$P432$ $\qquad$ O^1 $\qquad$ 432 $\qquad$ Cubic

No. 207 $\qquad$ $P432$ $\qquad$ Patterson symmetry $Pm\bar{3}m$
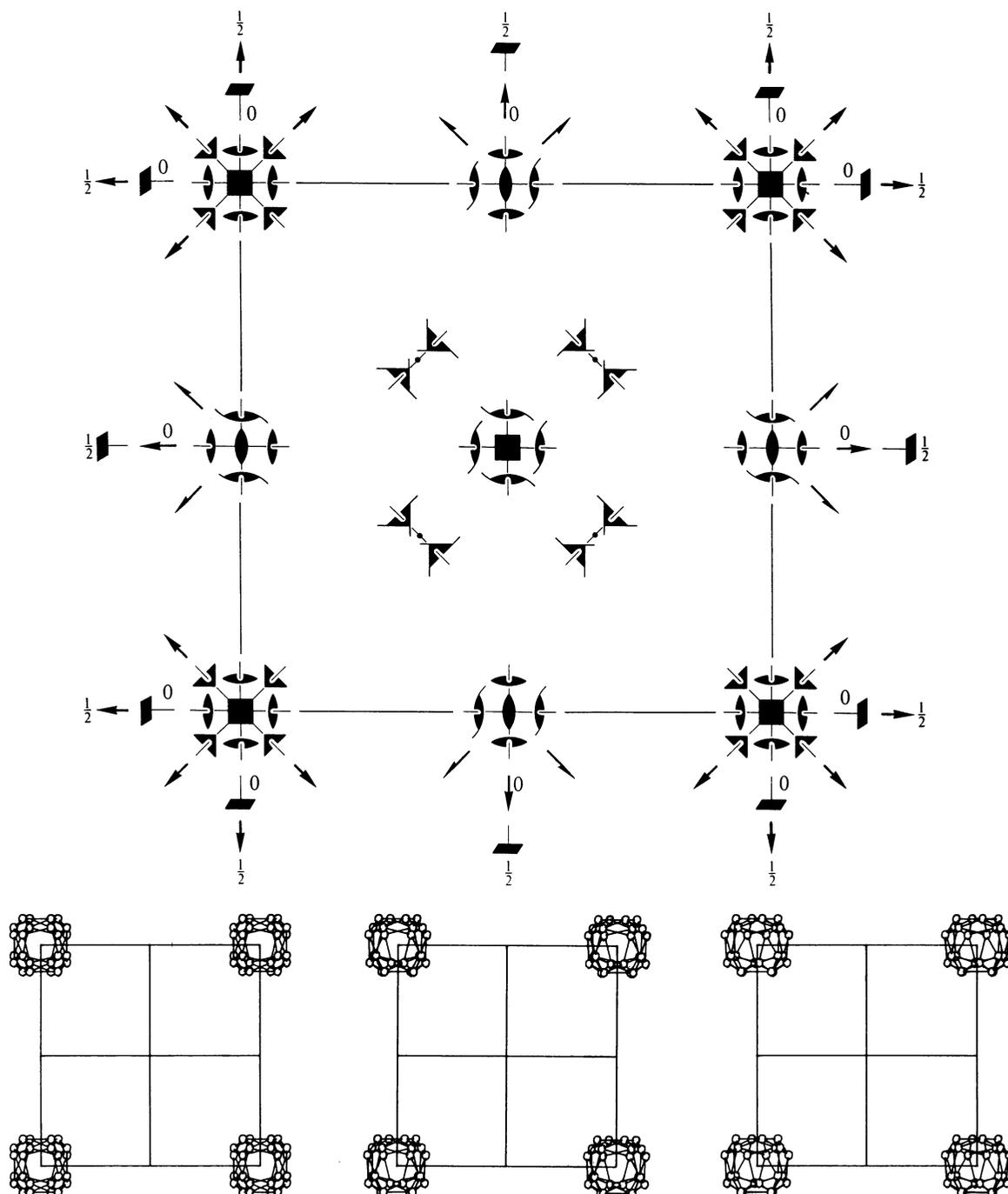
Origin at 432

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

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

Symmetry operations

(1) 1	(2) $2 \quad 0,0,z$	(3) $2 \quad 0,y,0$	(4) $2 \quad x,0,0$
(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) $2 \quad x,x,0$	(14) $2 \quad x,\bar{x},0$	(15) $4^- \ 0,0,z$	(16) $4^+ \ 0,0,z$
(17) $4^- \ x,0,0$	(18) $2 \quad 0,y,y$	(19) $2 \quad 0,y,\bar{y}$	(20) $4^+ \ x,0,0$
(21) $4^+ \ 0,y,0$	(22) $2 \quad x,0,x$	(23) $4^- \ 0,y,0$	(24) $2 \quad \bar{x},0,x$

