# $O_h^7$ $F\,4_1/d\,\bar{3}\,2/m$ No. 227 $F\,d\,\bar{3}\,m$

ORIGIN CHOICE 1, Origin at $\bar{4}\,3m$, at $-\frac{1}{8},-\frac{1}{8},-\frac{1}{8}$ from centre $(\bar{3}m)$

**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); (13); (25)

**General position**

| Multiplicity, Wyckoff letter, Site symmetry | Coordinates | | | |
|---|---|---|---|---|
| | $(0,0,0)+$ | $(0,\frac{1}{2},\frac{1}{2})+$ | $(\frac{1}{2},0,\frac{1}{2})+$ | $(\frac{1}{2},\frac{1}{2},0)+$ |
| 192 $i$ 1 | (1) $x,y,z$ | (2) $\bar{x},\bar{y}+\frac{1}{2},z+\frac{1}{2}$ | (3) $\bar{x}+\frac{1}{2},y+\frac{1}{2},\bar{z}$ | (4) $x+\frac{1}{2},\bar{y},\bar{z}+\frac{1}{2}$ |
| | (5) $z,x,y$ | (6) $z+\frac{1}{2},\bar{x},\bar{y}+\frac{1}{2}$ | (7) $\bar{z},\bar{x}+\frac{1}{2},y+\frac{1}{2}$ | (8) $\bar{z}+\frac{1}{2},x+\frac{1}{2},\bar{y}$ |
| | (9) $y,z,x$ | (10) $\bar{y}+\frac{1}{2},z+\frac{1}{2},\bar{x}$ | (11) $y+\frac{1}{2},\bar{z},\bar{x}+\frac{1}{2}$ | (12) $\bar{y},\bar{z}+\frac{1}{2},x+\frac{1}{2}$ |
| | (13) $y+\frac{3}{4},x+\frac{1}{4},\bar{z}+\frac{3}{4}$ | (14) $\bar{y}+\frac{1}{4},\bar{x}+\frac{1}{4},\bar{z}+\frac{1}{4}$ | (15) $y+\frac{1}{4},\bar{x}+\frac{3}{4},z+\frac{3}{4}$ | (16) $\bar{y}+\frac{3}{4},x+\frac{3}{4},z+\frac{1}{4}$ |
| | (17) $x+\frac{3}{4},z+\frac{1}{4},\bar{y}+\frac{3}{4}$ | (18) $\bar{x}+\frac{3}{4},z+\frac{3}{4},y+\frac{1}{4}$ | (19) $\bar{x}+\frac{1}{4},\bar{z}+\frac{1}{4},\bar{y}+\frac{1}{4}$ | (20) $x+\frac{1}{4},\bar{z}+\frac{3}{4},y+\frac{3}{4}$ |
| | (21) $z+\frac{3}{4},y+\frac{1}{4},\bar{x}+\frac{3}{4}$ | (22) $z+\frac{1}{4},\bar{y}+\frac{3}{4},x+\frac{3}{4}$ | (23) $\bar{z}+\frac{3}{4},y+\frac{3}{4},x+\frac{1}{4}$ | (24) $\bar{z}+\frac{1}{4},\bar{y}+\frac{1}{4},\bar{x}+\frac{1}{4}$ |
| | (25) $\bar{x}+\frac{1}{4},\bar{y}+\frac{1}{4},\bar{z}+\frac{1}{4}$ | (26) $x+\frac{1}{4},y+\frac{3}{4},\bar{z}+\frac{3}{4}$ | (27) $x+\frac{3}{4},\bar{y}+\frac{3}{4},z+\frac{1}{4}$ | (28) $\bar{x}+\frac{3}{4},y+\frac{1}{4},z+\frac{3}{4}$ |
| | (29) $\bar{z}+\frac{1}{4},\bar{x}+\frac{1}{4},\bar{y}+\frac{1}{4}$ | (30) $\bar{z}+\frac{3}{4},x+\frac{1}{4},y+\frac{3}{4}$ | (31) $z+\frac{1}{4},x+\frac{3}{4},\bar{y}+\frac{3}{4}$ | (32) $z+\frac{3}{4},\bar{x}+\frac{3}{4},y+\frac{1}{4}$ |
| | (33) $\bar{y}+\frac{1}{4},\bar{z}+\frac{1}{4},\bar{x}+\frac{1}{4}$ | (34) $y+\frac{3}{4},\bar{z}+\frac{3}{4},x+\frac{1}{4}$ | (35) $\bar{y}+\frac{3}{4},z+\frac{1}{4},x+\frac{3}{4}$ | (36) $y+\frac{1}{4},z+\frac{3}{4},\bar{x}+\frac{3}{4}$ |
| | (37) $\bar{y}+\frac{1}{2},\bar{x},z+\frac{1}{2}$ | (38) $y,x,z$ | (39) $\bar{y},x+\frac{1}{2},\bar{z}+\frac{1}{2}$ | (40) $y+\frac{1}{2},\bar{x}+\frac{1}{2},\bar{z}$ |
| | (41) $\bar{x}+\frac{1}{2},\bar{z},y+\frac{1}{2}$ | (42) $x+\frac{1}{2},\bar{z}+\frac{1}{2},\bar{y}$ | (43) $x,z,y$ | (44) $\bar{x},z+\frac{1}{2},\bar{y}+\frac{1}{2}$ |
| | (45) $\bar{z}+\frac{1}{2},\bar{y},x+\frac{1}{2}$ | (46) $\bar{z},y+\frac{1}{2},\bar{x}+\frac{1}{2}$ | (47) $z+\frac{1}{2},\bar{y}+\frac{1}{2},\bar{x}$ | (48) $z,y,x$ |

