

$P4_132$

O^7

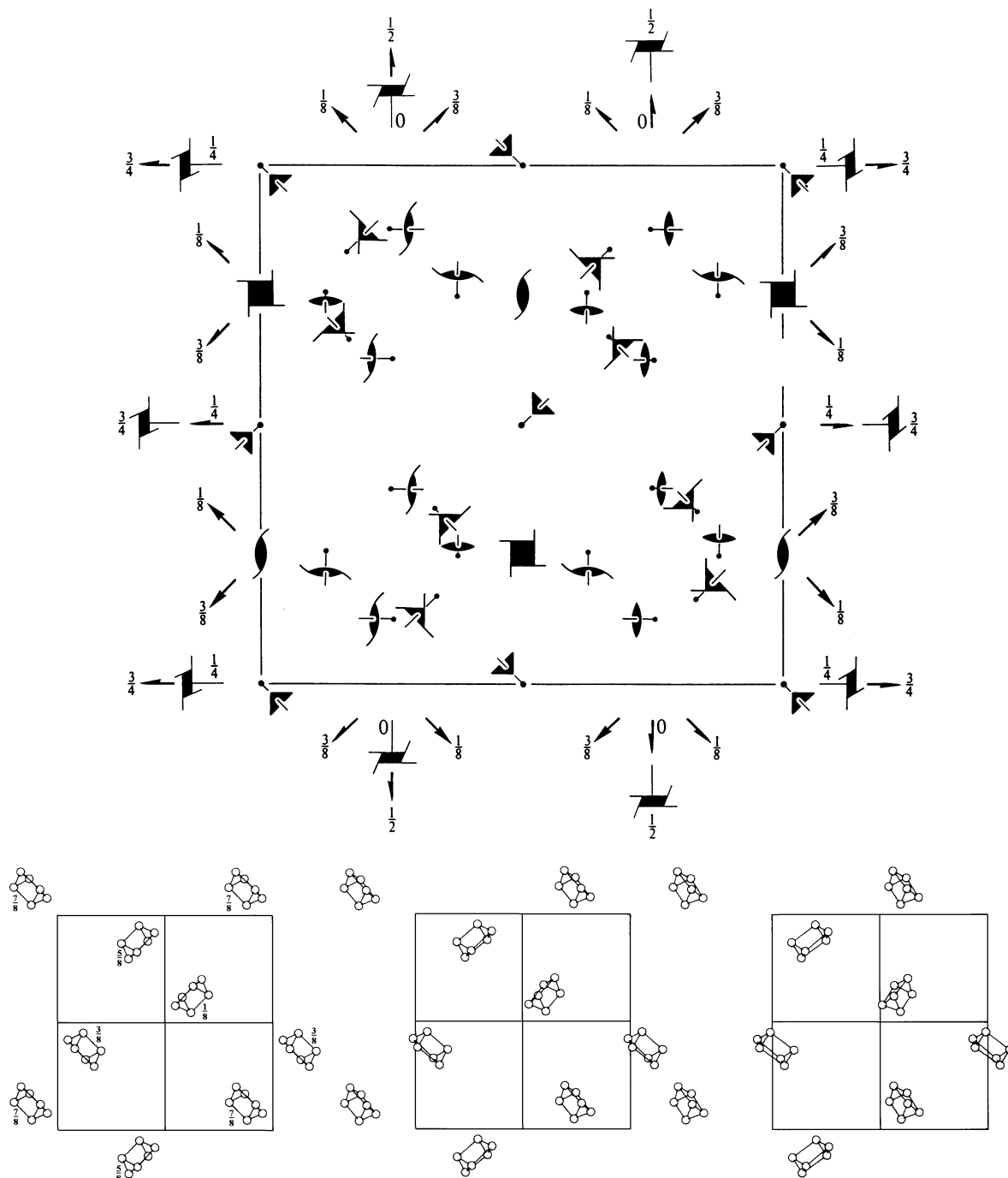
432

Cubic

No. 213

$P4_132$

Patterson symmetry $Pm\bar{3}m$



Origin on $3[111]$ at midpoint of three non-intersecting pairs of parallel screw axes 4_1 and 2_1

