

PG No. 32 O_h $m\bar{3}m$ [cubic] (axial, internal polar quadrupole)

* Harmonics for rank 0

* Harmonics for rank 1

$$\vec{\mathbb{G}}_{1,1}^{(2,1)}[q](T_{1g}), \vec{\mathbb{G}}_{1,2}^{(2,1)}[q](T_{1g}), \vec{\mathbb{G}}_{1,3}^{(2,1)}[q](T_{1g})$$

** symmetry

$$x$$

$$y$$

$$z$$

** expression

$$-\frac{3\sqrt{10}Q_{uyz}}{10} - \frac{\sqrt{30}Q_{vyz}}{10} + \frac{\sqrt{30}Q_{xyxz}}{10} - \frac{\sqrt{30}Q_{xzyx}}{10} - \frac{\sqrt{30}Q_{yz(y-z)(y+z)}}{10}$$

$$\frac{3\sqrt{10}Q_{uxz}}{10} - \frac{\sqrt{30}Q_{vzx}}{10} - \frac{\sqrt{30}Q_{xyyz}}{10} + \frac{\sqrt{30}Q_{xz(x-z)(x+z)}}{10} + \frac{\sqrt{30}Q_{yzxy}}{10}$$

$$\frac{\sqrt{30}Q_{vxy}}{5} - \frac{\sqrt{30}Q_{xy(x-y)(x+y)}}{10} + \frac{\sqrt{30}Q_{xzyz}}{10} - \frac{\sqrt{30}Q_{yzxz}}{10}$$

* Harmonics for rank 2

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

** symmetry

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

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

** expression

$$\frac{\sqrt{2}Q_{xzy}}{2} - \frac{\sqrt{2}Q_{yzx}}{2}$$

$$\frac{\sqrt{6}Q_{xyz}}{3} - \frac{\sqrt{6}Q_{xzy}}{6} - \frac{\sqrt{6}Q_{yzx}}{6}$$

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

** symmetry

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

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

** expression

$$\frac{5\sqrt{42}Q_{vxyz}}{14} - \frac{5\sqrt{42}Q_{xyxz}(x-y)(x+y)}{28} - \frac{\sqrt{42}Q_{xzy}(x^2+y^2-4z^2)}{28} + \frac{\sqrt{42}Q_{yzx}(x^2+y^2-4z^2)}{28}$$

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

$$\vec{\mathbb{G}}_{2,1}^{(2,-1)}[q](T_{2u}), \vec{\mathbb{G}}_{2,2}^{(2,-1)}[q](T_{2u}), \vec{\mathbb{G}}_{2,3}^{(2,-1)}[q](T_{2u})$$

** symmetry

$$\sqrt{3}yz$$

$$\sqrt{3}xz$$

$$\sqrt{3}xy$$

** expression

$$\frac{\sqrt{2}Q_{ux}}{2} + \frac{\sqrt{6}Q_{vx}}{6} + \frac{\sqrt{6}Q_{xyy}}{6} - \frac{\sqrt{6}Q_{xzz}}{6}$$

$$-\frac{\sqrt{2}Q_{uy}}{2} + \frac{\sqrt{6}Q_{vy}}{6} - \frac{\sqrt{6}Q_{xyx}}{6} + \frac{\sqrt{6}Q_{yzz}}{6}$$

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

$$\vec{\mathbb{G}}_{2,1}^{(2,1)}[q](T_{2u}), \vec{\mathbb{G}}_{2,2}^{(2,1)}[q](T_{2u}), \vec{\mathbb{G}}_{2,3}^{(2,1)}[q](T_{2u})$$

** symmetry

$$\sqrt{3}yz$$

$$\sqrt{3}xz$$

$$\sqrt{3}xy$$

** expression

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

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

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

* Harmonics for rank 3

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

** symmetry

$$\sqrt{15}xyz$$

** expression

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

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

** symmetry

$$\sqrt{15}xyz$$

** expression

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

$$\vec{\mathbb{G}}_{3,1}^{(2,-1)}[q](T_{1g}), \vec{\mathbb{G}}_{3,2}^{(2,-1)}[q](T_{1g}), \vec{\mathbb{G}}_{3,3}^{(2,-1)}[q](T_{1g})$$