**I Maximal *translationengleiche* subgroups**

| | | |
|---|---|---|
| [2] $F\bar{4}3m$ (216) | (1; 2; 3; 4; 5; 6; 7; 8; 9; 10; 11; 12; 37; 38; 39; 40; 41; 42; 43; 44; 45; 46; 47; 48)+ | |
| [2] $F4_132$ (210) | (1; 2; 3; 4; 5; 6; 7; 8; 9; 10; 11; 12; 13; 14; 15; 16; 17; 18; 19; 20; 21; 22; 23; 24)+ | |
| [2] $Fd\bar{3}1$ (203, $Fd\bar{3}$) | (1; 2; 3; 4; 5; 6; 7; 8; 9; 10; 11; 12; 25; 26; 27; 28; 29; 30; 31; 32; 33; 34; 35; 36)+ | |
| [3] $F4_1/d12/m$ (141, $I4_1/amd$) | (1; 2; 3; 4; 13; 14; 15; 16; 25; 26; 27; 28; 37; 38; 39; 40)+ | $1/2(\mathbf{a}-\mathbf{b}),1/2(\mathbf{a}+\mathbf{b}),\mathbf{c}$ |
| [3] $F4_1/d12/m$ (141, $I4_1/amd$) | (1; 4; 2; 3; 18; 19; 17; 20; 25; 28; 26; 27; 42; 43; 41; 44)+ | $1/2(\mathbf{b}-\mathbf{c}),1/2(\mathbf{b}+\mathbf{c}),\mathbf{a}$ |
| [3] $F4_1/d12/m$ (141, $I4_1/amd$) | (1; 3; 4; 2; 22; 24; 23; 21; 25; 27; 28; 26; 46; 48; 47; 45)+ | $1/2(-\mathbf{a}+\mathbf{c}),1/2(\mathbf{a}+\mathbf{c}),\mathbf{b}$ |
| [4] $F1\bar{3}2/m$ (166, $R\bar{3}m$) | (1; 5; 9; 14; 19; 24; 25; 29; 33; 38; 43; 48)+ | $1/2(-\mathbf{a}+\mathbf{b}),1/2(-\mathbf{b}+\mathbf{c}),\mathbf{a}+\mathbf{b}+\mathbf{c}$ $1/8,1/8,1/8$ |
| [4] $F1\bar{3}2/m$ (166, $R\bar{3}m$) | (1; 6; 12; 13; 18; 24; 25; 30; 36; 37; 42; 48)+ | $1/2(\mathbf{a}+\mathbf{b}),1/2(-\mathbf{b}-\mathbf{c}),-\mathbf{a}+\mathbf{b}-\mathbf{c}$ $3/8,1/8,3/8$ |
| [4] $F1\bar{3}2/m$ (166, $R\bar{3}m$) | (1; 7; 10; 13; 19; 22; 25; 31; 34; 37; 43; 46)+ | $1/2(-\mathbf{a}-\mathbf{b}),1/2(\mathbf{b}-\mathbf{c}),\mathbf{a}-\mathbf{b}-\mathbf{c}$ $1/8,3/8,3/8$ |
| [4] $F1\bar{3}2/m$ (166, $R\bar{3}m$) | (1; 8; 11; 14; 18; 22; 25; 32; 35; 38; 42; 46)+ | $1/2(\mathbf{a}-\mathbf{b}),1/2(\mathbf{b}+\mathbf{c}),-\mathbf{a}-\mathbf{b}+\mathbf{c}$ $3/8,3/8,1/8$ |