Asymmetric unit $-\frac{1}{4} \leq x \leq \frac{1}{2}$; $0 \leq y \leq \frac{3}{4}$; $0 \leq z \leq \frac{1}{2}$; $x \leq y \leq x + \frac{1}{2}$; $(y-x)/2 \leq z \leq \min(y, (-4x-2y+3)/2, (3-2x-2y)/4)$
Vertices $0,0,0$ $\frac{1}{2}, \frac{1}{2}, 0$ $\frac{1}{4}, \frac{3}{4}, \frac{1}{4}$ $-\frac{1}{4}, \frac{1}{4}, \frac{1}{4}$ $0, \frac{1}{2}, \frac{1}{2}$ $\frac{3}{8}, \frac{3}{8}, \frac{3}{8}$

Symmetry operations

- | | | | |
|---|---|---|---|
| (1) 1 | (2) $2(0,0,\frac{1}{2})$ $\frac{1}{4},0,z$ | (3) $2(0,\frac{1}{2},0)$ $0,y,\frac{1}{4}$ | (4) $2(\frac{1}{2},0,0)$ $x,\frac{1}{4},0$ |
| (5) 3^+ x,x,x | (6) 3^+ $\bar{x}+\frac{1}{2},x,\bar{x}$ | (7) 3^+ $x+\frac{1}{2},\bar{x}-\frac{1}{2},\bar{x}$ | (8) 3^+ $\bar{x},\bar{x}+\frac{1}{2},x$ |
| (9) 3^- x,x,x | (10) 3^- $(-\frac{1}{3},\frac{1}{3},\frac{1}{3})$ $x+\frac{1}{6},\bar{x}+\frac{1}{6},\bar{x}$ | (11) 3^- $(\frac{1}{3},\frac{1}{3},-\frac{1}{3})$ $\bar{x}+\frac{1}{3},\bar{x}+\frac{1}{6},x$ | (12) 3^- $(\frac{1}{3},-\frac{1}{3},\frac{1}{3})$ $\bar{x}-\frac{1}{6},x+\frac{1}{3},\bar{x}$ |
| (13) $2(\frac{1}{2},\frac{1}{2},0)$ $x,x-\frac{1}{4},\frac{1}{8}$ | (14) 2 $x,\bar{x}+\frac{3}{4},\frac{3}{8}$ | (15) $4^-(0,0,\frac{3}{4})$ $\frac{1}{4},0,z$ | (16) $4^+(0,0,\frac{1}{4})$ $-\frac{1}{4},\frac{1}{2},z$ |
| (17) $4^-(\frac{3}{4},0,0)$ $x,\frac{1}{4},0$ | (18) $2(0,\frac{1}{2},\frac{1}{2})$ $\frac{1}{8},y+\frac{1}{4},y$ | (19) 2 $\frac{3}{8},y+\frac{3}{4},\bar{y}$ | (20) $4^+(\frac{1}{4},0,0)$ $x,-\frac{1}{4},\frac{1}{2}$ |
| (21) $4^+(0,\frac{1}{4},0)$ $\frac{1}{2},y,-\frac{1}{4}$ | (22) $2(\frac{1}{2},0,\frac{1}{2})$ $x-\frac{1}{4},\frac{1}{8},x$ | (23) $4^-(0,\frac{3}{4},0)$ $0,y,\frac{1}{4}$ | (24) 2 $\bar{x}+\frac{3}{4},\frac{3}{8},x$ |

Generators selected (1); $t(1,0,0)$; $t(0,1,0)$; $t(0,0,1)$; (2); (3); (5); (13)