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	k	1	(1) x,y,z	(2) $\bar{x},\bar{y},z$	(3) $\bar{x},y,\bar{z}$	(4) $x,\bar{y},\bar{z}$	no conditions
			(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) $y,x,\bar{z}$	(14) $\bar{y},\bar{x},\bar{z}$	(15) $y,\bar{x},z$	(16) $\bar{y},x,z$	
			(17) $x,z,\bar{y}$	(18) $\bar{x},z,y$	(19) $\bar{x},\bar{z},\bar{y}$	(20) $x,\bar{z},y$	
			(21) $z,y,\bar{x}$	(22) $z,\bar{y},x$	(23) $\bar{z},y,x$	(24) $\bar{z},\bar{y},\bar{x}$	

Special: no extra conditions

| 12 | j | $.\,.\,2$ | $\frac{1}{2},y,y$ | $\frac{1}{2},\bar{y},y$ | $\frac{1}{2},y,\bar{y}$ | $\frac{1}{2},\bar{y},\bar{y}$ | $y,\frac{1}{2},y$ | $y,\frac{1}{2},\bar{y}$ |
| | | | $\bar{y},\frac{1}{2},y$ | $\bar{y},\frac{1}{2},\bar{y}$ | $y,y,\frac{1}{2}$ | $\bar{y},y,\frac{1}{2}$ | $y,\bar{y},\frac{1}{2}$ | $\bar{y},\bar{y},\frac{1}{2}$ |

| 12 | i | $.\,.\,2$ | $0,y,y$ | $0,\bar{y},y$ | $0,y,\bar{y}$ | $0,\bar{y},\bar{y}$ | $y,0,y$ | $y,0,\bar{y}$ |
| | | | $\bar{y},0,y$ | $\bar{y},0,\bar{y}$ | $y,y,0$ | $\bar{y},y,0$ | $y,\bar{y},0$ | $\bar{y},\bar{y},0$ |

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

| 8 | g | $.\,3\,.$ | x,x,x | $\bar{x},\bar{x},x$ | $\bar{x},x,\bar{x}$ | $x,\bar{x},\bar{x}$ |
| | | | $x,x,\bar{x}$ | $\bar{x},\bar{x},\bar{x}$ | $x,\bar{x},x$ | $\bar{x},x,x$ |

| 6 | f | $4\,.\,.$ | $x,\frac{1}{2},\frac{1}{2}$ | $\bar{x},\frac{1}{2},\frac{1}{2}$ | $\frac{1}{2},x,\frac{1}{2}$ | $\frac{1}{2},\bar{x},\frac{1}{2}$ | $\frac{1}{2},\frac{1}{2},x$ | $\frac{1}{2},\frac{1}{2},\bar{x}$ |

| 6 | e | $4\,.\,.$ | $x,0,0$ | $\bar{x},0,0$ | $0,x,0$ | $0,\bar{x},0$ | $0,0,x$ | $0,0,\bar{x}$ |

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

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

| 1 | b | $4\,3\,2$ | $\frac{1}{2},\frac{1}{2},\frac{1}{2}$ |

| 1 | a | $4\,3\,2$ | $0,0,0$ |

Symmetry of special projections

Along $[001]$ $p4mm$	Along $[111]$ $p3m1$	Along $[110]$ $p2mm$
$\mathbf{a}' = \mathbf{a}$ $\mathbf{b}' = \mathbf{b}$	$\mathbf{a}' = \frac{1}{3}(2\mathbf{a}-\mathbf{b}-\mathbf{c})$ $\mathbf{b}' = \frac{1}{3}(-\mathbf{a}+2\mathbf{b}-\mathbf{c})$	$\mathbf{a}' = \frac{1}{2}(-\mathbf{a}+\mathbf{b})$ $\mathbf{b}' = \mathbf{c}$
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

{ [3] $P412$ ($P422$, 89)   1; 2; 3; 4; 13; 14; 15; 16
  [3] $P412$ ($P422$, 89)   1; 2; 3; 4; 17; 18; 19; 20
  [3] $P412$ ($P422$, 89)   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

IIb   [2] $F432$ ($\mathbf{a}' = 2\mathbf{a}, \mathbf{b}' = 2\mathbf{b}, \mathbf{c}' = 2\mathbf{c}$) (209); [4] $I432$ ($\mathbf{a}' = 2\mathbf{a}, \mathbf{b}' = 2\mathbf{b}, \mathbf{c}' = 2\mathbf{c}$) (211)

Maximal isomorphic subgroups of lowest index

IIc   [27] $P432$ ($\mathbf{a}' = 3\mathbf{a}, \mathbf{b}' = 3\mathbf{b}, \mathbf{c}' = 3\mathbf{c}$) (207)

Minimal non-isomorphic supergroups

I   [2] $Pm\bar{3}m$ (221); [2] $Pn\bar{3}n$ (222)

II   [2] $I432$ (211); [4] $F432$ (209)