

$Pn\bar{3}n$

$O_h^2$

$m\bar{3}m$

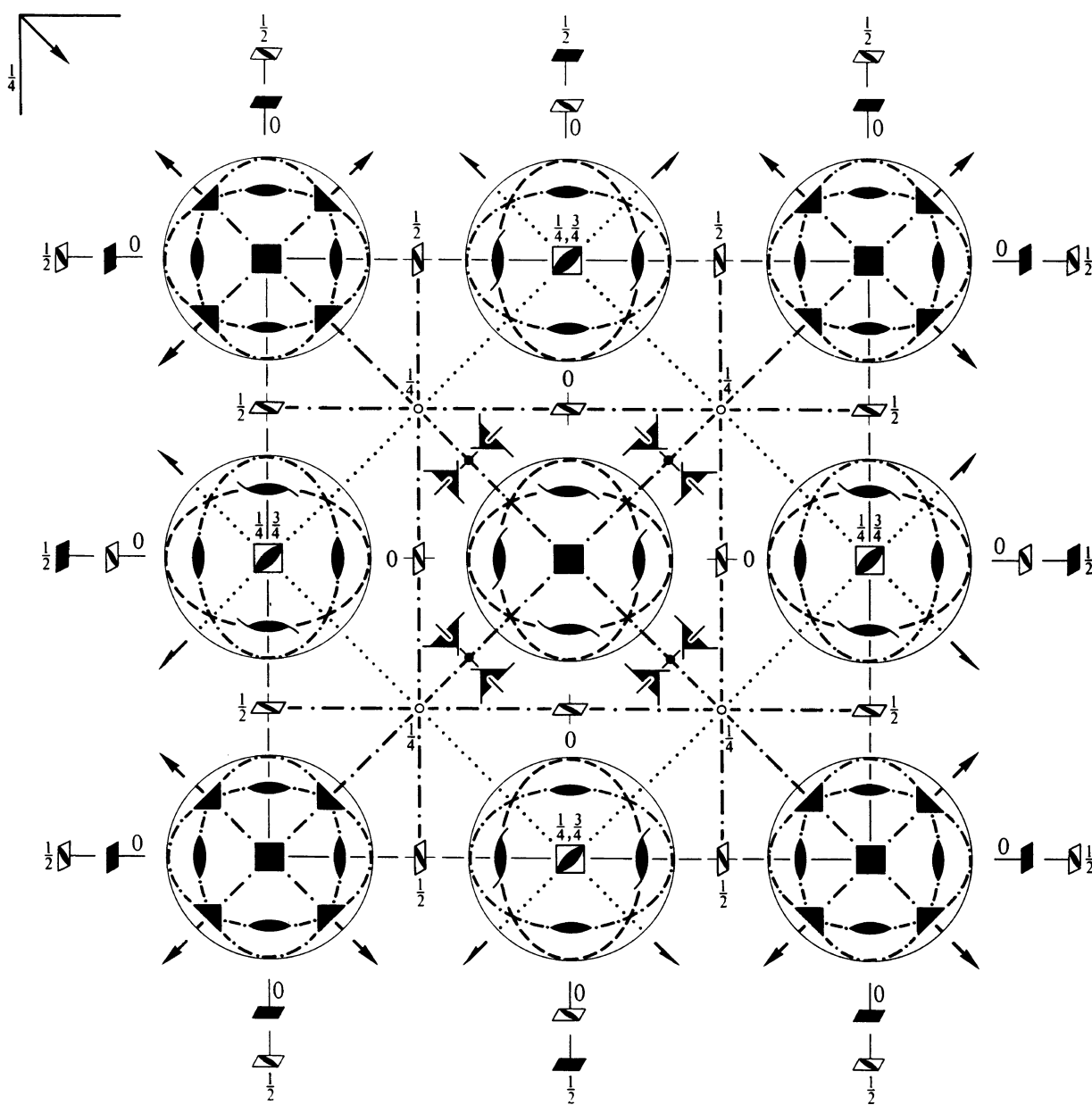
Cubic

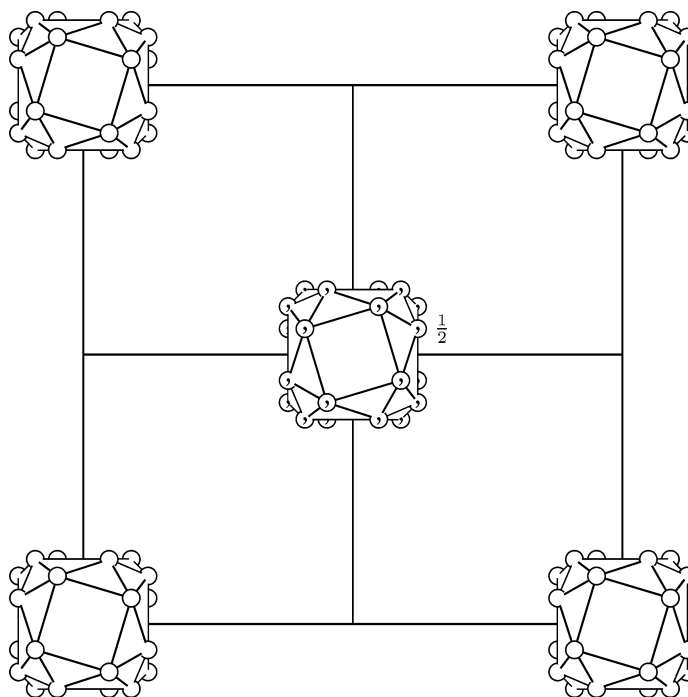
No. 222

$P 4/n \bar{3} 2/n$

Patterson symmetry  $Pm\bar{3}m$

ORIGIN CHOICE 1





**Origin** at 432, at  $-\frac{1}{4}, -\frac{1}{4}, -\frac{1}{4}$  from centre ( $\bar{3}$ )

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

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

### 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) 2 x,x,0   | (14) 2 x, $\bar{x},0$  | (15) $4^-$ 0,0,z   | (16) $4^+$ 0,0,z  |
| (17) $4^-$ x,0,0   | (18) 2 0,y,y   | (19) 2 0,y, $\bar{y}$  | (20) $4^+$ x,0,0  |
| (21) $4^+$ 0,y,0   | (22) 2 x,0,x   | (23) $4^-$ 0,y,0   | (24) 2 $\bar{x},0,x$  |
| (25) $\bar{1}$ $\frac{1}{4},\frac{1}{4},\frac{1}{4}$               | (26) $n(\frac{1}{2},\frac{1}{2},0)$ x,y, $\frac{1}{4}$                             | (27) $n(\frac{1}{2},0,\frac{1}{2})$ x, $\frac{1}{4},z$                           | (28) $n(0,\frac{1}{2},\frac{1}{2})$ $\frac{1}{4},y,z$                           |
| (29) $\bar{3}^+$ x,x,x; $\frac{1}{4},\frac{1}{4},\frac{1}{4}$      | (30) $\bar{3}^+$ $\bar{x}-1,x+1,\bar{x}$ ; $-\frac{1}{4},\frac{1}{4},\frac{3}{4}$  | (31) $\bar{3}^+$ x, $\bar{x}+1,\bar{x}$ ; $\frac{1}{4},\frac{3}{4},-\frac{1}{4}$ | (32) $\bar{3}^+$ $\bar{x}+1,\bar{x},x$ ; $\frac{3}{4},-\frac{1}{4},\frac{1}{4}$ |
| (33) $\bar{3}^-$ x,x,x; $\frac{1}{4},\frac{1}{4},\frac{1}{4}$      | (34) $\bar{3}^-$ x+1, $\bar{x}-1,\bar{x}$ ; $\frac{1}{4},-\frac{1}{4},\frac{3}{4}$ | (35) $\bar{3}^-$ $\bar{x},\bar{x}+1,x$ ; $-\frac{1}{4},\frac{3}{4},\frac{1}{4}$  | (36) $\bar{3}^-$ $\bar{x}+1,x,\bar{x}$ ; $\frac{3}{4},\frac{1}{4},-\frac{1}{4}$ |
| (37) c x+ $\frac{1}{2},\bar{x},z$                                  | (38) $n(\frac{1}{2},\frac{1}{2},\frac{1}{2})$ x,x,z                                | (39) $\bar{4}^-$ 0, $\frac{1}{2},z$ ; 0, $\frac{1}{2},\frac{1}{4}$               | (40) $\bar{4}^+$ $\frac{1}{2},0,z$ ; $\frac{1}{2},0,\frac{1}{4}$                |
| (41) $\bar{4}^-$ x,0, $\frac{1}{2}$ ; $\frac{1}{4},0,\frac{1}{2}$  | (42) a x,y+ $\frac{1}{2},\bar{y}$  | (43) $n(\frac{1}{2},\frac{1}{2},\frac{1}{2})$ x,y,y                              | (44) $\bar{4}^+$ x, $\frac{1}{2},0$ ; $\frac{1}{4},\frac{1}{2},0$               |
