

$F m m m$

D_{2h}^{23}

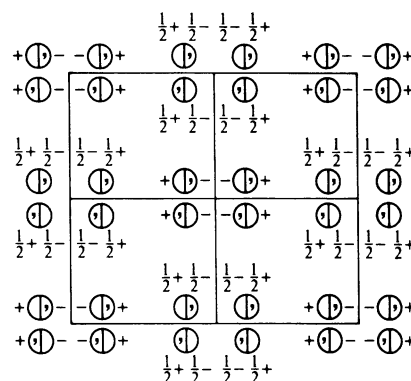
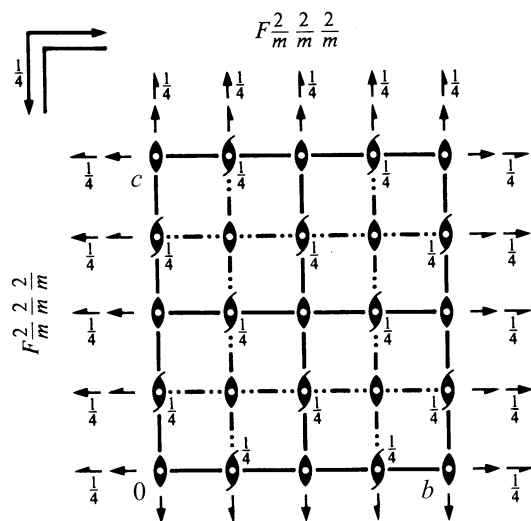
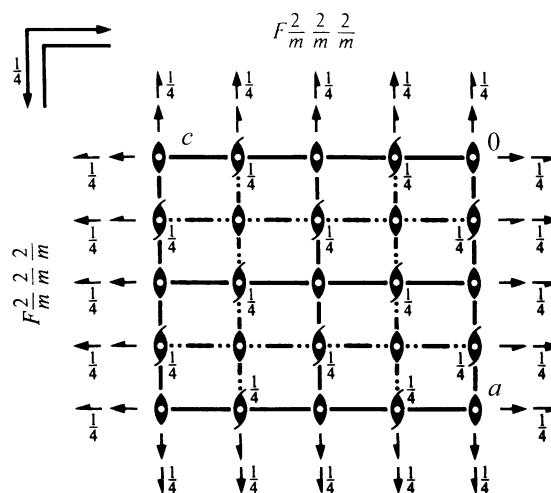
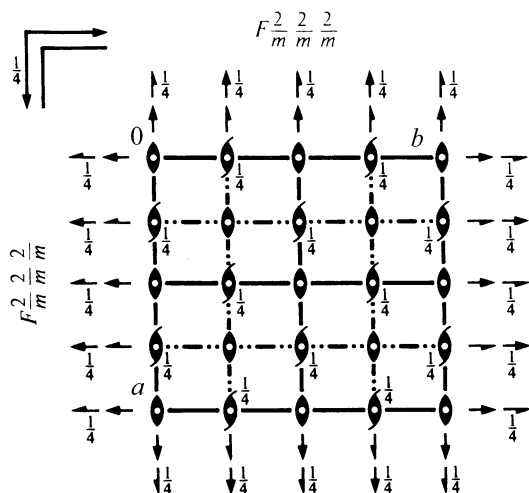
$m m m$

Orthorhombic

No. 69

$F 2/m 2/m 2/m$

Patterson symmetry $F m m m$



Origin at centre ($m m m$)

Asymmetric unit $0 \leq x \leq \frac{1}{4}$; $0 \leq y \leq \frac{1}{4}$; $0 \leq z \leq \frac{1}{2}$

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) $\bar{1}$ $0,0,0$
- (6) m $x,y,0$
- (7) m $x,0,z$
- (8) m $0,y,z$

For $(0, \frac{1}{2}, \frac{1}{2})+$ set

- (1) $t(\frac{1}{2}, \frac{1}{2}, \frac{1}{2})$
- (2) $2(0,0, \frac{1}{2})$ $0, \frac{1}{4}, z$
- (3) $2(0, \frac{1}{2}, 0)$ $0, y, \frac{1}{4}$
- (4) 2 $x, \frac{1}{4}, \frac{1}{4}$
- (5) $\bar{1}$ $0, \frac{1}{4}, \frac{1}{4}$
- (6) b $x, y, \frac{1}{4}$
- (7) c $x, \frac{1}{4}, z$
- (8) $n(0, \frac{1}{2}, \frac{1}{2})$ $0, y, z$

For $(\frac{1}{2}, 0, \frac{1}{2})+$ set

- (1) $t(\frac{1}{2}, 0, \frac{1}{2})$
- (2) $2(0,0, \frac{1}{2})$ $\frac{1}{4}, 0, z$
- (3) 2 $\frac{1}{4}, y, \frac{1}{4}$
- (4) $2(\frac{1}{2}, 0, 0)$ $x, 0, \frac{1}{4}$
- (5) $\bar{1}$ $\frac{1}{4}, 0, \frac{1}{4}$
- (6) a $x, y, \frac{1}{4}$
- (7) $n(\frac{1}{2}, 0, \frac{1}{2})$ $x, 0, z$
- (8) c $\frac{1}{4}, y, z$

