$P\bar{4}3m$	T_d^1	$\bar{4}3m$	Cubic

No. 215 $\qquad P\bar{4}3m$ $\qquad\qquad$ Patterson symmetry $Pm\bar{3}m$
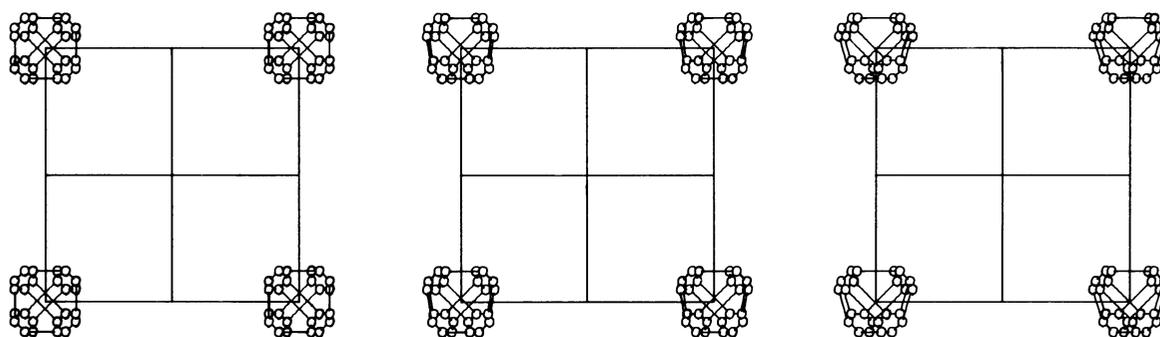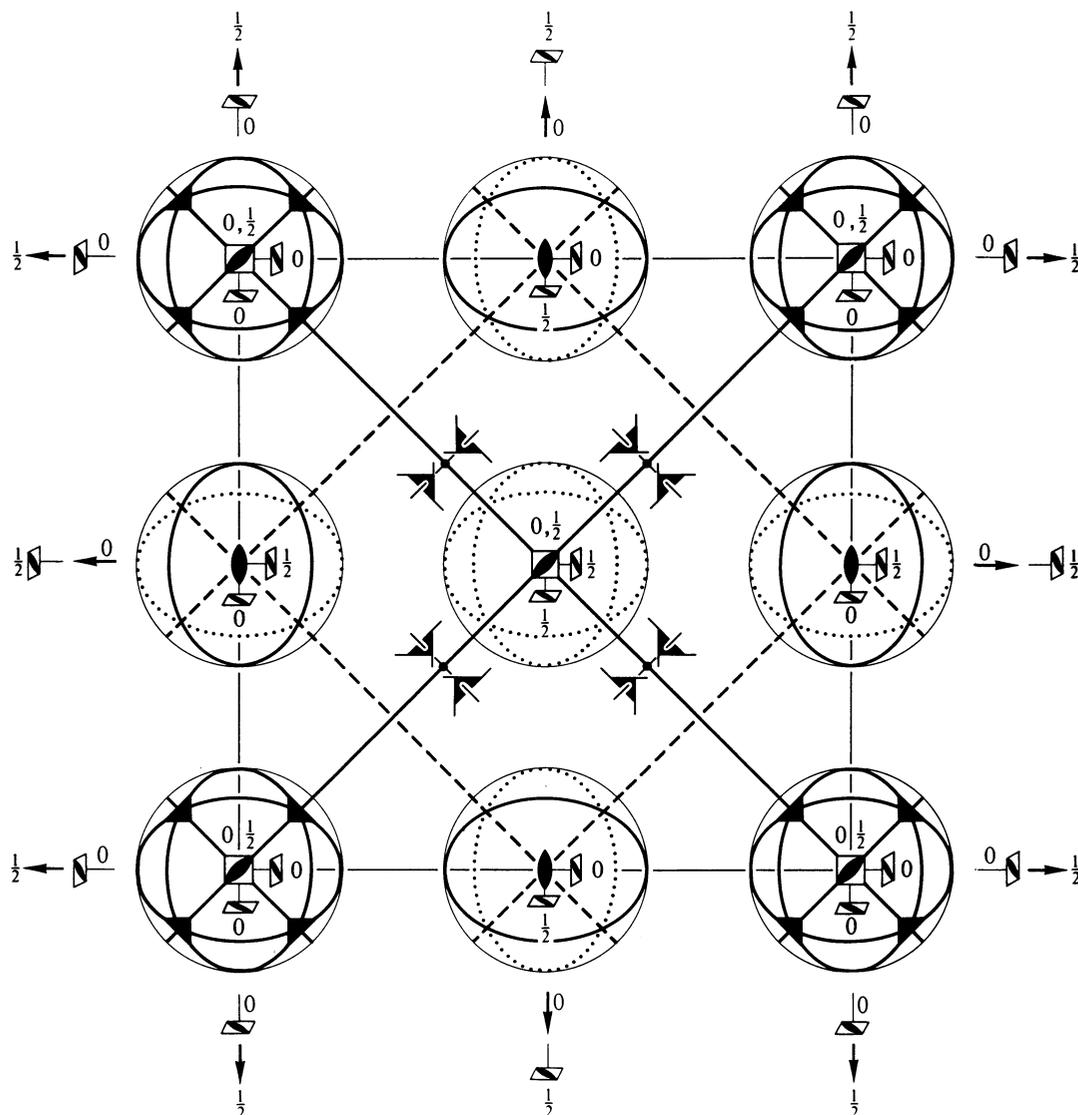
Origin at $\bar{4}3m$