| (45) $\bar{4}^+$ 0,y, $\frac{1}{2}$ ; 0, $\frac{1}{4},\frac{1}{2}$ | (46) b $\bar{x}+\frac{1}{2},y,x$   | (47) $\bar{4}^-$ $\frac{1}{2},y,0$ ; $\frac{1}{2},\frac{1}{4},0$                 | (48) $n(\frac{1}{2},\frac{1}{2},\frac{1}{2})$ x,y,x                             |

ORIGIN CHOICE 1

**Generators selected** (1);  $t(1,0,0)$ ;  $t(0,1,0)$ ;  $t(0,0,1)$ ; (2); (3); (5); (13); (25)

**Positions**

Multiplicity,  
Wyckoff letter,  
Site symmetry

Coordinates

Reflection conditions

$h, k, l$  permutable

General:

48	$i$	1	(1) $x, y, z$	(2) $\bar{x}, \bar{y}, z$	(3) $\bar{x}, y, \bar{z}$	(4) $x, \bar{y}, \bar{z}$	$OkI: k+l=2n$ $hhl: l=2n$ $h00: h=2n$
			(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) $y, x, \bar{z}$	(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) $\bar{z}, \bar{y}, \bar{x}$	
			(25) $\bar{x} + \frac{1}{2}, \bar{y} + \frac{1}{2}, \bar{z} + \frac{1}{2}$	(26) $x + \frac{1}{2}, y + \frac{1}{2}, \bar{z} + \frac{1}{2}$	(27) $x + \frac{1}{2}, \bar{y} + \frac{1}{2}, z + \frac{1}{2}$	(28) $\bar{x} + \frac{1}{2}, y + \frac{1}{2}, z + \frac{1}{2}$	
			(29) $\bar{z} + \frac{1}{2}, \bar{x} + \frac{1}{2}, \bar{y} + \frac{1}{2}$	(30) $\bar{z} + \frac{1}{2}, x + \frac{1}{2}, y + \frac{1}{2}$	(31) $z + \frac{1}{2}, x + \frac{1}{2}, \bar{y} + \frac{1}{2}$	(32) $z + \frac{1}{2}, \bar{x} + \frac{1}{2}, y + \frac{1}{2}$	
			(33) $\bar{y} + \frac{1}{2}, \bar{z} + \frac{1}{2}, \bar{x} + \frac{1}{2}$	(34) $y + \frac{1}{2}, \bar{z} + \frac{1}{2}, x + \frac{1}{2}$	(35) $\bar{y} + \frac{1}{2}, z + \frac{1}{2}, x + \frac{1}{2}$	(36) $y + \frac{1}{2}, z + \frac{1}{2}, \bar{x} + \frac{1}{2}$	
			(37) $\bar{y} + \frac{1}{2}, \bar{x} + \frac{1}{2}, z + \frac{1}{2}$	(38) $y + \frac{1}{2}, x + \frac{1}{2}, z + \frac{1}{2}$	(39) $\bar{y} + \frac{1}{2}, x + \frac{1}{2}, \bar{z} + \frac{1}{2}$	(40) $y + \frac{1}{2}, \bar{x} + \frac{1}{2}, \bar{z} + \frac{1}{2}$	
			(41) $\bar{x} + \frac{1}{2}, \bar{z} + \frac{1}{2}, y + \frac{1}{2}$	(42) $x + \frac{1}{2}, \bar{z} + \frac{1}{2}, \bar{y} + \frac{1}{2}$	(43) $x + \frac{1}{2}, z + \frac{1}{2}, y + \frac{1}{2}$	(44) $\bar{x} + \frac{1}{2}, z + \frac{1}{2}, \bar{y} + \frac{1}{2}$	
			(45) $\bar{z} + \frac{1}{2}, \bar{y} + \frac{1}{2}, x + \frac{1}{2}$	(46) $\bar{z} + \frac{1}{2}, y + \frac{1}{2}, \bar{x} + \frac{1}{2}$	(47) $z + \frac{1}{2}, \bar{y} + \frac{1}{2}, \bar{x} + \frac{1}{2}$	(48) $z + \frac{1}{2}, y + \frac{1}{2}, x + \frac{1}{2}$	

