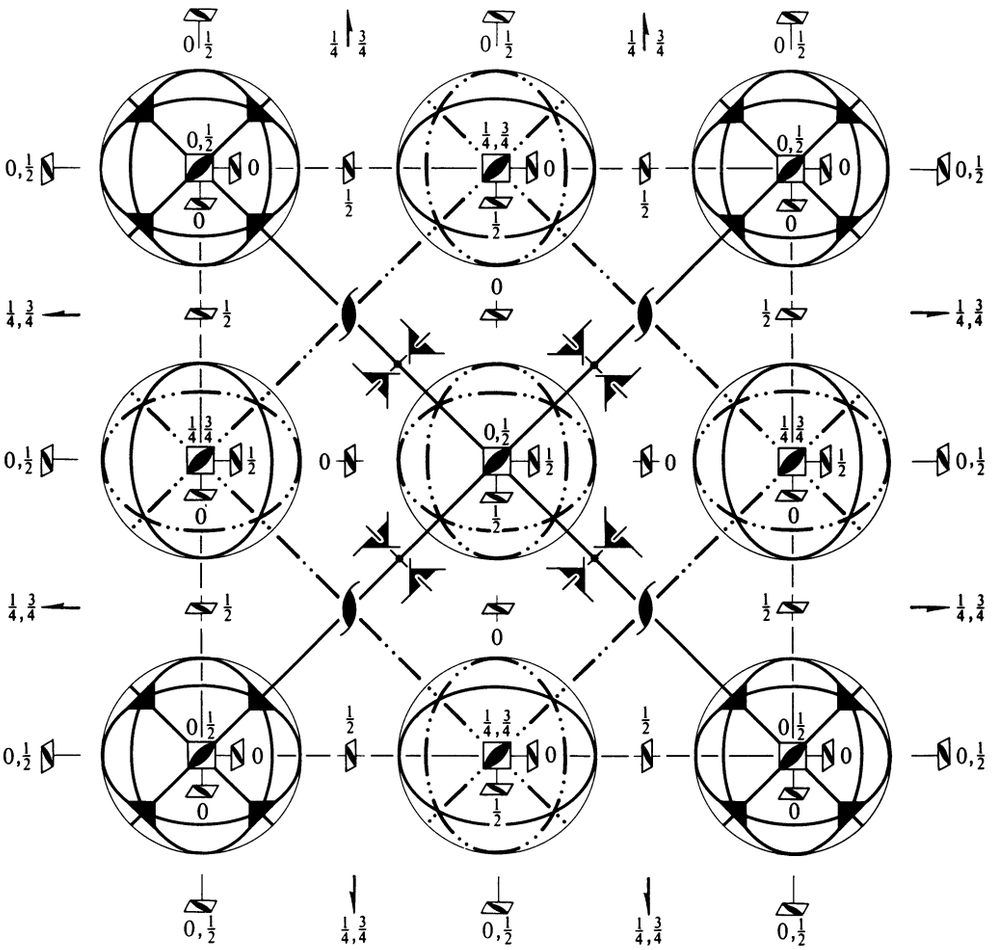
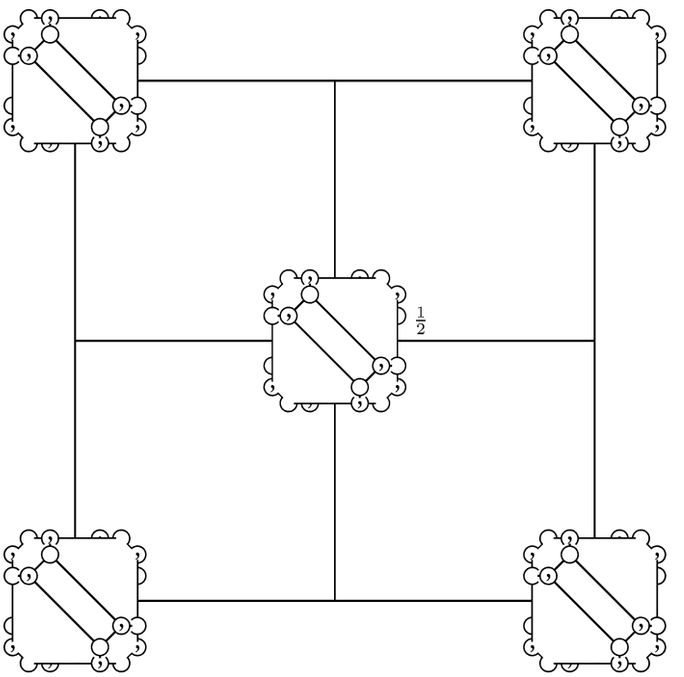
$I\bar{4}3m$ T_d^3 $\bar{4}3m$ Cubic

No. 217 $I\bar{4}3m$ Patterson symmetry $Im\bar{3}m$





Origin at $\bar{4}3m$

Asymmetric unit $0 \le x \le \frac{1}{2}$; $0 \le y \le \frac{1}{2}$; $0 \le z \le \frac{1}{2}$; $y \le x$; $z \le y$