Positions

Multiplicity, Wyckoff letter, Site symmetry		Coordinates	Reflection conditions			
24	e 1	(1) x, y, z (2) $\bar{x} + \frac{1}{2}, \bar{y}, z + \frac{1}{2}$ (3) $\bar{x}, y + \frac{1}{2}, \bar{z} + \frac{1}{2}$ (4) $x + \frac{1}{2}, \bar{y} + \frac{1}{2}, \bar{z}$ (5) z, x, y (6) $z + \frac{1}{2}, \bar{x} + \frac{1}{2}, \bar{y}$ (7) $\bar{z} + \frac{1}{2}, \bar{x}, y + \frac{1}{2}$ (8) $\bar{z}, x + \frac{1}{2}, \bar{y} + \frac{1}{2}$ (9) y, z, x (10) $\bar{y}, z + \frac{1}{2}, \bar{x} + \frac{1}{2}$ (11) $y + \frac{1}{2}, \bar{z} + \frac{1}{2}, \bar{x}$ (12) $\bar{y} + \frac{1}{2}, \bar{z}, x + \frac{1}{2}$ (13) $y + \frac{3}{4}, x + \frac{1}{4}, \bar{z} + \frac{1}{4}$ (14) $\bar{y} + \frac{3}{4}, \bar{x} + \frac{3}{4}, \bar{z} + \frac{3}{4}$ (15) $y + \frac{1}{4}, \bar{x} + \frac{1}{4}, z + \frac{3}{4}$ (16) $\bar{y} + \frac{1}{4}, x + \frac{3}{4}, z + \frac{1}{4}$ (17) $x + \frac{3}{4}, z + \frac{1}{4}, \bar{y} + \frac{1}{4}$ (18) $\bar{x} + \frac{1}{4}, z + \frac{3}{4}, y + \frac{1}{4}$ (19) $\bar{x} + \frac{3}{4}, \bar{z} + \frac{3}{4}, \bar{y} + \frac{3}{4}$ (20) $x + \frac{1}{4}, \bar{z} + \frac{1}{4}, y + \frac{3}{4}$ (21) $z + \frac{3}{4}, y + \frac{1}{4}, \bar{x} + \frac{1}{4}$ (22) $z + \frac{1}{4}, \bar{y} + \frac{1}{4}, x + \frac{3}{4}$ (23) $\bar{z} + \frac{1}{4}, y + \frac{3}{4}, x + \frac{1}{4}$ (24) $\bar{z} + \frac{3}{4}, \bar{y} + \frac{3}{4}, \bar{x} + \frac{3}{4}$	$h00: h = 4n$			
12	d .. 2	$\frac{1}{8}, y, y + \frac{1}{4}$ $y + \frac{1}{4}, \frac{1}{8}, y$ $y, y + \frac{1}{4}, \frac{1}{8}$	$\frac{3}{8}, \bar{y}, y + \frac{3}{4}$ $y + \frac{3}{4}, \frac{3}{8}, \bar{y}$ $\bar{y}, y + \frac{3}{4}, \frac{3}{8}$	$\frac{7}{8}, y + \frac{1}{2}, \bar{y} + \frac{1}{4}$ $\bar{y} + \frac{1}{4}, \frac{7}{8}, y + \frac{1}{2}$ $y + \frac{1}{2}, \bar{y} + \frac{1}{4}, \frac{7}{8}$	$\frac{5}{8}, \bar{y} + \frac{1}{2}, \bar{y} + \frac{3}{4}$ $\bar{y} + \frac{3}{4}, \frac{5}{8}, \bar{y} + \frac{1}{2}$ $\bar{y} + \frac{1}{2}, \bar{y} + \frac{3}{4}, \frac{5}{8}$	Special: as above, plus no extra conditions
8	c . 3 .	x, x, x $x + \frac{3}{4}, x + \frac{1}{4}, \bar{x} + \frac{1}{4}$	$\bar{x} + \frac{1}{2}, \bar{x}, x + \frac{1}{2}$ $\bar{x} + \frac{3}{4}, \bar{x} + \frac{3}{4}, \bar{x} + \frac{3}{4}$	$\bar{x}, x + \frac{1}{2}, \bar{x} + \frac{1}{2}$ $x + \frac{1}{4}, \bar{x} + \frac{1}{4}, x + \frac{3}{4}$	$x + \frac{1}{2}, \bar{x} + \frac{1}{2}, \bar{x}$ $\bar{x} + \frac{1}{4}, x + \frac{3}{4}, x + \frac{1}{4}$	$Ok_l: k = 2n + 1$ or $l = 2n + 1$ or $k + l = 4n$
4	b . 3 2	$\frac{7}{8}, \frac{7}{8}, \frac{7}{8}$	$\frac{5}{8}, \frac{1}{8}, \frac{3}{8}$ $\frac{1}{8}, \frac{3}{8}, \frac{5}{8}$	$\frac{3}{8}, \frac{5}{8}, \frac{1}{8}$	$hkl: h, k = 2n + 1$ or $h = 2n + 1, k = 4n$ and $l = 4n + 2$ or $h, k, l = 4n + 2$ or $h, k, l = 4n$	
4	a . 3 2	$\frac{3}{8}, \frac{3}{8}, \frac{3}{8}$	$\frac{1}{8}, \frac{5}{8}, \frac{7}{8}$ $\frac{5}{8}, \frac{7}{8}, \frac{1}{8}$	$\frac{7}{8}, \frac{1}{8}, \frac{5}{8}$		

