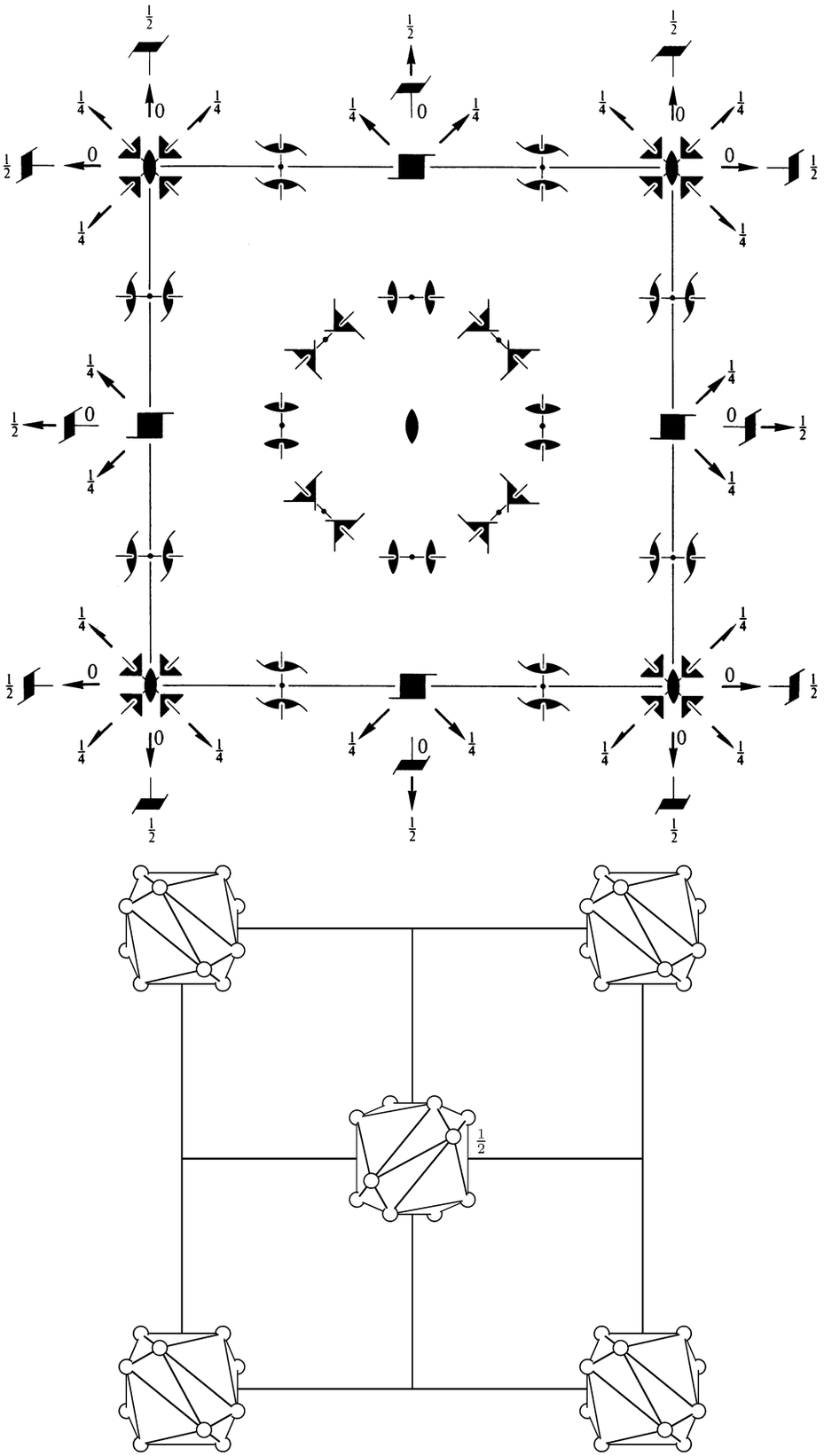
$P4_232$ O^2 432 Cubic

No. 208 $P4_232$ Patterson symmetry $Pm\bar{3}m$



Origin at 2 3

Asymmetric unit $0 \le x \le \frac{1}{2}$; $0 \le y \le \frac{1}{2}$; $-\frac{1}{4} \le z \le \frac{1}{4}$; $\max(-x, x-\frac{1}{2}, -y, y-\frac{1}{2}) \le z \le \min(x, \frac{1}{2}-x, y, \frac{1}{2}-y)$

Vertices $0,0,0$ $\frac{1}{2},0,0$ $\frac{1}{2},\frac{1}{2},0$ $0,\frac{1}{2},0$ $\frac{1}{4},\frac{1}{4},\frac{1}{4}$ $\frac{1}{4},\frac{1}{4},-\frac{1}{4}$