Special: as above, plus

24	$h$	$\dots 2$	$0, y, y$	$0, \bar{y}, y$	$0, y, \bar{y}$	$0, \bar{y}, \bar{y}$	$hkl: h+k+l=2n$
			$y, 0, y$	$y, 0, \bar{y}$	$\bar{y}, 0, y$	$\bar{y}, 0, \bar{y}$	
			$y, y, 0$	$\bar{y}, y, 0$	$y, \bar{y}, 0$	$\bar{y}, \bar{y}, 0$	
			$\frac{1}{2}, \bar{y} + \frac{1}{2}, \bar{y} + \frac{1}{2}$	$\frac{1}{2}, y + \frac{1}{2}, \bar{y} + \frac{1}{2}$	$\frac{1}{2}, \bar{y} + \frac{1}{2}, y + \frac{1}{2}$	$\frac{1}{2}, y + \frac{1}{2}, y + \frac{1}{2}$	
			$\bar{y} + \frac{1}{2}, \frac{1}{2}, \bar{y} + \frac{1}{2}$	$\bar{y} + \frac{1}{2}, \frac{1}{2}, y + \frac{1}{2}$	$y + \frac{1}{2}, \frac{1}{2}, \bar{y} + \frac{1}{2}$	$y + \frac{1}{2}, \frac{1}{2}, y + \frac{1}{2}$	

24	$g$	$2 \dots$	$x, 0, \frac{1}{2}$	$\bar{x}, 0, \frac{1}{2}$	$\frac{1}{2}, x, 0$	$\frac{1}{2}, \bar{x}, 0$	$0, \frac{1}{2}, x$	$0, \frac{1}{2}, \bar{x}$	$hkl: h+k+l=2n$
			$0, x, \frac{1}{2}$	$0, \bar{x}, \frac{1}{2}$	$x, \frac{1}{2}, 0$	$\bar{x}, \frac{1}{2}, 0$	$\frac{1}{2}, 0, \bar{x}$	$\frac{1}{2}, 0, x$	
			$\bar{x} + \frac{1}{2}, \frac{1}{2}, 0$	$x + \frac{1}{2}, \frac{1}{2}, 0$	$0, \bar{x} + \frac{1}{2}, \frac{1}{2}$	$0, x + \frac{1}{2}, \frac{1}{2}$	$\frac{1}{2}, 0, \bar{x} + \frac{1}{2}$	$\frac{1}{2}, 0, x + \frac{1}{2}$	
			$\frac{1}{2}, \bar{x} + \frac{1}{2}, 0$	$\frac{1}{2}, x + \frac{1}{2}, 0$	$\bar{x} + \frac{1}{2}, 0, \frac{1}{2}$	$x + \frac{1}{2}, 0, \frac{1}{2}$	$0, \frac{1}{2}, x + \frac{1}{2}$	$0, \frac{1}{2}, \bar{x} + \frac{1}{2}$	

16	$f$	$\dots 3 \dots$	$x, x, x$	$\bar{x}, \bar{x}, x$	$\bar{x}, x, \bar{x}$	$x, \bar{x}, \bar{x}$	$hkl: h+k+l=2n$
			$x, x, \bar{x}$	$\bar{x}, \bar{x}, \bar{x}$	$x, \bar{x}, x$	$\bar{x}, x, x$	
			$\bar{x} + \frac{1}{2}, \bar{x} + \frac{1}{2}, \bar{x} + \frac{1}{2}$	$x + \frac{1}{2}, x + \frac{1}{2}, \bar{x} + \frac{1}{2}$	$x + \frac{1}{2}, \bar{x} + \frac{1}{2}, x + \frac{1}{2}$	$\bar{x} + \frac{1}{2}, x + \frac{1}{2}, x + \frac{1}{2}$	

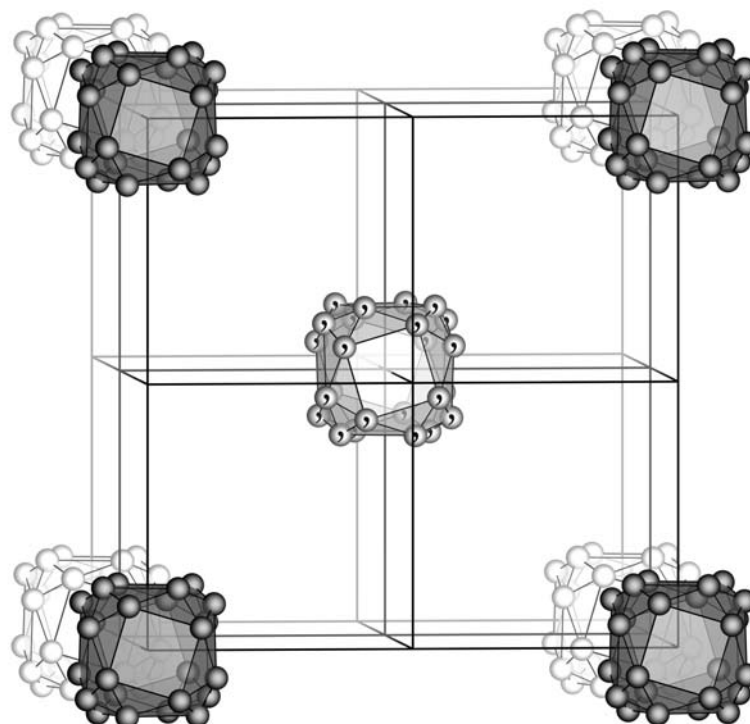
12	$e$	$4 \dots$	$x, 0, 0$	$\bar{x}, 0, 0$	$0, x, 0$	$0, \bar{x}, 0$	$0, 0, x$	$0, 0, \bar{x}$	$hkl: h+k+l=2n$
			$\bar{x} + \frac{1}{2}, \frac{1}{2}, \frac{1}{2}$	$x + \frac{1}{2}, \frac{1}{2}, \frac{1}{2}$	$\frac{1}{2}, \bar{x} + \frac{1}{2}, \frac{1}{2}$	$\frac{1}{2}, x + \frac{1}{2}, \frac{1}{2}$	$\frac{1}{2}, \frac{1}{2}, \bar{x} + \frac{1}{2}$	$\frac{1}{2}, \frac{1}{2}, x + \frac{1}{2}$	