Asymmetric unit $\qquad 0 \leq x \leq 1; \quad 0 \leq y \leq \frac{1}{2}; \quad 0 \leq z \leq \frac{1}{2}; \quad y \leq \min(x, 1-x); \quad z \leq y$

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

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) $m\ \ x,x,z$	(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) $\bar{4}^+\ 0,y,0;\ \ 0,0,0$

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

Reflection conditions: h,k,l permutable

General:

24 j 1	(1) x,y,z	(2) $\bar{x},\bar{y},z$	(3) $\bar{x},y,\bar{z}$	(4) $x,\bar{y},\bar{z}$

(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,x,z (14) $\bar{y},\bar{x},z$ (15) $y,\bar{x},\bar{z}$ (16) $\bar{y},x,\bar{z}$
(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) $\bar{z},\bar{y},x$

no conditions

Special: no extra conditions

12   i $..m$ x,x,z $\bar{x},\bar{x},z$ $\bar{x},x,\bar{z}$ $x,\bar{x},\bar{z}$ z,x,x $z,\bar{x},\bar{x}$
                  $\bar{z},\bar{x},x$ $\bar{z},x,\bar{x}$ x,z,x $\bar{x},z,\bar{x}$ $x,\bar{z},\bar{x}$ $\bar{x},\bar{z},x$

12   h $2..$ $x,\frac{1}{2},0$ $\bar{x},\frac{1}{2},0$ $0,x,\frac{1}{2}$ $0,\bar{x},\frac{1}{2}$ $\frac{1}{2},0,x$ $\frac{1}{2},0,\bar{x}$
                  $\frac{1}{2},x,0$ $\frac{1}{2},\bar{x},0$ $x,0,\frac{1}{2}$ $\bar{x},0,\frac{1}{2}$ $0,\frac{1}{2},x$ $0,\frac{1}{2},\bar{x}$

6   g $2.mm$ $x,\frac{1}{2},\frac{1}{2}$ $\bar{x},\frac{1}{2},\frac{1}{2}$ $\frac{1}{2},x,\frac{1}{2}$ $\frac{1}{2},\bar{x},\frac{1}{2}$ $\frac{1}{2},\frac{1}{2},x$ $\frac{1}{2},\frac{1}{2},\bar{x}$