**II Maximal *klassengleiche* subgroups**

- **Loss of centring translations** none
- **Enlarged unit cell** none

Copyright © 2006 International Union of Crystallography

- **Series of maximal isomorphic subgroups**

[$p^3$] $\mathbf{a}' = p\mathbf{a},\ \mathbf{b}' = p\mathbf{b},\ \mathbf{c}' = p\mathbf{c}$

| | | | |
|---|---|---|---|
| $Fd\bar{3}m$ (227) | $\langle 2+(\frac{1}{2}+2u, \frac{p}{2}+2v, \frac{p}{2}-\frac{1}{2});$<br>$3+(\frac{p}{2}+2u, \frac{p}{2}-\frac{1}{2}, \frac{1}{2}+2w);$<br>$5+(u-w, -u+v, -v+w);$<br>$13+(\frac{3p}{4}-\frac{3}{4}+u-v, \frac{p}{4}-\frac{1}{4}-u+v, \frac{3p}{4}-\frac{1}{4}+2w);$<br>$25+(\frac{p}{4}+\frac{1}{4}+2u, \frac{p}{4}+\frac{1}{4}+2v, \frac{p}{4}+\frac{1}{4}+2w)\rangle$<br>$p>2;\ 0\le u<p;\ 0\le v<p;\ 0\le w<p$<br>$p^3$ conjugate subgroups for prime $p\equiv 3\ (\mathrm{mod}\ 4)$ | $p\mathbf{a}, p\mathbf{b}, p\mathbf{c}$ | $u, v, w$ |
| $Fd\bar{3}m$ (227) | $\langle 2+(2u, \frac{p}{2}-\frac{1}{2}+2v, \frac{p}{2}-\frac{1}{2});$<br>$3+(\frac{p}{2}-\frac{1}{2}+2u, \frac{p}{2}-\frac{1}{2}, 2w);$<br>$5+(u-w, -u+v, -v+w);$<br>$13+(\frac{3p}{4}-\frac{3}{4}+u-v, \frac{p}{4}-\frac{1}{4}-u+v, \frac{3p}{4}-\frac{3}{4}+2w);$<br>$25+(\frac{p}{4}-\frac{1}{4}+2u, \frac{p}{4}-\frac{1}{4}+2v, \frac{p}{4}-\frac{1}{4}+2w)\rangle$<br>$p>4;\ 0\le u<p;\ 0\le v<p;\ 0\le w<p$<br>$p^3$ conjugate subgroups for prime $p\equiv 1\ (\mathrm{mod}\ 4)$ | $p\mathbf{a}, p\mathbf{b}, p\mathbf{c}$ | $u, v, w$ |