Symmetry of special projections

Along [001] $p4gm$ $\mathbf{a}' = \mathbf{a}$ $\mathbf{b}' = \mathbf{b}$ Origin at $\frac{1}{4}, 0, z$	Along [111] $p3m1$ $\mathbf{a}' = \frac{1}{3}(2\mathbf{a} - \mathbf{b} - \mathbf{c})$ $\mathbf{b}' = \frac{1}{3}(-\mathbf{a} + 2\mathbf{b} - \mathbf{c})$ Origin at x, x, x	Along [110] $p2gm$ $\mathbf{a}' = \frac{1}{2}(-\mathbf{a} + \mathbf{b})$ $\mathbf{b}' = \mathbf{c}$ Origin at $x, x + \frac{1}{4}, \frac{1}{8}$
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Maximal non-isomorphic subgroups

I	[2] $P2_131 (P2_1, 3, 198)$	1; 2; 3; 4; 5; 6; 7; 8; 9; 10; 11; 12
	{ [3] $P4_112 (P4_1, 2, 2, 92)$	1; 2; 3; 4; 13; 14; 15; 16
	{ [3] $P4_112 (P4_1, 2, 2, 92)$	1; 2; 3; 4; 17; 18; 19; 20
	{ [3] $P4_112 (P4_1, 2, 2, 92)$	1; 2; 3; 4; 21; 22; 23; 24
	{ [4] $P132 (R32, 155)$	1; 5; 9; 14; 19; 24
	{ [4] $P132 (R32, 155)$	1; 6; 12; 13; 18; 24
	{ [4] $P132 (R32, 155)$	1; 7; 10; 13; 19; 22
	{ [4] $P132 (R32, 155)$	1; 8; 11; 14; 18; 22

IIa none

IIIb none

Maximal isomorphic subgroups of lowest index

IIc [27] $P4_332 (\mathbf{a}' = 3\mathbf{a}, \mathbf{b}' = 3\mathbf{b}, \mathbf{c}' = 3\mathbf{c}) (212)$; [125] $P4_132 (\mathbf{a}' = 5\mathbf{a}, \mathbf{b}' = 5\mathbf{b}, \mathbf{c}' = 5\mathbf{c}) (213)$

Minimal non-isomorphic supergroups

I none

II [2] $I4_132 (214)$; [4] $F4_132 (210)$