12	$d$	$\bar{4} \dots$	$\frac{1}{4}, 0, \frac{1}{2}$	$\frac{3}{4}, 0, \frac{1}{2}$	$\frac{1}{2}, \frac{1}{4}, 0$	$\frac{1}{2}, \frac{3}{4}, 0$	$0, \frac{1}{2}, \frac{1}{4}$	$0, \frac{1}{2}, \frac{3}{4}$	$hkl: h+k+l=2n$
			$0, \frac{1}{4}, \frac{1}{2}$	$0, \frac{3}{4}, \frac{1}{2}$	$\frac{1}{4}, \frac{1}{2}, 0$	$\frac{3}{4}, \frac{1}{2}, 0$	$\frac{1}{2}, 0, \frac{3}{4}$	$\frac{1}{2}, 0, \frac{1}{4}$	

8	$c$	$\dots \bar{3} \dots$	$\frac{1}{4}, \frac{1}{4}, \frac{1}{4}$	$\frac{3}{4}, \frac{3}{4}, \frac{1}{4}$	$\frac{3}{4}, \frac{1}{4}, \frac{3}{4}$	$\frac{1}{4}, \frac{3}{4}, \frac{3}{4}$	$\frac{1}{4}, \frac{1}{4}, \frac{3}{4}$	$\frac{3}{4}, \frac{3}{4}, \frac{3}{4}$	$\frac{1}{4}, \frac{3}{4}, \frac{1}{4}$	$\frac{3}{4}, \frac{1}{4}, \frac{1}{4}$	$hkl: h, k, l = 2n$
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6	$b$	$4 2 \dots 2$	$0, \frac{1}{2}, \frac{1}{2}$	$\frac{1}{2}, 0, \frac{1}{2}$	$\frac{1}{2}, \frac{1}{2}, 0$	$\frac{1}{2}, 0, 0$	$0, \frac{1}{2}, 0$	$0, 0, \frac{1}{2}$	$hkl: h+k+l=2n$
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2	$a$	$4 3 2$	$0, 0, 0$	$\frac{1}{2}, \frac{1}{2}, \frac{1}{2}$					$hkl: h+k+l=2n$
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### Symmetry of special projections

Along  $[001]$   $p4mm$

$$\mathbf{a}' = \frac{1}{2}(\mathbf{a} - \mathbf{b}) \quad \mathbf{b}' = \frac{1}{2}(\mathbf{a} + \mathbf{b})$$

Origin at  $0, 0, z$

Along  $[111]$   $p6mm$

$$\mathbf{a}' = \frac{1}{3}(2\mathbf{a} - \mathbf{b} - \mathbf{c}) \quad \mathbf{b}' = \frac{1}{3}(-\mathbf{a} + 2\mathbf{b} - \mathbf{c})$$

Origin at  $x, x, x$

Along  $[110]$   $p2mm$

$$\mathbf{a}' = \frac{1}{2}(-\mathbf{a} + \mathbf{b}) \quad \mathbf{b}' = \frac{1}{2}\mathbf{c}$$

