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

* Harmonics for rank 0
* Harmonics for rank 1

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

** symmetry

x

y

z

** expression

$$-\frac{3\sqrt{10}G_u yz}{10}-\frac{\sqrt{30}G_v yz}{10}+\frac{\sqrt{30}G_{xy}xz}{10}-\frac{\sqrt{30}G_{xz}xy}{10}-\frac{\sqrt{30}G_{yz}\left(y-z\right)\left(y+z\right)}{10}$$

$$\frac{3\sqrt{10}G_u xz}{10}-\frac{\sqrt{30}G_v xz}{10}-\frac{\sqrt{30}G_{xy}yz}{10}+\frac{\sqrt{30}G_{xz}\left(x-z\right)\left(x+z\right)}{10}+\frac{\sqrt{30}G_{yz}xy}{10}$$

$$\frac{\sqrt{30}G_v xy}{5}-\frac{\sqrt{30}G_{xy}\left(x-y\right)\left(x+y\right)}{10}+\frac{\sqrt{30}G_{xz}yz}{10}-\frac{\sqrt{30}G_{yz}xz}{10}$$

* Harmonics for rank 2

$\vec{\mathbb{Q}}^{(2,-1)}_{2,1}[g](E_g)$, $\vec{\mathbb{Q}}^{(2,-1)}_{2,2}[g](E_g)$

** symmetry

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

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

** expression

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

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

$\vec{\mathbb{Q}}^{(2,1)}_{2,1}[g](E_g)$, $\vec{\mathbb{Q}}^{(2,1)}_{2,2}[g](E_g)$

** symmetry

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

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

** expression

$$\frac{5\sqrt{42}G_v xyz}{14}-\frac{5\sqrt{42}G_{xy}z\left(x-y\right)\left(x+y\right)}{28}-\frac{\sqrt{42}G_{xz}y\left(x^2+y^2-4z^2\right)}{28}+\frac{\sqrt{42}G_{yz}x\left(x^2+y^2-4z^2\right)}{28}$$

$$-\frac{5\sqrt{42}G_u xyz}{14}+\frac{\sqrt{14}G_{xy}z\left(3x^2+3y^2-2z^2\right)}{28}-\frac{\sqrt{14}G_{xz}y\left(9x^2-y^2-6z^2\right)}{28}+\frac{\sqrt{14}G_{yz}x\left(x^2-9y^2+6z^2\right)}{28}$$

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

** symmetry

$\sqrt{3}yz$

$\sqrt{3}xz$

$\sqrt{3}xy$

** expression

$$\frac{\sqrt{2}G_u x}{2}+\frac{\sqrt{6}G_v x}{6}+\frac{\sqrt{6}G_{xy}y}{6}-\frac{\sqrt{6}G_{xz}z}{6}$$

$$-\frac{\sqrt{2}G_u y}{2}+\frac{\sqrt{6}G_v y}{6}-\frac{\sqrt{6}G_{xy}x}{6}+\frac{\sqrt{6}G_{yz}z}{6}$$

$$-\frac{\sqrt{6}G_v z}{3}+\frac{\sqrt{6}G_{xz}x}{6}-\frac{\sqrt{6}G_{yz}y}{6}$$

$\vec{\mathbb{Q}}^{(2,1)}_{2,1}[g](T_{2g})$, $\vec{\mathbb{Q}}^{(2,1)}_{2,2}[g](T_{2g})$, $\vec{\mathbb{Q}}^{(2,1)}_{2,3}[g](T_{2g})$
** symmetry

$$\sqrt{3}yz$$

$$\sqrt{3}xz$$

$$\sqrt{3}xy$$

** expression

$$-\frac{\sqrt{42}G_u x\left(x^2+y^2-4z^2\right)}{28}-\frac{\sqrt{14}G_v x\left(x^2-9y^2+6z^2\right)}{28}-\frac{\sqrt{14}G_{xy}y\left(3x^2-2y^2+3z^2\right)}{14}+\frac{\sqrt{14}G_{xz}z\left(3x^2+3y^2-2z^2\right)}{14}$$

$$\frac{\sqrt{42}G_u y\left(x^2+y^2-4z^2\right)}{28}+\frac{\sqrt{14}G_v y\left(9x^2-y^2-6z^2\right)}{28}-\frac{\sqrt{14}G_{xy}x\left(2x^2-3y^2-3z^2\right)}{14}-\frac{\sqrt{14}G_{yz}z\left(3x^2+3y^2-2z^2\right)}{14}$$

$$\frac{5\sqrt{42}G_u z\left(x-y\right)\left(x+y\right)}{28}-\frac{\sqrt{14}G_v z\left(3x^2+3y^2-2z^2\right)}{28}+\frac{\sqrt{14}G_{xz}x\left(2x^2-3y^2-3z^2\right)}{14}+\frac{\sqrt{14}G_{yz}y\left(3x^2-2y^2+3z^2\right)}{14}$$