**I Minimal *translationengleiche* supergroups** none

**II Minimal non-isomorphic *klassengleiche* supergroups**

- **Additional centring translations** none

- **Decreased unit cell**

[2] $\mathbf{a}' = \frac{1}{2}\mathbf{a},\ \mathbf{b}' = \frac{1}{2}\mathbf{b},\ \mathbf{c}' = \frac{1}{2}\mathbf{c}$ $Pn\bar{3}m$ (224)

---



- **Series of maximal isomorphic subgroups**

[$p^3$] $\mathbf{a}' = p\mathbf{a},\ \mathbf{b}' = p\mathbf{b},\ \mathbf{c}' = p\mathbf{c}$

| | | | |
|---|---|---|---|
| $Fd\bar{3}m$ (227) | $\langle 2+(\frac{3p}{4}-\frac{3}{4}+2u, \frac{p}{4}-\frac{1}{4}+2v, \frac{p}{2}-\frac{1}{2});$<br>$3+(\frac{p}{4}-\frac{1}{4}+2u, \frac{p}{2}-\frac{1}{2}, \frac{3p}{4}-\frac{3}{4}+2w);$<br>$5+(u-w, -u+v, -v+w);$<br>$13+(\frac{3p}{4}-\frac{3}{4}+u-v, \frac{p}{4}-\frac{1}{4}-u+v, \frac{p}{2}-\frac{1}{2}+2w);$<br>$25+(2u, 2v, 2w)\rangle$<br>$p>2;\ 0\le u<p;\ 0\le v<p;\ 0\le w<p$<br>$p^3$ conjugate subgroups for the prime $p$ | $p\mathbf{a}, p\mathbf{b}, p\mathbf{c}$ | $u, v, w$ |

**I Minimal *translationengleiche* supergroups** none

**II Minimal non-isomorphic *klassengleiche* supergroups**

- **Additional centring translations** none

- **Decreased unit cell**

[2] $\mathbf{a}' = \frac{1}{2}\mathbf{a},\ \mathbf{b}' = \frac{1}{2}\mathbf{b},\ \mathbf{c}' = \frac{1}{2}\mathbf{c}$ $Pn\bar{3}m$ (224)

ORIGIN CHOICE 2, Origin at centre $(\bar{3}m)$, at $\frac{1}{8},\frac{1}{8},\frac{1}{8}$ from $\bar{4}3m$