Origin at  $x, x, 0$

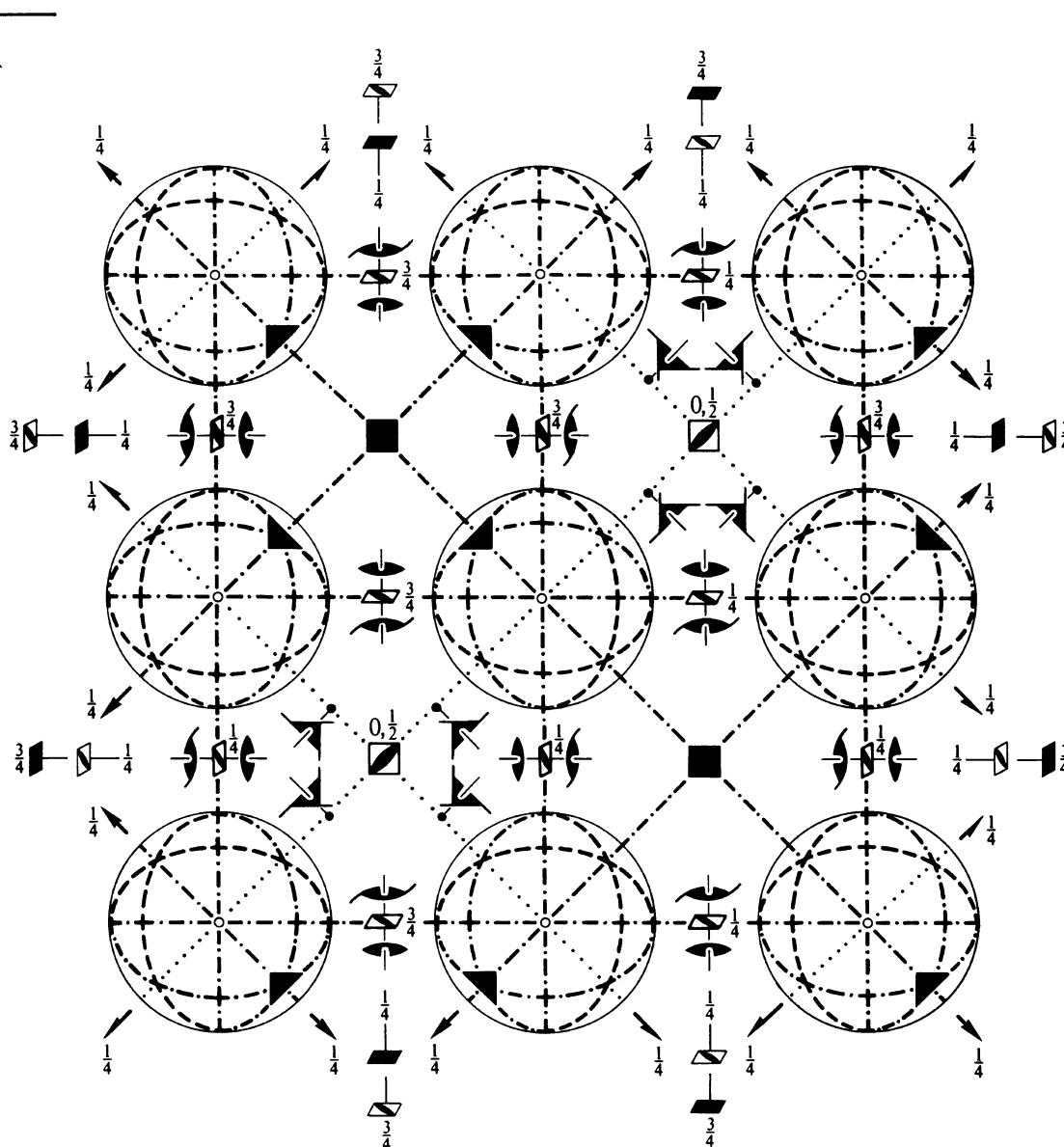
$Pn\bar{3}n$  $O_h^2$  $m\bar{3}m$ 

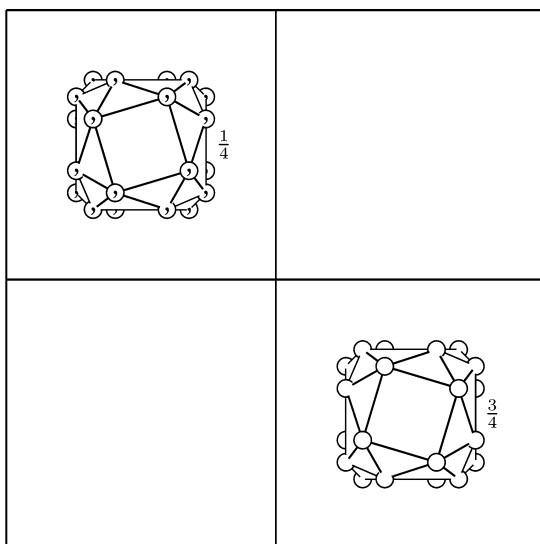
Cubic

No. 222

 $P 4/n \bar{3} 2/n$ Patterson symmetry  $Pm\bar{3}m$ 

ORIGIN CHOICE 2





**Origin** at centre ( $\bar{3}$ ), at  $\frac{1}{4}, \frac{1}{4}, \frac{1}{4}$  from 432

**Asymmetric unit**  $\frac{1}{4} \leq x \leq \frac{3}{4}; \frac{1}{4} \leq y \leq \frac{3}{4}; \frac{1}{4} \leq z \leq \frac{3}{4}; y \leq x; z \leq y$

**Vertices**  $\frac{1}{4}, \frac{1}{4}, \frac{1}{4} \quad \frac{3}{4}, \frac{1}{4}, \frac{1}{4} \quad \frac{3}{4}, \frac{3}{4}, \frac{1}{4} \quad \frac{3}{4}, \frac{3}{4}, \frac{3}{4}$