** symmetry

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

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

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

** expression

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

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

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

$$\vec{\mathbb{G}}_{3,1}^{(2,1)}[q](T_{1g}), \vec{\mathbb{G}}_{3,2}^{(2,1)}[q](T_{1g}), \vec{\mathbb{G}}_{3,3}^{(2,1)}[q](T_{1g})$$

** symmetry

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

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

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

** expression

$$-\frac{\sqrt{5}Q_u y z (6x^2 - y^2 - z^2)}{4} - \frac{\sqrt{15}Q_v y z (6x^2 - y^2 - z^2)}{12} + \frac{\sqrt{15}Q_{xy} x z (4x^2 - 3y^2 - 3z^2)}{12}$$

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

$$-\frac{\sqrt{5}Q_u x z (x^2 - 6y^2 + z^2)}{4} + \frac{\sqrt{15}Q_v x z (x^2 - 6y^2 + z^2)}{12} + \frac{\sqrt{15}Q_{xy} y z (3x^2 - 4y^2 + 3z^2)}{12}$$

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

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

$$\vec{\mathbb{G}}_{3,1}^{(2,-1)}[q](T_{2g}), \vec{\mathbb{G}}_{3,2}^{(2,-1)}[q](T_{2g}), \vec{\mathbb{G}}_{3,3}^{(2,-1)}[q](T_{2g})$$

** symmetry

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

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

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

** expression

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

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

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

$$\vec{\mathbb{G}}_{3,1}^{(2,1)}[q](T_{2g}), \vec{\mathbb{G}}_{3,2}^{(2,1)}[q](T_{2g}), \vec{\mathbb{G}}_{3,3}^{(2,1)}[q](T_{2g})$$

** symmetry

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

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

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

** expression

$$\frac{\sqrt{3}Q_u y z (12x^2 - 9y^2 + 5z^2)}{12} - \frac{Q_v y z (36x^2 + y^2 - 13z^2)}{12} + \frac{7Q_{xy} x z (2x^2 - 3y^2 - z^2)}{12}$$

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

$$-\frac{\sqrt{3}Q_u x z (9x^2 - 12y^2 - 5z^2)}{12} + \frac{Q_v x z (x^2 + 36y^2 - 13z^2)}{12} - \frac{7Q_{xy} y z (3x^2 - 2y^2 + z^2)}{12}$$

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

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

$$-\frac{7Q_{xz} y z (3x^2 + y^2 - 2z^2)}{12} - \frac{7Q_{yz} x z (x^2 + 3y^2 - 2z^2)}{12}$$

* Harmonics for rank 4

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

** symmetry

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

** expression

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

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

** symmetry

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

** expression

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

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

** symmetry

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

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

** expression

$$\begin{aligned} & -\frac{6\sqrt{7}Q_vxyz}{7} - \frac{\sqrt{7}Q_{xyz}(x-y)(x+y)}{14} + \frac{\sqrt{7}Q_{xz}y(4x^2-3y^2+5z^2)}{14} + \frac{\sqrt{7}Q_{yz}x(3x^2-4y^2-5z^2)}{14} \\ & \frac{6\sqrt{7}Q_{uxyz}}{7} + \frac{\sqrt{21}Q_{xyz}(3x^2+3y^2-2z^2)}{14} - \frac{\sqrt{21}Q_{xz}y(2x^2-y^2+z^2)}{14} + \frac{\sqrt{21}Q_{yz}x(x^2-2y^2-z^2)}{14} \end{aligned}$$

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

** symmetry

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

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

** expression

$$\begin{aligned} & \frac{21\sqrt{66}Q_{uxyz}(x-y)(x+y)}{44} - \frac{21\sqrt{22}Q_vxyz(x^2+y^2-2z^2)}{44} + \frac{7\sqrt{22}Q_{xyz}(x-y)(x+y)(x^2+y^2-2z^2)}{44} \\ & + \frac{\sqrt{22}Q_{xz}y(17x^4-22x^2y^2-36x^2z^2+3y^4-8y^2z^2+10z^4)}{44} - \frac{\sqrt{22}Q_{yz}x(3x^4-22x^2y^2-8x^2z^2+17y^4-36y^2z^2+10z^4)}{44} \\ & - \frac{21\sqrt{22}Q_{uxyz}(x^2+y^2-2z^2)}{44} - \frac{21\sqrt{66}Q_vxyz(x-y)(x+y)}{44} + \frac{\sqrt{66}Q_{xyz}(9x^4-24x^2y^2-10x^2z^2+9y^4-10y^2z^2+2z^4)}{44} \\ & - \frac{\sqrt{66}Q_{xz}y(x^4+2x^2y^2-12x^2z^2+y^4-12y^2z^2+8z^4)}{44} - \frac{\sqrt{66}Q_{yz}x(x^4+2x^2y^2-12x^2z^2+y^4-12y^2z^2+8z^4)}{44} \end{aligned}$$