**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); (13); (25)

**General position**

| Multiplicity, Wyckoff letter, Site symmetry | | Coordinates | | | |
|---|---|---|---|---|---|
| | | $(0,0,0)+$ | $(0,\frac{1}{2},\frac{1}{2})+$ | $(\frac{1}{2},0,\frac{1}{2})+$ | $(\frac{1}{2},\frac{1}{2},0)+$ |
| 192 $i$ 1 | (1) $x,y,z$ | (2) $\bar{x}+\frac{3}{4},\bar{y}+\frac{1}{4},z+\frac{1}{2}$ | (3) $\bar{x}+\frac{1}{4},y+\frac{1}{2},\bar{z}+\frac{3}{4}$ | (4) $x+\frac{1}{2},\bar{y}+\frac{3}{4},\bar{z}+\frac{1}{4}$ | |
| | (5) $z,x,y$ | (6) $z+\frac{1}{2},\bar{x}+\frac{3}{4},\bar{y}+\frac{1}{4}$ | (7) $\bar{z}+\frac{3}{4},\bar{x}+\frac{1}{4},y+\frac{1}{2}$ | (8) $\bar{z}+\frac{1}{4},x+\frac{1}{2},\bar{y}+\frac{3}{4}$ | |
| | (9) $y,z,x$ | (10) $\bar{y}+\frac{1}{4},z+\frac{1}{2},\bar{x}+\frac{3}{4}$ | (11) $y+\frac{1}{2},\bar{z}+\frac{3}{4},\bar{x}+\frac{1}{4}$ | (12) $\bar{y}+\frac{3}{4},\bar{z}+\frac{1}{4},x+\frac{1}{2}$ | |
| | (13) $y+\frac{3}{4},x+\frac{1}{4},\bar{z}+\frac{1}{2}$ | (14) $\bar{y},\bar{x},\bar{z}$ | (15) $y+\frac{1}{4},\bar{x}+\frac{1}{2},z+\frac{3}{4}$ | (16) $\bar{y}+\frac{1}{2},x+\frac{3}{4},z+\frac{1}{4}$ | |
| | (17) $x+\frac{3}{4},z+\frac{1}{4},\bar{y}+\frac{1}{2}$ | (18) $\bar{x}+\frac{1}{2},z+\frac{3}{4},y+\frac{1}{4}$ | (19) $\bar{x},\bar{z},\bar{y}$ | (20) $x+\frac{1}{4},\bar{z}+\frac{1}{2},y+\frac{3}{4}$ | |
| | (21) $z+\frac{3}{4},y+\frac{1}{4},\bar{x}+\frac{1}{2}$ | (22) $z+\frac{1}{4},\bar{y}+\frac{1}{2},x+\frac{3}{4}$ | (23) $\bar{z}+\frac{1}{2},y+\frac{3}{4},x+\frac{1}{4}$ | (24) $\bar{z},\bar{y},\bar{x}$ | |
| | (25) $\bar{x},\bar{y},\bar{z}$ | (26) $x+\frac{1}{4},y+\frac{3}{4},\bar{z}+\frac{1}{2}$ | (27) $x+\frac{3}{4},\bar{y}+\frac{1}{2},z+\frac{1}{4}$ | (28) $\bar{x}+\frac{1}{2},y+\frac{1}{4},z+\frac{3}{4}$ | |
| | (29) $\bar{z},\bar{x},\bar{y}$ | (30) $\bar{z}+\frac{1}{2},x+\frac{1}{4},y+\frac{3}{4}$ | (31) $z+\frac{1}{4},x+\frac{3}{4},\bar{y}+\frac{1}{2}$ | (32) $z+\frac{3}{4},\bar{x}+\frac{1}{2},y+\frac{1}{4}$ | |
| | (33) $\bar{y},\bar{z},\bar{x}$ | (34) $y+\frac{3}{4},\bar{z}+\frac{1}{2},x+\frac{1}{4}$ | (35) $\bar{y}+\frac{1}{2},z+\frac{1}{4},x+\frac{3}{4}$ | (36) $y+\frac{1}{4},z+\frac{3}{4},\bar{x}+\frac{1}{2}$ | |
| | (37) $\bar{y}+\frac{1}{4},\bar{x}+\frac{3}{4},z+\frac{1}{2}$ | (38) $y,x,z$ | (39) $\bar{y}+\frac{3}{4},x+\frac{1}{2},\bar{z}+\frac{1}{4}$ | (40) $y+\frac{1}{2},\bar{x}+\frac{1}{4},\bar{z}+\frac{3}{4}$ | |
| | (41) $\bar{x}+\frac{1}{4},\bar{z}+\frac{3}{4},y+\frac{1}{2}$ | (42) $x+\frac{1}{2},\bar{z}+\frac{1}{4},\bar{y}+\frac{3}{4}$ | (43) $x,z,y$ | (44) $\bar{x}+\frac{3}{4},z+\frac{1}{2},\bar{y}+\frac{1}{4}$ | |
| | (45) $\bar{z}+\frac{1}{4},\bar{y}+\frac{3}{4},x+\frac{1}{2}$ | (46) $\bar{z}+\frac{3}{4},y+\frac{1}{2},\bar{x}+\frac{1}{4}$ | (47) $z+\frac{1}{2},\bar{y}+\frac{1}{4},\bar{x}+\frac{3}{4}$ | (48) $z,y,x$ | |