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

Symmetry operations

For $(0,0,0)+$ set

(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) m x,x,z	(14) m $x,\bar{x},z$	(15) $\bar{4}^+$ 0,0,z; 0,0,0	(16) $\bar{4}^-$ 0,0,z; 0,0,0
(17) m x,y,y	(18) $\bar{4}^+$ x,0,0; 0,0,0	(19) $\bar{4}^-$ x,0,0; 0,0,0	(20) m $x,y,\bar{y}$
(21) m x,y,x	(22) $\bar{4}^-$ 0,y,0; 0,0,0	(23) m $\bar{x},y,x$	(24) $\bar{4}^+$ 0,y,0; 0,0,0

For $(\frac{1}{2},\frac{1}{2},\frac{1}{2})+$ set

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

Generators selected (1); $t(1,0,0)$; $t(0,1,0)$; $t(0,0,1)$; $t(\frac{1}{2},\frac{1}{2},\frac{1}{2})$; (2); (3); (5); (13)

Positions

Multiplicity, Wyckoff letter, Site symmetry			Coordinates $(0,0,0)+$	$(\frac{1}{2},\frac{1}{2},\frac{1}{2})+$			Reflection conditions
							h,k,l permutable
							General:
48	h	1	(1) x,y,z	(2) $\bar{x},\bar{y},z$	(3) $\bar{x},y,\bar{z}$	(4) $x,\bar{y},\bar{z}$	hkl: $h+k+l=2n$
			(5) z,x,y	(6) $z,\bar{x},\bar{y}$	(7) $\bar{z},\bar{x},y$	(8) $\bar{z},x,\bar{y}$	$0kl$: $k+l=2n$
			(9) y,z,x	(10) $\bar{y},z,\bar{x}$	(11) $y,\bar{z},\bar{x}$	(12) $\bar{y},\bar{z},x$	hhl: $l=2n$
			(13) y,x,z	(14) $\bar{y},\bar{x},z$	(15) $y,\bar{x},\bar{z}$	(16) $\bar{y},x,\bar{z}$	$h00$: $h=2n$
			(17) x,z,y	(18) $\bar{x},z,\bar{y}$	(19) $\bar{x},\bar{z},y$	(20) $x,\bar{z},\bar{y}$	
			(21) z,y,x	(22) $z,\bar{y},\bar{x}$	(23) $\bar{z},y,\bar{x}$	(24) $\bar{z},\bar{y},x$	
							Special: no extra conditions
24	g	. . m	x,x,z $\bar{z},\bar{x},x$	$\bar{x},\bar{x},z$ $\bar{z},x,\bar{x}$	$\bar{x},x,\bar{z}$ x,z,x	$x,\bar{x},\bar{z}$ $\bar{x},z,\bar{x}$	z,x,x $x,\bar{z},\bar{x}$	$z,\bar{x},\bar{x}$ $\bar{x},\bar{z},x$
24	f	2 . .	$x,\frac{1}{2},0$ $\frac{1}{2},x,0$	$\bar{x},\frac{1}{2},0$ $\frac{1}{2},\bar{x},0$	$0,x,\frac{1}{2}$ $x,0,\frac{1}{2}$	$0,\bar{x},\frac{1}{2}$ $\bar{x},0,\frac{1}{2}$	$\frac{1}{2},0,x$ $0,\frac{1}{2},x$	$\frac{1}{2},0,\bar{x}$ $0,\frac{1}{2},\bar{x}$
12	e	2 . mm	$x,0,0$	$\bar{x},0,0$	$0,x,0$	$0,\bar{x},0$	$0,0,x$	$0,0,\bar{x}$
12	d	$\bar{4}$ . .	$\frac{1}{4},\frac{1}{2},0$	$\frac{3}{4},\frac{1}{2},0$	$0,\frac{1}{4},\frac{1}{2}$	$0,\frac{3}{4},\frac{1}{2}$	$\frac{1}{2},0,\frac{1}{4}$	$\frac{1}{2},0,\frac{3}{4}$
8	c	. 3 m	x,x,x	$\bar{x},\bar{x},x$	$\bar{x},x,\bar{x}$	$x,\bar{x},\bar{x}$		
6	b	$\bar{4}$ 2 . m	$0,\frac{1}{2},\frac{1}{2}$	$\frac{1}{2},0,\frac{1}{2}$	$\frac{1}{2},\frac{1}{2},0$			
2	a	$\bar{4}$ 3 m	0,0,0					

Symmetry of special projections

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

Along [111] $p31m$
$\mathbf{a}' = \frac{1}{3}(2\mathbf{a}-\mathbf{b}-\mathbf{c})$ $\mathbf{b}' = \frac{1}{3}(-\mathbf{a}+2\mathbf{b}-\mathbf{c})$
Origin at x,x,x

Along [110] $p1m1$
$\mathbf{a}' = \frac{1}{2}(-\mathbf{a}+\mathbf{b})$ $\mathbf{b}' = \frac{1}{2}\mathbf{c}$
Origin at $x,x,0$