$$\vec{\mathbb{G}}_{4,1}^{(2,-1)}[q](T_{1u}), \vec{\mathbb{G}}_{4,2}^{(2,-1)}[q](T_{1u}), \vec{\mathbb{G}}_{4,3}^{(2,-1)}[q](T_{1u})$$

** symmetry

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

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

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

** expression

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

$$\vec{\mathbb{G}}_{4,1}^{(2,1)}[q](T_{1u}), \vec{\mathbb{G}}_{4,2}^{(2,1)}[q](T_{1u}), \vec{\mathbb{G}}_{4,3}^{(2,1)}[q](T_{1u})$$

** symmetry

$$\begin{aligned} & \frac{\sqrt{35}yz (y-z)(y+z)}{2} \\ & - \frac{\sqrt{35}xz (x-z)(x+z)}{2} \\ & \frac{\sqrt{35}xy (x-y)(x+y)}{2} \end{aligned}$$

** expression

$$\begin{aligned} & - \frac{3\sqrt{154}Q_u x (x^2y^2 - x^2z^2 + y^4 - 9y^2z^2 + 2z^4)}{88} - \frac{\sqrt{462}Q_v x (x^2y^2 - x^2z^2 - 5y^4 + 27y^2z^2 - 4z^4)}{88} \\ & - \frac{\sqrt{462}Q_{xy} y (2x^2y^2 - 6x^2z^2 - y^4 + 8y^2z^2 - 3z^4)}{44} + \frac{\sqrt{462}Q_{xz} z (6x^2y^2 - 2x^2z^2 + 3y^4 - 8y^2z^2 + z^4)}{44} - \frac{\sqrt{462}Q_{yz} x y z (2x^2 - y^2 - z^2)}{44} \\ & - \frac{3\sqrt{154}Q_u y (x^4 + x^2y^2 - 9x^2z^2 - y^2z^2 + 2z^4)}{88} - \frac{\sqrt{462}Q_v y (5x^4 - x^2y^2 - 27x^2z^2 + y^2z^2 + 4z^4)}{88} \\ & + \frac{\sqrt{462}Q_{xy} x (x^4 - 2x^2y^2 - 8x^2z^2 + 6y^2z^2 + 3z^4)}{44} + \frac{\sqrt{462}Q_{xz} x y z (x^2 - 2y^2 + z^2)}{44} + \frac{\sqrt{462}Q_{yz} z (3x^4 + 6x^2y^2 - 8x^2z^2 - 2y^2z^2 + z^4)}{44} \\ & \frac{9\sqrt{154}Q_u z (x^2 - 2xy - y^2)(x^2 + 2xy - y^2)}{88} - \frac{\sqrt{462}Q_v z (x-y)(x+y)(x^2 + y^2 - 2z^2)}{88} + \frac{\sqrt{462}Q_{xy} x y z (x^2 + y^2 - 2z^2)}{44} \\ & + \frac{\sqrt{462}Q_{xz} x (x^4 - 8x^2y^2 - 2x^2z^2 + 3y^4 + 6y^2z^2)}{44} + \frac{\sqrt{462}Q_{yz} y (3x^4 - 8x^2y^2 + 6x^2z^2 + y^4 - 2y^2z^2)}{44} \end{aligned}$$

$$\vec{\mathbb{G}}_{4,1}^{(2,-1)}[q](T_{2u}), \vec{\mathbb{G}}_{4,2}^{(2,-1)}[q](T_{2u}), \vec{\mathbb{G}}_{4,3}^{(2,-1)}[q](T_{2u})$$

** symmetry

$$\begin{aligned} & \frac{\sqrt{5}yz (6x^2 - y^2 - z^2)}{2} \\ & - \frac{\sqrt{5}xz (x^2 - 6y^2 + z^2)}{2} \\ & - \frac{\sqrt{5}xy (x^2 + y^2 - 6z^2)}{2} \end{aligned}$$