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Symmetry operations

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

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
									h,k,l permutable
									General:
24	m	1	(1) x,y,z	(2) $\bar{x},\bar{y},z$	(3) $\bar{x},y,\bar{z}$	(4) $x,\bar{y},\bar{z}$			$h00$: $h=2n$
			(5) z,x,y	(6) $z,\bar{x},\bar{y}$	(7) $\bar{z},\bar{x},y$	(8) $\bar{z},x,\bar{y}$			
			(9) y,z,x	(10) $\bar{y},z,\bar{x}$	(11) $y,\bar{z},\bar{x}$	(12) $\bar{y},\bar{z},x$			
			(13) $y+\frac{1}{2},x+\frac{1}{2},\bar{z}+\frac{1}{2}$	(14) $\bar{y}+\frac{1}{2},\bar{x}+\frac{1}{2},\bar{z}+\frac{1}{2}$	(15) $y+\frac{1}{2},\bar{x}+\frac{1}{2},z+\frac{1}{2}$	(16) $\bar{y}+\frac{1}{2},x+\frac{1}{2},z+\frac{1}{2}$			
			(17) $x+\frac{1}{2},z+\frac{1}{2},\bar{y}+\frac{1}{2}$	(18) $\bar{x}+\frac{1}{2},z+\frac{1}{2},y+\frac{1}{2}$	(19) $\bar{x}+\frac{1}{2},\bar{z}+\frac{1}{2},\bar{y}+\frac{1}{2}$	(20) $x+\frac{1}{2},\bar{z}+\frac{1}{2},y+\frac{1}{2}$			
			(21) $z+\frac{1}{2},y+\frac{1}{2},\bar{x}+\frac{1}{2}$	(22) $z+\frac{1}{2},\bar{y}+\frac{1}{2},x+\frac{1}{2}$	(23) $\bar{z}+\frac{1}{2},y+\frac{1}{2},x+\frac{1}{2}$	(24) $\bar{z}+\frac{1}{2},\bar{y}+\frac{1}{2},\bar{x}+\frac{1}{2}$			
									Special: as above, plus
12	l	. . 2	$\frac{1}{4},y,y+\frac{1}{2}$ $y+\frac{1}{2},\frac{1}{4},y$ $y,y+\frac{1}{2},\frac{1}{4}$	$\frac{3}{4},\bar{y},y+\frac{1}{2}$ $y+\frac{1}{2},\frac{3}{4},\bar{y}$ $\bar{y},y+\frac{1}{2},\frac{3}{4}$	$\frac{3}{4},y,\bar{y}+\frac{1}{2}$ $\bar{y}+\frac{1}{2},\frac{3}{4},y$ $y,\bar{y}+\frac{1}{2},\frac{3}{4}$	$\frac{1}{4},\bar{y},\bar{y}+\frac{1}{2}$ $\bar{y}+\frac{1}{2},\frac{1}{4},\bar{y}$ $\bar{y},\bar{y}+\frac{1}{2},\frac{1}{4}$			no extra conditions
12	k	. . 2	$\frac{1}{4},y,\bar{y}+\frac{1}{2}$ $\bar{y}+\frac{1}{2},\frac{1}{4},y$ $y,\bar{y}+\frac{1}{2},\frac{1}{4}$	$\frac{3}{4},\bar{y},\bar{y}+\frac{1}{2}$ $\bar{y}+\frac{1}{2},\frac{3}{4},\bar{y}$ $\bar{y},\bar{y}+\frac{1}{2},\frac{3}{4}$	$\frac{3}{4},y,y+\frac{1}{2}$ $y+\frac{1}{2},\frac{3}{4},y$ $y,y+\frac{1}{2},\frac{3}{4}$	$\frac{1}{4},\bar{y},y+\frac{1}{2}$ $y+\frac{1}{2},\frac{1}{4},\bar{y}$ $\bar{y},y+\frac{1}{2},\frac{1}{4}$			no extra conditions
12	j	2 . .	$x,\frac{1}{2},0$ $0,x+\frac{1}{2},\frac{1}{2}$	$\bar{x},\frac{1}{2},0$ $0,\bar{x}+\frac{1}{2},\frac{1}{2}$	$0,x,\frac{1}{2}$ $x+\frac{1}{2},\frac{1}{2},0$	$0,\bar{x},\frac{1}{2}$ $\bar{x}+\frac{1}{2},\frac{1}{2},0$	$\frac{1}{2},0,x$ $\frac{1}{2},0,\bar{x}+\frac{1}{2}$	$\frac{1}{2},0,\bar{x}$ $\frac{1}{2},0,x+\frac{1}{2}$	hkl: $h=2n$ hhl: $l=2n$
