^2 - z^2)}{2}$$

\*\* expression

$$\frac{3\sqrt{7}Q_{ux}(2x^2 - 5y^2 - z^2)}{28} + \frac{\sqrt{21}Q_{vx}(2x^2 + 3y^2 - 9z^2)}{28} - \frac{\sqrt{21}Q_{xy}y(2x^2 + y^2 - 5z^2)}{28} + \frac{\sqrt{21}Q_{xz}z(2x^2 - 5y^2 + z^2)}{28}$$

$\vec{\mathbb{G}}_4^{(2,-1)}[q](B_u, 4)$

\*\* symmetry

$$-\frac{\sqrt{5}xy(x^2 + y^2 - 6z^2)}{2}$$

\*\* expression

$$\frac{3\sqrt{7}Q_{uz}(x - y)(x + y)}{7} + \frac{\sqrt{21}Q_{vz}(3x^2 + 3y^2 - 2z^2)}{14} - \frac{\sqrt{21}Q_{xz}x(x^2 - 5y^2 + 2z^2)}{28} - \frac{\sqrt{21}Q_{yz}y(5x^2 - y^2 - 2z^2)}{28}$$

$\vec{\mathbb{G}}_4^{(2,1)}[q](B_u, 1)$

\*\* symmetry

$$\frac{\sqrt{35}yz(y - z)(y + z)}{2}$$

\*\* expression

$$-\frac{3\sqrt{154}Q_{ux}(x^2y^2 - x^2z^2 + y^4 - 9y^2z^2 + 2z^4)}{88} - \frac{\sqrt{462}Q_{vx}(x^2y^2 - x^2z^2 - 5y^4 + 27y^2z^2 - 4z^4)}{88} \\ - \frac{\sqrt{462}Q_{xy}y(2x^2y^2 - 6x^2z^2 - y^4 + 8y^2z^2 - 3z^4)}{44} + \frac{\sqrt{462}Q_{xz}z(6x^2y^2 - 2x^2z^2 + 3y^4 - 8y^2z^2 + z^4)}{44} - \frac{\sqrt{462}Q_{yz}xyz(2x^2 - y^2 - z^2)}{44}$$

$\vec{\mathbb{G}}_4^{(2,1)}[q](B_u, 2)$

\*\* symmetry

$$\frac{\sqrt{35}xy(x - y)(x + y)}{2}$$

\*\* expression

$$\begin{aligned} & \frac{9\sqrt{154}Q_uz(x^2 - 2xy - y^2)(x^2 + 2xy - y^2)}{88} - \frac{\sqrt{462}Q_vz(x - y)(x + y)(x^2 + y^2 - 2z^2)}{88} + \frac{\sqrt{462}Q_{xy}xyz(x^2 + y^2 - 2z^2)}{44} \\ & + \frac{\sqrt{462}Q_{xz}x(x^4 - 8x^2y^2 - 2x^2z^2 + 3y^4 + 6y^2z^2)}{44} + \frac{\sqrt{462}Q_{yz}y(3x^4 - 8x^2y^2 + 6x^2z^2 + y^4 - 2y^2z^2)}{44} \end{aligned}$$

$\tilde{\mathbb{G}}_4^{(2,1)}[q](B_u, 3)$

\*\* symmetry

$$\frac{\sqrt{5}yz(6x^2 - y^2 - z^2)}{2}$$

\*\* expression

$$\begin{aligned} & -\frac{3\sqrt{22}Q_ux(2x^4 - 3x^2y^2 - 17x^2z^2 - 5y^4 + 39y^2z^2 + 2z^4)}{88} - \frac{\sqrt{66}Q_vx(2x^4 - 31x^2y^2 + 11x^2z^2 + 9y^4 + 39y^2z^2 - 12z^4)}{88} \\ & - \frac{\sqrt{66}Q_{xy}y(8x^4 - 12x^2y^2 - 12x^2z^2 + y^4 + 2y^2z^2 + z^4)}{44} + \frac{\sqrt{66}Q_{xz}z(8x^4 - 12x^2y^2 - 12x^2z^2 + y^4 + 2y^2z^2 + z^4)}{44} - \frac{21\sqrt{66}Q_{yz}xyz(y - z)(y + z)}{44} \end{aligned}$$

$\tilde{\mathbb{G}}_4^{(2,1)}[q](B_u, 4)$

\*\* symmetry

$$-\frac{\sqrt{5}xy(x^2 + y^2 - 6z^2)}{2}$$

\*\* expression

$$\begin{aligned} & -\frac{21\sqrt{22}Q_uz(x - y)(x + y)(x^2 + y^2 - 2z^2)}{88} - \frac{\sqrt{66}Q_vz(3x^4 - 78x^2y^2 + 20x^2z^2 + 3y^4 + 20y^2z^2 - 4z^4)}{88} - \frac{21\sqrt{66}Q_{xy}xyz(x - y)(x + y)}{44} \\ & - \frac{\sqrt{66}Q_{xz}x(x^4 + 2x^2y^2 - 12x^2z^2 + y^4 - 12y^2z^2 + 8z^4)}{44} + \frac{\sqrt{66}Q_{yz}y(x^4 + 2x^2y^2 - 12x^2z^2 + y^4 - 12y^2z^2 + 8z^4)}{44} \end{aligned}$$