### Symmetry operations

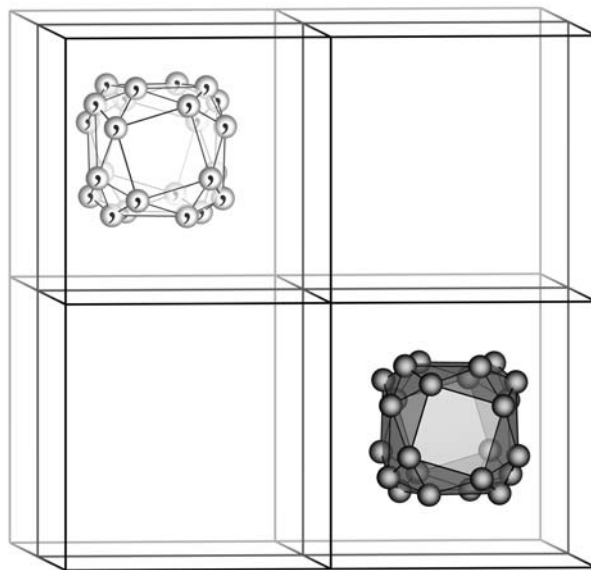
- |   |  |  |  |
|---|--|--|--|
| (1) 1   | (2) 2 $\frac{1}{4}, \frac{1}{4}, z$  | (3) 2 $\frac{1}{4}, y, \frac{1}{4}$  | (4) 2 $x, \frac{1}{4}, \frac{1}{4}$  |
| (5) $3^+$ $x, x, x$   | (6) $3^+$ $\bar{x}, x + \frac{1}{2}, \bar{x}$  | (7) $3^+$ $x + \frac{1}{2}, \bar{x}, \bar{x}$  | (8) $3^+$ $\bar{x} + \frac{1}{2}, \bar{x} + \frac{1}{2}, x$                                      |
| (9) $3^-$ $x, x, x$   | (10) $3^-$ $x + \frac{1}{2}, \bar{x}, \bar{x}$   | (11) $3^-$ $\bar{x} + \frac{1}{2}, \bar{x} + \frac{1}{2}, x$                                     | (12) $3^-$ $\bar{x}, x + \frac{1}{2}, \bar{x}$   |
| (13) 2 $x, x, \frac{1}{4}$  | (14) 2 $x, \bar{x} + \frac{1}{2}, \frac{1}{4}$   | (15) $4^-$ $\frac{1}{4}, \frac{1}{4}, z$   | (16) $4^+$ $\frac{1}{4}, \frac{1}{4}, z$   |
| (17) $4^-$ $x, \frac{1}{4}, \frac{1}{4}$                                      | (18) 2 $\frac{1}{4}, y, y$   | (19) 2 $\frac{1}{4}, y + \frac{1}{2}, \bar{y}$   | (20) $4^+$ $x, \frac{1}{4}, \frac{1}{4}$   |
| (21) $4^+$ $\frac{1}{4}, y, \frac{1}{4}$                                      | (22) 2 $x, \frac{1}{4}, x$   | (23) $4^-$ $\frac{1}{4}, y, \frac{1}{4}$   | (24) 2 $\bar{x} + \frac{1}{2}, \frac{1}{4}, x$   |
| (25) $\bar{1}$ 0,0,0  | (26) $n(\frac{1}{2}, \frac{1}{2}, 0)$ $x, y, 0$  | (27) $n(\frac{1}{2}, 0, \frac{1}{2})$ $x, 0, z$  | (28) $n(0, \frac{1}{2}, \frac{1}{2})$ $0, y, z$  |
| (29) $\bar{3}^+$ $x, x, x; 0, 0, 0$   | (30) $\bar{3}^+$ $\bar{x} - 1, x + \frac{1}{2}, \bar{x}; -\frac{1}{2}, 0, \frac{1}{2}$ | (31) $\bar{3}^+$ $x - \frac{1}{2}, \bar{x} + 1, \bar{x}; 0, \frac{1}{2}, -\frac{1}{2}$           | (32) $\bar{3}^+$ $\bar{x} + \frac{1}{2}, \bar{x} - \frac{1}{2}, x; \frac{1}{2}, -\frac{1}{2}, 0$ |
| (33) $\bar{3}^-$ $x, x, x; 0, 0, 0$   | (34) $\bar{3}^-$ $x + \frac{1}{2}, \bar{x} - 1, \bar{x}; 0, -\frac{1}{2}, \frac{1}{2}$ | (35) $\bar{3}^-$ $\bar{x} - \frac{1}{2}, \bar{x} + \frac{1}{2}, x; -\frac{1}{2}, \frac{1}{2}, 0$ | (36) $\bar{3}^-$ $\bar{x} + 1, x - \frac{1}{2}, \bar{x}; \frac{1}{2}, 0, -\frac{1}{2}$           |
| (37) $c$ $x, \bar{x}, z$  | (38) $n(\frac{1}{2}, \frac{1}{2}, \frac{1}{2})$ $x, x, z$                              | (39) $\bar{4}^-$ $-\frac{1}{4}, \frac{1}{4}, z; -\frac{1}{4}, \frac{1}{4}, 0$                    | (40) $\bar{4}^+$ $\frac{1}{4}, -\frac{1}{4}, z; \frac{1}{4}, -\frac{1}{4}, 0$                    |
| (41) $\bar{4}^-$ $x, -\frac{1}{4}, \frac{1}{4}; 0, -\frac{1}{4}, \frac{1}{4}$ | (42) $a$ $x, y, \bar{y}$   | (43) $n(\frac{1}{2}, \frac{1}{2}, \frac{1}{2})$ $x, y, y$  | (44) $\bar{4}^+$ $x, \frac{1}{4}, -\frac{1}{4}; 0, \frac{1}{4}, -\frac{1}{4}$                    |
| (45) $\bar{4}^+$ $-\frac{1}{4}, y, \frac{1}{4}; -\frac{1}{4}, 0, \frac{1}{4}$ | (46) $b$ $\bar{x}, y, x$   | (47) $\bar{4}^-$ $\frac{1}{4}, y, -\frac{1}{4}; \frac{1}{4}, 0, -\frac{1}{4}$                    | (48) $n(\frac{1}{2}, \frac{1}{2}, \frac{1}{2})$ $x, y, x$  |