* Harmonics for rank 3
$\vec{\mathbb{Q}}^{(2,-1)}_{3}[g](A_{2u})$
** symmetry

$$\sqrt{15}xyz$$

** expression

$$\frac{\sqrt{6}G_u\left(x-y\right)\left(x+y\right)}{4}+\frac{\sqrt{2}G_v\left(x^2+y^2-2z^2\right)}{4}$$

$\vec{\mathbb{Q}}^{(2,1)}_{3}[g](A_{2u})$
** symmetry

$$\sqrt{15}xyz$$

** expression

$$-\frac{\sqrt{3}G_u\left(x-y\right)\left(x+y\right)\left(x^2+y^2-6z^2\right)}{6}-\frac{G_v\left(x^4-12x^2y^2+6x^2z^2+y^4+6y^2z^2-2z^4\right)}{6}$$
$$-\frac{7G_{xy}xy\left(x-y\right)\left(x+y\right)}{6}+\frac{7G_{xz}xz\left(x-z\right)\left(x+z\right)}{6}-\frac{7G_{yz}yz\left(y-z\right)\left(y+z\right)}{6}$$

$\vec{\mathbb{Q}}^{(2,-1)}_{3,1}[g](T_{1u})$, $\vec{\mathbb{Q}}^{(2,-1)}_{3,2}[g](T_{1u})$, $\vec{\mathbb{Q}}^{(2,-1)}_{3,3}[g](T_{1u})$
** symmetry

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

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

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

** expression

$$\frac{3\sqrt{10}G_u yz}{20}+\frac{\sqrt{30}G_v yz}{20}+\frac{\sqrt{30}G_{xy}xz}{5}-\frac{\sqrt{30}G_{xz}xy}{5}+\frac{\sqrt{30}G_{yz}\left(y-z\right)\left(y+z\right)}{20}$$

$$-\frac{3\sqrt{10}G_u xz}{20}+\frac{\sqrt{30}G_v xz}{20}-\frac{\sqrt{30}G_{xy}yz}{5}-\frac{\sqrt{30}G_{xz}\left(x-z\right)\left(x+z\right)}{20}+\frac{\sqrt{30}G_{yz}xy}{5}$$

$$-\frac{\sqrt{30}G_v xy}{10}+\frac{\sqrt{30}G_{xy}\left(x-y\right)\left(x+y\right)}{20}+\frac{\sqrt{30}G_{xz}yz}{5}-\frac{\sqrt{30}G_{yz}xz}{5}$$

$\vec{\mathbb{Q}}^{(2,1)}_{3,1}[g](T_{1u})$, $\vec{\mathbb{Q}}^{(2,1)}_{3,2}[g](T_{1u})$, $\vec{\mathbb{Q}}^{(2,1)}_{3,3}[g](T_{1u})$
** symmetry

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

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

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

** expression

$$-\frac{\sqrt{5}G_u yz\left(6x^2-y^2-z^2\right)}{4}-\frac{\sqrt{15}G_v yz\left(6x^2-y^2-z^2\right)}{12}+\frac{\sqrt{15}G_{xy}xz\left(4x^2-3y^2-3z^2\right)}{12}$$
$$-\frac{\sqrt{15}G_{xz}xy\left(4x^2-3y^2-3z^2\right)}{12}-\frac{\sqrt{15}G_{yz}\left(y-z\right)\left(y+z\right)\left(6x^2-y^2-z^2\right)}{12}$$

$$-\frac{\sqrt{5}G_u xz\left(x^2-6y^2+z^2\right)}{4}+\frac{\sqrt{15}G_v xz\left(x^2-6y^2+z^2\right)}{12}+\frac{\sqrt{15}G_{xy}yz\left(3x^2-4y^2+3z^2\right)}{12}$$
$$-\frac{\sqrt{15}G_{xz}\left(x-z\right)\left(x+z\right)\left(x^2-6y^2+z^2\right)}{12}-\frac{\sqrt{15}G_{yz}xy\left(3x^2-4y^2+3z^2\right)}{12}$$

$$-\frac{\sqrt{15}G_v xy\left(x^2+y^2-6z^2\right)}{6}+\frac{\sqrt{15}G_{xy}\left(x-y\right)\left(x+y\right)\left(x^2+y^2-6z^2\right)}{12}-\frac{\sqrt{15}G_{xz}yz\left(3x^2+3y^2-4z^2\right)}{12}+\frac{\sqrt{15}G_{yz}xz\left(3x^2+3y^2-4z^2\right)}{12}$$