For $(\frac{1}{2}, \frac{1}{2}, 0)+$ set

- (1) $t(\frac{1}{2}, \frac{1}{2}, 0)$
- (2) 2 $\frac{1}{4}, \frac{1}{4}, z$
- (3) $2(0, \frac{1}{2}, 0)$ $\frac{1}{4}, y, 0$
- (4) $2(\frac{1}{2}, 0, 0)$ $x, \frac{1}{4}, 0$
- (5) $\bar{1}$ $\frac{1}{4}, \frac{1}{4}, 0$
- (6) $n(\frac{1}{2}, \frac{1}{2}, 0)$ $x, y, 0$
- (7) a $x, \frac{1}{4}, z$
- (8) b $\frac{1}{4}, y, z$

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

Positions

Multiplicity, Wyckoff letter, Site symmetry	Coordinates				Reflection conditions
	$(0,0,0)+$	$(0, \frac{1}{2}, \frac{1}{2})+$	$(\frac{1}{2}, 0, \frac{1}{2})+$	$(\frac{1}{2}, \frac{1}{2}, 0)+$	
32 p 1	(1) x, y, z (5) $\bar{x}, \bar{y}, \bar{z}$	(2) \bar{x}, \bar{y}, z (6) x, y, \bar{z}	(3) \bar{x}, y, \bar{z} (7) x, \bar{y}, z	(4) x, \bar{y}, \bar{z} (8) \bar{x}, y, z	General: $hkl: h+k, h+l, k+l = 2n$ $0kl: k, l = 2n$ $h0l: h, l = 2n$ $hk0: h, k = 2n$ $h00: h = 2n$ $0k0: k = 2n$ $00l: l = 2n$ Special: as above, plus
16 o $..m$	$x, y, 0$	$\bar{x}, \bar{y}, 0$	$\bar{x}, y, 0$	$x, \bar{y}, 0$	no extra conditions
16 n $.m.$	$x, 0, z$	$\bar{x}, 0, z$	$\bar{x}, 0, \bar{z}$	$x, 0, \bar{z}$	no extra conditions
16 m $m..$	$0, y, z$	$0, \bar{y}, z$	$0, y, \bar{z}$	$0, \bar{y}, \bar{z}$	no extra conditions
16 l $2..$	$x, \frac{1}{4}, \frac{1}{4}$	$\bar{x}, \frac{3}{4}, \frac{1}{4}$	$\bar{x}, \frac{3}{4}, \frac{3}{4}$	$x, \frac{1}{4}, \frac{3}{4}$	$hkl: h = 2n$
16 k $.2.$	$\frac{1}{4}, y, \frac{1}{4}$	$\frac{3}{4}, \bar{y}, \frac{1}{4}$	$\frac{3}{4}, \bar{y}, \frac{3}{4}$	$\frac{1}{4}, y, \frac{3}{4}$	$hkl: h = 2n$
16 j $..2$	$\frac{1}{4}, \frac{1}{4}, z$	$\frac{3}{4}, \frac{1}{4}, \bar{z}$	$\frac{3}{4}, \frac{3}{4}, \bar{z}$	$\frac{1}{4}, \frac{3}{4}, z$	$hkl: h = 2n$
8 i $mm2$	$0, 0, z$	$0, 0, \bar{z}$			no extra conditions
8 h $m2m$	$0, y, 0$	$0, \bar{y}, 0$			no extra conditions
8 g $2mm$	$x, 0, 0$	$\bar{x}, 0, 0$			no extra conditions
8 f 222	$\frac{1}{4}, \frac{1}{4}, \frac{1}{4}$	$\frac{3}{4}, \frac{3}{4}, \frac{3}{4}$			$hkl: h = 2n$
8 e $..2/m$	$\frac{1}{4}, \frac{1}{4}, 0$	$\frac{3}{4}, \frac{1}{4}, 0$			$hkl: h = 2n$
8 d $.2/m.$	$\frac{1}{4}, 0, \frac{1}{4}$	$\frac{3}{4}, 0, \frac{1}{4}$			$hkl: h = 2n$
8 c $2/m..$	$0, \frac{1}{4}, \frac{1}{4}$	$0, \frac{3}{4}, \frac{1}{4}$			$hkl: h = 2n$
4 b mmm	$0, 0, \frac{1}{2}$				no extra conditions
4 a mmm	$0, 0, 0$				no extra conditions

Symmetry of special projections

Along $[001]$ $p2mm$
 $\mathbf{a}' = \frac{1}{2}\mathbf{a}$ $\mathbf{b}' = \frac{1}{2}\mathbf{b}$
 Origin at $0, 0, z$

Along $[100]$ $p2mm$
 $\mathbf{a}' = \frac{1}{2}\mathbf{b}$ $\mathbf{b}' = \frac{1}{2}\mathbf{c}$
 Origin at $x, 0, 0$

Along $[010]$ $p2mm$
 $\mathbf{a}' = \frac{1}{2}\mathbf{c}$ $\mathbf{b}' = \frac{1}{2}\mathbf{a}$
 Origin at $0, y, 0$