6   f $2.mm$ $x,0,0$ $\bar{x},0,0$ $0,x,0$ $0,\bar{x},0$ $0,0,x$ $0,0,\bar{x}$

4   e $.3m$ x,x,x $\bar{x},\bar{x},x$ $\bar{x},x,\bar{x}$ $x,\bar{x},\bar{x}$

3   d $\bar{4}2.m$ $\frac{1}{2},0,0$ $0,\frac{1}{2},0$ $0,0,\frac{1}{2}$

3   c $\bar{4}2.m$ $0,\frac{1}{2},\frac{1}{2}$ $\frac{1}{2},0,\frac{1}{2}$ $\frac{1}{2},\frac{1}{2},0$

1   b $\bar{4}3m$ $\frac{1}{2},\frac{1}{2},\frac{1}{2}$

1   a $\bar{4}3m$ $0,0,0$

Symmetry of special projections

Along [001] $p4mm$ Along [111] $p31m$ Along [110] $p1m1$
$\mathbf{a}' = \mathbf{a}$ $\mathbf{b}' = \mathbf{b}$ $\mathbf{a}' = \frac{1}{3}(2\mathbf{a} - \mathbf{b} - \mathbf{c})$ $\mathbf{b}' = \frac{1}{3}(-\mathbf{a} + 2\mathbf{b} - \mathbf{c})$ $\mathbf{a}' = \frac{1}{2}(-\mathbf{a} + \mathbf{b})$ $\mathbf{b}' = \mathbf{c}$
Origin at $0,0,z$ Origin at x,x,x Origin at $x,x,0$

Maximal non-isomorphic subgroups

I   [2] $P231$ ($P23$, 195)   1; 2; 3; 4; 5; 6; 7; 8; 9; 10; 11; 12
      $\Big\{$ [3] $P\bar{4}1m$ ($P\bar{4}2m$, 111)   1; 2; 3; 4; 13; 14; 15; 16
         [3] $P\bar{4}1m$ ($P\bar{4}2m$, 111)   1; 2; 3; 4; 17; 18; 19; 20
         [3] $P\bar{4}1m$ ($P\bar{4}2m$, 111)   1; 2; 3; 4; 21; 22; 23; 24
      $\Big\{$ [4] $P13m$ ($R3m$, 160)   1; 5; 9; 13; 17; 21
         [4] $P13m$ ($R3m$, 160)   1; 6; 12; 14; 20; 21
         [4] $P13m$ ($R3m$, 160)   1; 7; 10; 14; 17; 23
         [4] $P13m$ ($R3m$, 160)   1; 8; 11; 13; 20; 23

IIa   none
IIb   [2] $F\bar{4}3c$ ($\mathbf{a}' = 2\mathbf{a}, \mathbf{b}' = 2\mathbf{b}, \mathbf{c}' = 2\mathbf{c}$) (219); [2] $F\bar{4}3m$ ($\mathbf{a}' = 2\mathbf{a}, \mathbf{b}' = 2\mathbf{b}, \mathbf{c}' = 2\mathbf{c}$) (216); [4] $I\bar{4}3m$ ($\mathbf{a}' = 2\mathbf{a}, \mathbf{b}' = 2\mathbf{b}, \mathbf{c}' = 2\mathbf{c}$) (217)

Maximal isomorphic subgroups of lowest index

IIc   [27] $P\bar{4}3m$ ($\mathbf{a}' = 3\mathbf{a}, \mathbf{b}' = 3\mathbf{b}, \mathbf{c}' = 3\mathbf{c}$) (215)

Minimal non-isomorphic supergroups

I   [2] $Pm\bar{3}m$ (221); [2] $Pn\bar{3}m$ (224)
II   [2] $I\bar{4}3m$ (217); [4] $F\bar{4}3m$ (216)