** expression

$$\begin{aligned} & \frac{3\sqrt{7}Q_u x (2x^2 - 5y^2 - z^2)}{28} + \frac{\sqrt{21}Q_v x (2x^2 + 3y^2 - 9z^2)}{28} - \frac{\sqrt{21}Q_{xy} y (2x^2 + y^2 - 5z^2)}{28} + \frac{\sqrt{21}Q_{xz} z (2x^2 - 5y^2 + z^2)}{28} \\ & \frac{3\sqrt{7}Q_u y (5x^2 - 2y^2 + z^2)}{28} + \frac{\sqrt{21}Q_v y (3x^2 + 2y^2 - 9z^2)}{28} + \frac{\sqrt{21}Q_{xy} x (x^2 + 2y^2 - 5z^2)}{28} + \frac{\sqrt{21}Q_{yz} z (5x^2 - 2y^2 - z^2)}{28} \\ & \frac{3\sqrt{7}Q_u z (x-y)(x+y)}{7} + \frac{\sqrt{21}Q_v z (3x^2 + 3y^2 - 2z^2)}{14} - \frac{\sqrt{21}Q_{xz} x (x^2 - 5y^2 + 2z^2)}{28} - \frac{\sqrt{21}Q_{yz} y (5x^2 - y^2 - 2z^2)}{28} \end{aligned}$$

$$\vec{\mathbb{G}}_{4,1}^{(2,1)}[q](T_{2u}), \vec{\mathbb{G}}_{4,2}^{(2,1)}[q](T_{2u}), \vec{\mathbb{G}}_{4,3}^{(2,1)}[q](T_{2u})$$

** symmetry

$$\begin{aligned} & \frac{\sqrt{5}yz (6x^2 - y^2 - z^2)}{2} \\ & - \frac{\sqrt{5}xz (x^2 - 6y^2 + z^2)}{2} \end{aligned}$$

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

** expression

$$\begin{aligned}
& -\frac{3\sqrt{22}Q_{ux}(2x^4-3x^2y^2-17x^2z^2-5y^4+39y^2z^2+2z^4)}{88}-\frac{\sqrt{66}Q_{vx}(2x^4-31x^2y^2+11x^2z^2+9y^4+39y^2z^2-12z^4)}{88} \\
& -\frac{\sqrt{66}Q_{xyy}(8x^4-12x^2y^2-12x^2z^2+y^4+2y^2z^2+z^4)}{44}+\frac{\sqrt{66}Q_{xzz}(8x^4-12x^2y^2-12x^2z^2+y^4+2y^2z^2+z^4)}{44}-\frac{21\sqrt{66}Q_{yzxyz}(y-z)(y+z)}{44} \\
& -\frac{3\sqrt{22}Q_{uy}(5x^4+3x^2y^2-39x^2z^2-2y^4+17y^2z^2-2z^4)}{88}-\frac{\sqrt{66}Q_{vy}(9x^4-31x^2y^2+39x^2z^2+2y^4+11y^2z^2-12z^4)}{88} \\
& +\frac{\sqrt{66}Q_{xyx}(x^4-12x^2y^2+2x^2z^2+8y^4-12y^2z^2+z^4)}{44}+\frac{21\sqrt{66}Q_{xxyz}(x-z)(x+z)}{44}-\frac{\sqrt{66}Q_{yzx}(x^4-12x^2y^2+2x^2z^2+8y^4-12y^2z^2+z^4)}{44} \\
& -\frac{21\sqrt{22}Q_{uz}(x-y)(x+y)(x^2+y^2-2z^2)}{88}-\frac{\sqrt{66}Q_{vz}(3x^4-78x^2y^2+20x^2z^2+3y^4+20y^2z^2-4z^4)}{88}-\frac{21\sqrt{66}Q_{xyz}(x-y)(x+y)}{44} \\
& -\frac{\sqrt{66}Q_{xzx}(x^4+2x^2y^2-12x^2z^2+y^4-12y^2z^2+8z^4)}{44}+\frac{\sqrt{66}Q_{yzy}(x^4+2x^2y^2-12x^2z^2+y^4-12y^2z^2+8z^4)}{44}
\end{aligned}$$