**I Maximal *translationengleiche* subgroups**

| | | | |
|---|---|---|---|
| [2] $F\bar{4}3m$ (216) | (1; 2; 3; 4; 5; 6; 7; 8; 9; 10; 11; 12; 37; 38; 39; 40; 41; 42; 43; 44; 45; 46; 47; 48)+ | | $1/8,1/8,1/8$ |
| [2] $F4_132$ (210) | (1; 2; 3; 4; 5; 6; 7; 8; 9; 10; 11; 12; 13; 14; 15; 16; 17; 18; 19; 20; 21; 22; 23; 24)+ | | $3/8,3/8,3/8$ |
| [2] $Fd\bar{3}1$ (203, $Fd\bar{3}$) | (1; 2; 3; 4; 5; 6; 7; 8; 9; 10; 11; 12; 25; 26; 27; 28; 29; 30; 31; 32; 33; 34; 35; 36)+ | | |
| [3] $F4_1/d12/m$ (141, $I4_1/amd$) | (1; 2; 3; 4; 13; 14; 15; 16; 25; 26; 27; 28; 37; 38; 39; 40)+ | $1/2(\mathbf{a}-\mathbf{b}),1/2(\mathbf{a}+\mathbf{b}),\mathbf{c}$ | $1/4,1/4,0$ |
| [3] $F4_1/d12/m$ (141, $I4_1/amd$) | (1; 4; 2; 3; 18; 19; 17; 20; 25; 28; 26; 27; 42; 43; 41; 44)+ | $1/2(\mathbf{b}-\mathbf{c}),1/2(\mathbf{b}+\mathbf{c}),\mathbf{a}$ | $0,1/4,1/4$ |
| [3] $F4_1/d12/m$ (141, $I4_1/amd$) | (1; 3; 4; 2; 22; 24; 23; 21; 25; 27; 28; 26; 46; 48; 47; 45)+ | $1/2(-\mathbf{a}+\mathbf{c}),1/2(\mathbf{a}+\mathbf{c}),\mathbf{b}$ | $1/4,0,1/4$ |
| [4] $F1\bar{3}2/m$ (166, $R\bar{3}m$) | (1; 5; 9; 14; 19; 24; 25; 29; 33; 38; 43; 48)+ | $1/2(-\mathbf{a}+\mathbf{b}),1/2(-\mathbf{b}+\mathbf{c}),\mathbf{a}+\mathbf{b}+\mathbf{c}$ | |
| [4] $F1\bar{3}2/m$ (166, $R\bar{3}m$) | (1; 6; 12; 13; 18; 24; 25; 30; 36; 37; 42; 48)+ | $1/2(\mathbf{a}+\mathbf{b}),1/2(-\mathbf{b}-\mathbf{c}),-\mathbf{a}+\mathbf{b}-\mathbf{c}$ | $1/4,0,1/4$ |
| [4] $F1\bar{3}2/m$ (166, $R\bar{3}m$) | (1; 7; 10; 13; 19; 22; 25; 31; 34; 37; 43; 46)+ | $1/2(-\mathbf{a}-\mathbf{b}),1/2(\mathbf{b}-\mathbf{c}),\mathbf{a}-\mathbf{b}-\mathbf{c}$ | $0,1/4,1/4$ |
| [4] $F1\bar{3}2/m$ (166, $R\bar{3}m$) | (1; 8; 11; 14; 18; 22; 25; 32; 35; 38; 42; 46)+ | $1/2(\mathbf{a}-\mathbf{b}),1/2(\mathbf{b}+\mathbf{c}),-\mathbf{a}-\mathbf{b}+\mathbf{c}$ | $1/4,1/4,0$ |

**II Maximal *klassengleiche* subgroups**

- **Loss of centring translations** none
- **Enlarged unit cell** none

(*Continued on the facing page*)

- **Series of maximal isomorphic subgroups**

[$p^3$] $\mathbf{a}' = p\mathbf{a},\ \mathbf{b}' = p\mathbf{b},\ \mathbf{c}' = p\mathbf{c}$