ORIGIN CHOICE 2

**Generators selected** (1);  $t(1,0,0)$ ;  $t(0,1,0)$ ;  $t(0,0,1)$ ; (2); (3); (5); (13); (25)

**Positions**

Multiplicity, Wyckoff letter, Site symmetry	Coordinates	Reflection conditions
		$h, k, l$ permutable General:
48 <i>i</i> 1	(1) $x, y, z$ (2) $\bar{x} + \frac{1}{2}, \bar{y} + \frac{1}{2}, z$ (3) $\bar{x} + \frac{1}{2}, y, \bar{z} + \frac{1}{2}$ (4) $x, \bar{y} + \frac{1}{2}, \bar{z} + \frac{1}{2}$ (5) $z, x, y$ (6) $z, \bar{x} + \frac{1}{2}, \bar{y} + \frac{1}{2}$ (7) $\bar{z} + \frac{1}{2}, \bar{x} + \frac{1}{2}, y$ (8) $\bar{z} + \frac{1}{2}, x, \bar{y} + \frac{1}{2}$ (9) $y, z, x$ (10) $\bar{y} + \frac{1}{2}, z, \bar{x} + \frac{1}{2}$ (11) $y, \bar{z} + \frac{1}{2}, \bar{x} + \frac{1}{2}$ (12) $\bar{y} + \frac{1}{2}, \bar{z} + \frac{1}{2}, x$ (13) $y, x, \bar{z} + \frac{1}{2}$ (14) $\bar{y} + \frac{1}{2}, \bar{x} + \frac{1}{2}, \bar{z} + \frac{1}{2}$ (15) $y, \bar{x} + \frac{1}{2}, z$ (16) $\bar{y} + \frac{1}{2}, x, z$ (17) $x, z, \bar{y} + \frac{1}{2}$ (18) $\bar{x} + \frac{1}{2}, z, y$ (19) $\bar{x} + \frac{1}{2}, \bar{z} + \frac{1}{2}, \bar{y} + \frac{1}{2}$ (20) $x, \bar{z} + \frac{1}{2}, y$ (21) $z, y, \bar{x} + \frac{1}{2}$ (22) $z, \bar{y} + \frac{1}{2}, x$ (23) $\bar{z} + \frac{1}{2}, y, x$ (24) $\bar{z} + \frac{1}{2}, \bar{y} + \frac{1}{2}, \bar{x} + \frac{1}{2}$ (25) $\bar{x}, \bar{y}, \bar{z}$ (26) $x + \frac{1}{2}, y + \frac{1}{2}, \bar{z}$ (27) $x + \frac{1}{2}, \bar{y}, z + \frac{1}{2}$ (28) $\bar{x}, y + \frac{1}{2}, z + \frac{1}{2}$ (29) $\bar{z}, \bar{x}, \bar{y}$ (30) $\bar{z}, x + \frac{1}{2}, y + \frac{1}{2}$ (31) $z + \frac{1}{2}, x + \frac{1}{2}, \bar{y}$ (32) $z + \frac{1}{2}, \bar{x}, y + \frac{1}{2}$ (33) $\bar{y}, \bar{z}, \bar{x}$ (34) $y + \frac{1}{2}, \bar{z}, x + \frac{1}{2}$ (35) $\bar{y}, z + \frac{1}{2}, x + \frac{1}{2}$ (36) $y + \frac{1}{2}, z + \frac{1}{2}, \bar{x}$ (37) $\bar{y}, \bar{x}, z + \frac{1}{2}$ (38) $y + \frac{1}{2}, x + \frac{1}{2}, z + \frac{1}{2}$ (39) $\bar{y}, x + \frac{1}{2}, \bar{z}$ (40) $y + \frac{1}{2}, \bar{x}, \bar{z}$ (41) $\bar{x}, \bar{z}, y + \frac{1}{2}$ (42) $x + \frac{1}{2}, \bar{z}, \bar{y}$ (43) $x + \frac{1}{2}, z + \frac{1}{2}, y + \frac{1}{2}$ (44) $\bar{x}, z + \frac{1}{2}, \bar{y}$ (45) $\bar{z}, \bar{y}, x + \frac{1}{2}$ (46) $\bar{z}, y + \frac{1}{2}, \bar{x}$ (47) $z + \frac{1}{2}, \bar{y}, \bar{x}$ (48) $z + \frac{1}{2}, y + \frac{1}{2}, x + \frac{1}{2}$	$Ok\bar{l}: k + l = 2n$ $hhl: l = 2n$ $h00: h = 2n$
		Special: as above, plus
24 <i>h</i> .. 2	$\frac{1}{4}, y, y$ $\frac{1}{4}, \bar{y} + \frac{1}{2}, y$ $\frac{1}{4}, y, \bar{y} + \frac{1}{2}$ $\frac{1}{4}, \bar{y} + \frac{1}{2}, \bar{y} + \frac{1}{2}$ $y, \frac{1}{4}, y$ $y, \frac{1}{4}, \bar{y} + \frac{1}{2}$ $\bar{y} + \frac{1}{2}, \frac{1}{4}, y$ $\bar{y} + \frac{1}{2}, \frac{1}{4}, \bar{y} + \frac{1}{2}$ $y, y, \frac{1}{4}$ $\bar{y} + \frac{1}{2}, y, \frac{1}{4}$ $y, \bar{y} + \frac{1}{2}, \frac{1}{4}$ $\bar{y} + \frac{1}{2}, \bar{y} + \frac{1}{2}, \frac{1}{4}$ $\frac{3}{4}, \bar{y}, \bar{y}$ $\frac{3}{4}, y + \frac{1}{2}, \bar{y}$ $\frac{3}{4}, \bar{y}, y + \frac{1}{2}$ $\frac{3}{4}, y + \frac{1}{2}, y + \frac{1}{2}$ $\bar{y}, \frac{3}{4}, \bar{y}$ $\bar{y}, \frac{3}{4}, y + \frac{1}{2}$ $y + \frac{1}{2}, \frac{3}{4}, \bar{y}$ $y + \frac{1}{2}, \frac{3}{4}, y + \frac{1}{2}$ $\bar{y}, \bar{y}, \frac{3}{4}$ $y + \frac{1}{2}, \bar{y}, \frac{3}{4}$ $\bar{y}, y + \frac{1}{2}, \frac{3}{4}$ $y + \frac{1}{2}, y + \frac{1}{2}, \frac{3}{4}$	$hkl: h + k + l = 2n$