$\vec{\mathbb{Q}}_{3,1}^{(2,-1)}[g](T_{2u})$, $\vec{\mathbb{Q}}_{3,2}^{(2,-1)}[g](T_{2u})$, $\vec{\mathbb{Q}}_{3,3}^{(2,-1)}[g](T_{2u})$
** symmetry

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

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

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

** expression

$$\frac{\sqrt{6}G_u yz}{4}-\frac{3\sqrt{2}G_v yz}{4}+\frac{\sqrt{2}G_{yz}\left(2x^2-y^2-z^2\right)}{4}$$

$$\frac{\sqrt{6}G_u xz}{4}+\frac{3\sqrt{2}G_v xz}{4}-\frac{\sqrt{2}G_{xz}\left(x^2-2y^2+z^2\right)}{4}$$

$$-\frac{\sqrt{6}G_u xy}{2}-\frac{\sqrt{2}G_{xy}\left(x^2+y^2-2z^2\right)}{4}$$

$\vec{\mathbb{Q}}_{3,1}^{(2,1)}[g](T_{2u})$, $\vec{\mathbb{Q}}_{3,2}^{(2,1)}[g](T_{2u})$, $\vec{\mathbb{Q}}_{3,3}^{(2,1)}[g](T_{2u})$
** symmetry

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

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

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

** expression

$$\frac{\sqrt{3}G_u yz\left(12x^2-9y^2+5z^2\right)}{12}-\frac{G_v yz\left(36x^2+y^2-13z^2\right)}{12}+\frac{7G_{xy}xz\left(2x^2-3y^2-z^2\right)}{12}$$
$$+\frac{7G_{xz}xy\left(2x^2-y^2-3z^2\right)}{12}-\frac{G_{yz}\left(4x^4-12x^2y^2-12x^2z^2+5y^4-18y^2z^2+5z^4\right)}{12}$$

$$-\frac{\sqrt{3}G_u xz\left(9x^2-12y^2-5z^2\right)}{12}+\frac{G_v xz\left(x^2+36y^2-13z^2\right)}{12}-\frac{7G_{xy}yz\left(3x^2-2y^2+z^2\right)}{12}$$
$$-\frac{G_{xz}\left(5x^4-12x^2y^2-18x^2z^2+4y^4-12y^2z^2+5z^4\right)}{12}-\frac{7G_{yz}xy\left(x^2-2y^2+3z^2\right)}{12}$$

$$\frac{\sqrt{3}G_u xy\left(x^2+y^2-6z^2\right)}{3}+\frac{7G_v xy\left(x-y\right)\left(x+y\right)}{6}-\frac{G_{xy}\left(5x^4-18x^2y^2-12x^2z^2+5y^4-12y^2z^2+4z^4\right)}{12}$$
$$-\frac{7G_{xz}yz\left(3x^2+y^2-2z^2\right)}{12}-\frac{7G_{yz}xz\left(x^2+3y^2-2z^2\right)}{12}$$

* Harmonics for rank 4

$\vec{\mathbb{Q}}_4^{(2,-1)}[g](A_{1g})$

** symmetry

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

** expression

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

$\vec{\mathbb{Q}}_4^{(2,1)}[g](A_{1g})$

** symmetry

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

** expression

$$-\frac{3\sqrt{2310}G_uxyz\,(x-y)\,(x+y)}{44}-\frac{3\sqrt{770}G_vxyz\left(x^2+y^2-2z^2\right)}{44}+\frac{\sqrt{770}G_{xy}z\,(x-y)\,(x+y)\left(x^2+y^2-2z^2\right)}{22}$$
$$-\frac{\sqrt{770}G_{xz}y\,(x-z)\,(x+z)\left(x^2-2y^2+z^2\right)}{22}-\frac{\sqrt{770}G_{yz}x\,(y-z)\,(y+z)\left(2x^2-y^2-z^2\right)}{22}$$

$\vec{\mathbb{Q}}_{4,1}^{(2,-1)}[g](E_g)$, $\vec{\mathbb{Q}}_{4,2}^{(2,-1)}[g](E_g)$