| | | | |
|---|---|---|---|
| $Fd\bar{3}m$ (227) | $\langle 2+(\frac{1}{2}+2u, \frac{p}{2}+2v, \frac{p}{2}-\frac{1}{2});$<br>$3+(\frac{p}{2}+2u, \frac{p}{2}-\frac{1}{2}, \frac{1}{2}+2w);$<br>$5+(u-w, -u+v, -v+w);$<br>$13+(\frac{3p}{4}-\frac{3}{4}+u-v, \frac{p}{4}-\frac{1}{4}-u+v, \frac{3p}{4}-\frac{1}{4}+2w);$<br>$25+(\frac{p}{4}+\frac{1}{4}+2u, \frac{p}{4}+\frac{1}{4}+2v, \frac{p}{4}+\frac{1}{4}+2w)\rangle$<br>$p>2;\ 0\le u<p;\ 0\le v<p;\ 0\le w<p$<br>$p^3$ conjugate subgroups for prime $p\equiv 3\ (\mathrm{mod}\ 4)$ | $p\mathbf{a}, p\mathbf{b}, p\mathbf{c}$ | $u, v, w$ |
| $Fd\bar{3}m$ (227) | $\langle 2+(2u, \frac{p}{2}-\frac{1}{2}+2v, \frac{p}{2}-\frac{1}{2});$<br>$3+(\frac{p}{2}-\frac{1}{2}+2u, \frac{p}{2}-\frac{1}{2}, 2w);$<br>$5+(u-w, -u+v, -v+w);$<br>$13+(\frac{3p}{4}-\frac{3}{4}+u-v, \frac{p}{4}-\frac{1}{4}-u+v, \frac{3p}{4}-\frac{3}{4}+2w);$<br>$25+(\frac{p}{4}-\frac{1}{4}+2u, \frac{p}{4}-\frac{1}{4}+2v, \frac{p}{4}-\frac{1}{4}+2w)\rangle$<br>$p>4;\ 0\le u<p;\ 0\le v<p;\ 0\le w<p$<br>$p^3$ conjugate subgroups for prime $p\equiv 1\ (\mathrm{mod}\ 4)$ | $p\mathbf{a}, p\mathbf{b}, p\mathbf{c}$ | $u, v, w$ |

**I Minimal *translationengleiche* supergroups** none

**II Minimal non-isomorphic *klassengleiche* supergroups**

- **Additional centring translations** none

- **Decreased unit cell**

[2] $\mathbf{a}' = \frac{1}{2}\mathbf{a},\ \mathbf{b}' = \frac{1}{2}\mathbf{b},\ \mathbf{c}' = \frac{1}{2}\mathbf{c}$ $Pn\bar{3}m$ (224)

---



- **Series of maximal isomorphic subgroups**

[$p^3$] $\mathbf{a}' = p\mathbf{a},\ \mathbf{b}' = p\mathbf{b},\ \mathbf{c}' = p\mathbf{c}$

| | | | |
|---|---|---|---|
| $Fd\bar{3}m$ (227) | $\langle 2+(\frac{3p}{4}-\frac{3}{4}+2u, \frac{p}{4}-\frac{1}{4}+2v, \frac{p}{2}-\frac{1}{2});$<br>$3+(\frac{p}{4}-\frac{1}{4}+2u, \frac{p}{2}-\frac{1}{2}, \frac{3p}{4}-\frac{3}{4}+2w);$<br>$5+(u-w, -u+v, -v+w);$<br>$13+(\frac{3p}{4}-\frac{3}{4}+u-v, \frac{p}{4}-\frac{1}{4}-u+v, \frac{p}{2}-\frac{1}{2}+2w);$<br>$25+(2u, 2v, 2w)\rangle$<br>$p>2;\ 0\le u<p;\ 0\le v<p;\ 0\le w<p$<br>$p^3$ conjugate subgroups for the prime $p$ | $p\mathbf{a}, p\mathbf{b}, p\mathbf{c}$ | $u, v, w$ |

**I Minimal *translationengleiche* supergroups** none

**II Minimal non-isomorphic *klassengleiche* supergroups**

- **Additional centring translations** none

- **Decreased unit cell**

[2] $\mathbf{a}' = \frac{1}{2}\mathbf{a},\ \mathbf{b}' = \frac{1}{2}\mathbf{b},\ \mathbf{c}' = \frac{1}{2}\mathbf{c}$ $Pn\bar{3}m$ (224)