24 <i>g</i> 2..	$x, \frac{3}{4}, \frac{1}{4}$ $\bar{x} + \frac{1}{2}, \frac{3}{4}, \frac{1}{4}$ $\frac{1}{4}, x, \frac{3}{4}$ $\frac{1}{4}, \bar{x} + \frac{1}{2}, \frac{3}{4}$ $\frac{3}{4}, \frac{1}{4}, x$ $\frac{3}{4}, \frac{1}{4}, \bar{x} + \frac{1}{2}$ $\frac{3}{4}, x, \frac{1}{4}$ $\frac{3}{4}, \bar{x} + \frac{1}{2}, \frac{1}{4}$ $x, \frac{1}{4}, \frac{3}{4}$ $\bar{x} + \frac{1}{2}, \frac{1}{4}, \frac{3}{4}$ $\frac{1}{4}, \frac{3}{4}, \bar{x} + \frac{1}{2}$ $\frac{1}{4}, \frac{3}{4}, x$ $\bar{x}, \frac{1}{4}, \frac{3}{4}$ $x + \frac{1}{2}, \frac{1}{4}, \frac{3}{4}$ $\frac{3}{4}, \bar{x}, \frac{1}{4}$ $\frac{3}{4}, x + \frac{1}{2}, \frac{1}{4}$ $\frac{1}{4}, \frac{3}{4}, \bar{x}$ $\frac{1}{4}, \frac{3}{4}, x + \frac{1}{2}$ $\frac{1}{4}, \bar{x}, \frac{3}{4}$ $\frac{1}{4}, x + \frac{1}{2}, \frac{3}{4}$ $\bar{x}, \frac{3}{4}, \frac{1}{4}$ $x + \frac{1}{2}, \frac{3}{4}, \frac{1}{4}$ $\frac{3}{4}, \frac{1}{4}, x + \frac{1}{2}$ $\frac{3}{4}, \frac{1}{4}, \bar{x}$	$hkl: h + k + l = 2n$
16 <i>f</i> . 3.	$x, x, x$ $\bar{x} + \frac{1}{2}, \bar{x} + \frac{1}{2}, x$ $\bar{x} + \frac{1}{2}, x, \bar{x} + \frac{1}{2}$ $x, \bar{x} + \frac{1}{2}, \bar{x} + \frac{1}{2}$ $x, x, \bar{x} + \frac{1}{2}$ $\bar{x} + \frac{1}{2}, \bar{x} + \frac{1}{2}, \bar{x} + \frac{1}{2}$ $x, \bar{x} + \frac{1}{2}, x$ $\bar{x} + \frac{1}{2}, x, x$ $\bar{x}, \bar{x}, \bar{x}$ $x + \frac{1}{2}, x + \frac{1}{2}, \bar{x}$ $x + \frac{1}{2}, \bar{x}, x + \frac{1}{2}$ $\bar{x}, x + \frac{1}{2}, x + \frac{1}{2}$ $\bar{x}, \bar{x}, x + \frac{1}{2}$ $x + \frac{1}{2}, x + \frac{1}{2}, x + \frac{1}{2}$ $\bar{x}, x + \frac{1}{2}, \bar{x}$ $x + \frac{1}{2}, \bar{x}, \bar{x}$	$hkl: h + k + l = 2n$
12 <i>e</i> 4..	$x, \frac{1}{4}, \frac{1}{4}$ $\bar{x} + \frac{1}{2}, \frac{1}{4}, \frac{1}{4}$ $\frac{1}{4}, x, \frac{1}{4}$ $\frac{1}{4}, \bar{x} + \frac{1}{2}, \frac{1}{4}$ $\frac{1}{4}, \frac{1}{4}, x$ $\frac{1}{4}, \frac{1}{4}, \bar{x} + \frac{1}{2}$ $\bar{x}, \frac{3}{4}, \frac{3}{4}$ $x + \frac{1}{2}, \frac{3}{4}, \frac{3}{4}$ $\frac{3}{4}, \bar{x}, \frac{3}{4}$ $\frac{3}{4}, x + \frac{1}{2}, \frac{3}{4}$ $\frac{3}{4}, \frac{3}{4}, \bar{x}$ $\frac{3}{4}, \frac{3}{4}, x + \frac{1}{2}$	$hkl: h + k + l = 2n$
12 <i>d</i> $\bar{4}$ ..	$0, \frac{3}{4}, \frac{1}{4}$ $\frac{1}{2}, \frac{3}{4}, \frac{1}{4}$ $\frac{1}{4}, 0, \frac{3}{4}$ $\frac{1}{4}, \frac{1}{2}, \frac{3}{4}$ $\frac{3}{4}, \frac{1}{4}, 0$ $\frac{3}{4}, \frac{1}{4}, \frac{1}{2}$ $\frac{3}{4}, 0, \frac{1}{4}$ $\frac{3}{4}, \frac{1}{2}, \frac{1}{4}$ $0, \frac{1}{4}, \frac{3}{4}$ $\frac{1}{2}, \frac{1}{4}, \frac{3}{4}$ $\frac{1}{4}, \frac{3}{4}, \frac{1}{2}$ $\frac{1}{4}, \frac{3}{4}, 0$	$hkl: h + k + l = 2n$
8 <i>c</i> . $\bar{3}$ .	$0, 0, 0$ $\frac{1}{2}, \frac{1}{2}, 0$ $\frac{1}{2}, 0, \frac{1}{2}$ $0, \frac{1}{2}, \frac{1}{2}$ $0, 0, \frac{1}{2}$ $\frac{1}{2}, \frac{1}{2}, \frac{1}{2}$ $0, \frac{1}{2}, 0$ $\frac{1}{2}, 0, 0$	$hkl: h, k, l = 2n$
6 <i>b</i> 4 2 . 2	$\frac{3}{4}, \frac{1}{4}, \frac{1}{4}$ $\frac{1}{4}, \frac{3}{4}, \frac{1}{4}$ $\frac{1}{4}, \frac{1}{4}, \frac{3}{4}$ $\frac{1}{4}, \frac{3}{4}, \frac{3}{4}$ $\frac{3}{4}, \frac{1}{4}, \frac{3}{4}$ $\frac{3}{4}, \frac{3}{4}, \frac{1}{4}$	$hkl: h + k + l = 2n$
2 <i>a</i> 4 3 2	$\frac{1}{4}, \frac{1}{4}, \frac{1}{4}$ $\frac{3}{4}, \frac{3}{4}, \frac{3}{4}$	$hkl: h + k + l = 2n$



### Symmetry of special projections

Along  $[001]$   $p4mm$

$$\mathbf{a}' = \frac{1}{2}(\mathbf{a} - \mathbf{b}) \quad \mathbf{b}' = \frac{1}{2}(\mathbf{a} + \mathbf{b})$$

Origin at  $\frac{1}{4}, \frac{1}{4}, z$

Along  $[111]$   $p6mm$

$$\mathbf{a}' = \frac{1}{3}(2\mathbf{a} - \mathbf{b} - \mathbf{c}) \quad \mathbf{b}' = \frac{1}{3}(-\mathbf{a} + 2\mathbf{b} - \mathbf{c})$$

Origin at  $x, x, x$

Along  $[110]$   $p2mm$

$$\mathbf{a}' = \frac{1}{2}(-\mathbf{a} + \mathbf{b}) \quad \mathbf{b}' = \frac{1}{2}\mathbf{c}$$

Origin at  $x, x, 0$