** symmetry

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

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

** expression

$$-\frac{6\sqrt{7}G_vxyz}{7}-\frac{\sqrt{7}G_{xy}z\,(x-y)\,(x+y)}{14}+\frac{\sqrt{7}G_{xz}y\left(4x^2-3y^2+5z^2\right)}{14}+\frac{\sqrt{7}G_{yz}x\left(3x^2-4y^2-5z^2\right)}{14}$$

$$\frac{6\sqrt{7}G_uxyz}{7}+\frac{\sqrt{21}G_{xy}z\left(3x^2+3y^2-2z^2\right)}{14}-\frac{\sqrt{21}G_{xz}y\left(2x^2-y^2+z^2\right)}{14}+\frac{\sqrt{21}G_{yz}x\left(x^2-2y^2-z^2\right)}{14}$$

$\vec{\mathbb{Q}}_{4,1}^{(2,1)}[g](E_g)$, $\vec{\mathbb{Q}}_{4,2}^{(2,1)}[g](E_g)$

** symmetry

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

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

** expression

$$\frac{21\sqrt{66}G_uxyz\,(x-y)\,(x+y)}{44}-\frac{21\sqrt{22}G_vxyz\left(x^2+y^2-2z^2\right)}{44}+\frac{7\sqrt{22}G_{xy}z\,(x-y)\,(x+y)\left(x^2+y^2-2z^2\right)}{44}$$
$$+\frac{\sqrt{22}G_{xz}y\left(17x^4-22x^2y^2-36x^2z^2+3y^4-8y^2z^2+10z^4\right)}{44}-\frac{\sqrt{22}G_{yz}x\left(3x^4-22x^2y^2-8x^2z^2+17y^4-36y^2z^2+10z^4\right)}{44}$$

$$-\frac{21\sqrt{22}G_uxyz\left(x^2+y^2-2z^2\right)}{44}-\frac{21\sqrt{66}G_vxyz\,(x-y)\,(x+y)}{44}+\frac{\sqrt{66}G_{xy}z\left(9x^4-24x^2y^2-10x^2z^2+9y^4-10y^2z^2+2z^4\right)}{44}$$
$$-\frac{\sqrt{66}G_{xz}y\left(x^4+2x^2y^2-12x^2z^2+y^4-12y^2z^2+8z^4\right)}{44}-\frac{\sqrt{66}G_{yz}x\left(x^4+2x^2y^2-12x^2z^2+y^4-12y^2z^2+8z^4\right)}{44}$$

$\vec{\mathbb{Q}}_{4,1}^{(2,-1)}[g](T_{1g})$, $\vec{\mathbb{Q}}_{4,2}^{(2,-1)}[g](T_{1g})$, $\vec{\mathbb{Q}}_{4,3}^{(2,-1)}[g](T_{1g})$

** 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

$$\frac{3G_u x\left(y-z\right)\left(y+z\right)}{4}+\frac{\sqrt{3}G_v x\left(y-z\right)\left(y+z\right)}{4}+\frac{\sqrt{3}G_{xy} y\left(y^2-3z^2\right)}{4}-\frac{\sqrt{3}G_{xz} z\left(3y^2-z^2\right)}{4}+\sqrt{3}G_{yz} xyz$$

$$\frac{3G_u y\left(x-z\right)\left(x+z\right)}{4}-\frac{\sqrt{3}G_v y\left(x-z\right)\left(x+z\right)}{4}+\frac{\sqrt{3}G_{xy} x\left(x^2-3z^2\right)}{4}+\sqrt{3}G_{xz} xyz-\frac{\sqrt{3}G_{yz} z\left(3x^2-z^2\right)}{4}$$

$$-\frac{\sqrt{3}G_v z\left(x-y\right)\left(x+y\right)}{2}+\sqrt{3}G_{xy} xyz+\frac{\sqrt{3}G_{xz} x\left(x^2-3y^2\right)}{4}-\frac{\sqrt{3}G_{yz} y\left(3x^2-y^2\right)}{4}$$

$\vec{\mathbb{Q}}_{4,1}^{(2,1)}[g](T_{1g})$, $\vec{\mathbb{Q}}_{4,2}^{(2,1)}[g](T_{1g})$, $\vec{\mathbb{Q}}_{4,3}^{(2,1)}[g](T_{1g})$
** symmetry