12	i	2 . .	$x,0,\frac{1}{2}$ $\frac{1}{2},x+\frac{1}{2},0$	$\bar{x},0,\frac{1}{2}$ $\frac{1}{2},\bar{x}+\frac{1}{2},0$	$\frac{1}{2},x,0$ $x+\frac{1}{2},0,\frac{1}{2}$	$\frac{1}{2},\bar{x},0$ $\bar{x}+\frac{1}{2},0,\frac{1}{2}$	$0,\frac{1}{2},x$ $0,\frac{1}{2},\bar{x}+\frac{1}{2}$	$0,\frac{1}{2},\bar{x}$ $0,\frac{1}{2},x+\frac{1}{2}$	hkl: $h=2n$ hhl: $l=2n$
12	h	2 . .	$x,0,0$ $\frac{1}{2},x+\frac{1}{2},\frac{1}{2}$	$\bar{x},0,0$ $\frac{1}{2},\bar{x}+\frac{1}{2},\frac{1}{2}$	$0,x,0$ $x+\frac{1}{2},\frac{1}{2},\frac{1}{2}$	$0,\bar{x},0$ $\bar{x}+\frac{1}{2},\frac{1}{2},\frac{1}{2}$	$0,0,x$ $\frac{1}{2},\frac{1}{2},\bar{x}+\frac{1}{2}$	$0,0,\bar{x}$ $\frac{1}{2},\frac{1}{2},x+\frac{1}{2}$	hkl: $h+k+l=2n$
8	g	. 3 .	x,x,x $\bar{x},x,\bar{x}$ $x+\frac{1}{2},x+\frac{1}{2},\bar{x}+\frac{1}{2}$ $x+\frac{1}{2},\bar{x}+\frac{1}{2},x+\frac{1}{2}$	$\bar{x},\bar{x},x$ $x,\bar{x},\bar{x}$ $\bar{x}+\frac{1}{2},\bar{x}+\frac{1}{2},\bar{x}+\frac{1}{2}$ $\bar{x}+\frac{1}{2},x+\frac{1}{2},x+\frac{1}{2}$					$0kl$: $k+l=2n$
6	f	2 . 2 2	$\frac{1}{4},\frac{1}{2},0$	$\frac{3}{4},\frac{1}{2},0$	$0,\frac{1}{4},\frac{1}{2}$	$0,\frac{3}{4},\frac{1}{2}$	$\frac{1}{2},0,\frac{1}{4}$	$\frac{1}{2},0,\frac{3}{4}$	hkl: $h+k+l=2n$ or $h=2n+1,k=4n$ and $l=4n+2$
6	e	2 . 2 2	$\frac{1}{4},0,\frac{1}{2}$	$\frac{3}{4},0,\frac{1}{2}$	$\frac{1}{2},\frac{1}{4},0$	$\frac{1}{2},\frac{3}{4},0$	$0,\frac{1}{2},\frac{1}{4}$	$0,\frac{1}{2},\frac{3}{4}$	
6	d	2 2 2 . .	$0,\frac{1}{2},\frac{1}{2}$	$\frac{1}{2},0,\frac{1}{2}$	$\frac{1}{2},\frac{1}{2},0$	$0,\frac{1}{2},0$	$\frac{1}{2},0,0$	$0,0,\frac{1}{2}$	hkl: $h+k+l=2n$
4	c	. 3 2	$\frac{3}{4},\frac{3}{4},\frac{3}{4}$	$\frac{1}{4},\frac{1}{4},\frac{3}{4}$	$\frac{1}{4},\frac{3}{4},\frac{1}{4}$	$\frac{3}{4},\frac{1}{4},\frac{1}{4}$			hkl: $h+k,h+l,k+l=2n$
4	b	. 3 2	$\frac{1}{4},\frac{1}{4},\frac{1}{4}$	$\frac{3}{4},\frac{3}{4},\frac{1}{4}$	$\frac{3}{4},\frac{1}{4},\frac{3}{4}$	$\frac{1}{4},\frac{3}{4},\frac{3}{4}$			hkl: $h+k,h+l,k+l=2n$
2	a	2 3 .	$0,0,0$	$\frac{1}{2},\frac{1}{2},\frac{1}{2}$					hkl: $h+k+l=2n$

Symmetry of special projections

Along [001] $p4mm$
$\mathbf{a}'=\mathbf{a}$ $\mathbf{b}'=\mathbf{b}$
Origin at $0,\frac{1}{2},z$

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] $p2mm$
$\mathbf{a}'=\frac{1}{2}(-\mathbf{a}+\mathbf{b})$ $\mathbf{b}'=\mathbf{c}$
Origin at $x,x,\frac{1}{4}$