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

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

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

** expression

$$-\frac{3\sqrt{154}G_u x\left(x^2y^2-x^2z^2+y^4-9y^2z^2+2z^4\right)}{88}-\frac{\sqrt{462}G_v x\left(x^2y^2-x^2z^2-5y^4+27y^2z^2-4z^4\right)}{88}$$
$$-\frac{\sqrt{462}G_{xy} y\left(2x^2y^2-6x^2z^2-y^4+8y^2z^2-3z^4\right)}{44}+\frac{\sqrt{462}G_{xz} z\left(6x^2y^2-2x^2z^2+3y^4-8y^2z^2+z^4\right)}{44}-\frac{\sqrt{462}G_{yz} xyz\left(2x^2-y^2-z^2\right)}{44}$$

$$-\frac{3\sqrt{154}G_u y\left(x^4+x^2y^2-9x^2z^2-y^2z^2+2z^4\right)}{88}-\frac{\sqrt{462}G_v y\left(5x^4-x^2y^2-27x^2z^2+y^2z^2+4z^4\right)}{88}$$
$$+\frac{\sqrt{462}G_{xy} x\left(x^4-2x^2y^2-8x^2z^2+6y^2z^2+3z^4\right)}{44}+\frac{\sqrt{462}G_{xz} xyz\left(x^2-2y^2+z^2\right)}{44}+\frac{\sqrt{462}G_{yz} z\left(3x^4+6x^2y^2-8x^2z^2-2y^2z^2+z^4\right)}{44}$$

$$\frac{9\sqrt{154}G_u z\left(x^2-2xy-y^2\right)\left(x^2+2xy-y^2\right)}{88}-\frac{\sqrt{462}G_v z\left(x-y\right)\left(x+y\right)\left(x^2+y^2-2z^2\right)}{88}+\frac{\sqrt{462}G_{xy} xyz\left(x^2+y^2-2z^2\right)}{44}$$
$$+\frac{\sqrt{462}G_{xz} x\left(x^4-8x^2y^2-2x^2z^2+3y^4+6y^2z^2\right)}{44}+\frac{\sqrt{462}G_{yz} y\left(3x^4-8x^2y^2+6x^2z^2+y^4-2y^2z^2\right)}{44}$$

$\vec{\mathbb{Q}}_{4,1}^{(2,-1)}[g](T_{2g})$, $\vec{\mathbb{Q}}_{4,2}^{(2,-1)}[g](T_{2g})$, $\vec{\mathbb{Q}}_{4,3}^{(2,-1)}[g](T_{2g})$
** symmetry

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

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

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

** expression

$$\frac{3\sqrt{7}G_u x\left(2x^2-5y^2-z^2\right)}{28}+\frac{\sqrt{21}G_v x\left(2x^2+3y^2-9z^2\right)}{28}-\frac{\sqrt{21}G_{xy} y\left(2x^2+y^2-5z^2\right)}{28}+\frac{\sqrt{21}G_{xz} z\left(2x^2-5y^2+z^2\right)}{28}$$

$$\frac{3\sqrt{7}G_u y\left(5x^2-2y^2+z^2\right)}{28}+\frac{\sqrt{21}G_v y\left(3x^2+2y^2-9z^2\right)}{28}+\frac{\sqrt{21}G_{xy} x\left(x^2+2y^2-5z^2\right)}{28}+\frac{\sqrt{21}G_{yz} z\left(5x^2-2y^2-z^2\right)}{28}$$

$$\frac{3\sqrt{7}G_u z\left(x-y\right)\left(x+y\right)}{7}+\frac{\sqrt{21}G_v z\left(3x^2+3y^2-2z^2\right)}{14}-\frac{\sqrt{21}G_{xz} x\left(x^2-5y^2+2z^2\right)}{28}-\frac{\sqrt{21}G_{yz} y\left(5x^2-y^2-2z^2\right)}{28}$$

$\vec{\mathbb{Q}}_{4,1}^{(2,1)}[g](T_{2g})$, $\vec{\mathbb{Q}}_{4,2}^{(2,1)}[g](T_{2g})$, $\vec{\mathbb{Q}}_{4,3}^{(2,1)}[g](T_{2g})$
** symmetry

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

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

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

** expression

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

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

$$-\frac{21\sqrt{22}G_u z\left(x-y\right)\left(x+y\right)\left(x^2+y^2-2z^2\right)}{88}-\frac{\sqrt{66}G_v z\left(3x^4-78x^2y^2+20x^2z^2+3y^4+20y^2z^2-4z^4\right)}{88}-\frac{21\sqrt{66}G_{xy}xyz\left(x-y\right)\left(x+y\right)}{44}$$
$$-\frac{\sqrt{66}G_{xz} x\left(x^4+2x^2y^2-12x^2z^2+y^4-12y^2z^2+8z^4\right)}{44}+\frac{\sqrt{66}G_{yz} y\left(x^4+2x^2y^2-12x^2z^2+y^4-12y^2z^2+8z^4\right)}{44}$$