Yale' s group C2 .

Here we have with our 3 independent translations one half turn . We will use

In[•]:=
```
ηz
```

Out[•]=

$$\text{TransformationFunction}\left[\left(\begin{array}{ccc|c} -1 & 0 & 0 & 0 \\ 0 & -1 & 0 & 0 \\ 0 & 0 & 1 & 0 \\ \hline 0 & 0 & 0 & 1 \end{array}\right)\right]$$

Note that

In[•]:=
```
ηz@*τbx@*ηz
```

Out[•]=

$$\text{TransformationFunction}\left[\left(\begin{array}{ccc|c} 1 & 0 & 0 & -2 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 \\ \hline 0 & 0 & 0 & 1 \end{array}\right)\right]$$

which is the inverse of **τbx** so we don' t need that or the identity. This also holds for **τby** but not for **τbz** so we need its inverse.

In[•]:=
```
tasC2 := <|1 → τbx, 2 → τby, 3 → τbz, 4 → ηz, 5 → τb[{0, 0, -1}]|>
```

In[•]:=
```
tc2 := {.21997, .13498, -.31787}
```

In[•]:=
```
GC2[3] = transGroup[tasC2, tc2, 3]
```

» number of group elements calculated 57

Out[•]=
```
{{1}, {2}, {3}, {4}, {5}, {1, 1}, {1, 2}, {1, 3}, {1, 4}, {1, 5}, {2, 2}, {2, 3}, {2, 4},
 {2, 5}, {3, 3}, {3, 4}, {3, 5}, {4, 1}, {4, 2}, {4, 5}, {5, 5}, {1, 1, 1}, {1, 1, 2}, {1, 1, 3},
 {1, 1, 4}, {1, 1, 5}, {1, 2, 2}, {1, 2, 3}, {1, 2, 4}, {1, 2, 5}, {1, 3, 3}, {1, 3, 4}, {1, 4, 2},
 {1, 4, 5}, {1, 5, 5}, {2, 2, 2}, {2, 2, 3}, {2, 2, 4}, {2, 2, 5}, {2, 3, 3}, {2, 3, 4},
 {2, 4, 1}, {2, 4, 5}, {2, 5, 5}, {3, 3, 3}, {3, 3, 4}, {3, 4, 1}, {3, 4, 2}, {4, 1, 1},
 {4, 1, 2}, {4, 1, 4}, {4, 1, 5}, {4, 2, 2}, {4, 2, 4}, {4, 2, 5}, {4, 5, 5}, {5, 5, 5}}
```

In[•]:=
```
GroupFindKey[ι, GC2[3], tasC2, tc2]
GroupFindKey[τb[{-2, 0, 0}], GC2[3], tasC2, tc2]
GroupFindKey[τb[{0, -1, 0}], GC2[3], tasC2, tc2]
```

Out[•]=
```
{3, 5}
```

Out[•]=
```
{4, 1, 4}
```

Out[•]=
```
{4, 2, 4}
```

So we have a group . Notice, unlike C1, the choice of ordered list is not aways in lexical order and there are repeats, for example {4,2,4}.

In[•]:=
```
classCountG[GC2[3], tasC2]
```

```
L  1
T  31
H  13
SD2  12
```

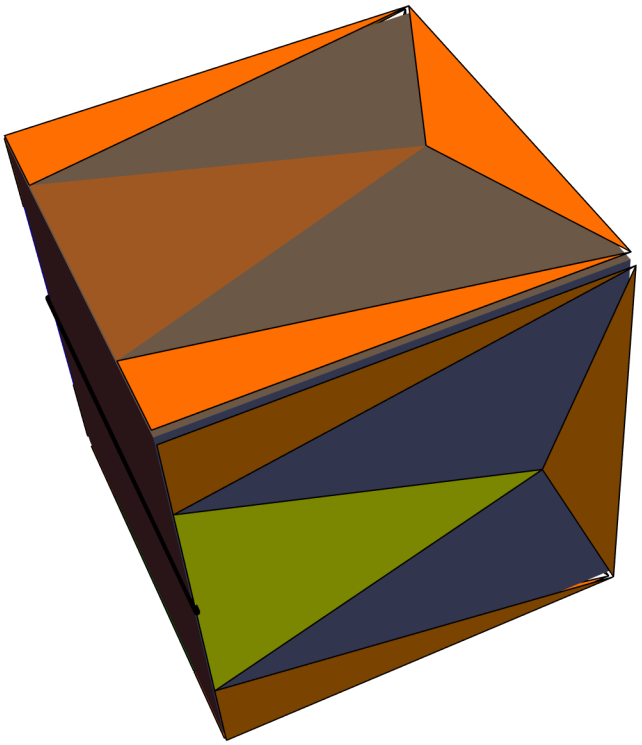
While we had only one half turn as a generator we actually get 13 half turns in this part of the group . Notice also 12 screw displacements.

To verify that our group is distinct we will show that this group is a symmetry group of a lattice. We modify our DBbox by cutting it in half and slightly modifying it

```
In[•]:= DHBbox[α_] := {{GrayLevel[.4], EdgeForm[],
    Polyhedron[α /@ {{{0, -.5, .5}, {0, .5, .5}, {0, .5, -.5}, {0, -.5, -.5}},
       {{0, -.5, .5}, {0, -.5, -.5}, {1, -.5, -.5}, {1, -.5, .5}},
       {{0, -.5, -.5}, {1, -.5, -.5}, {1, .5, -.5}, {0, .5, -.5}}, {{0, .5, .5}, {1, .5, .5},
        {1, .5, -.5}, {0, .5, -.5}}, {{1, .5, .5}, {1, .5, -.5}, {1, -.5, -.5}, {1, -.5, .5}},
       {{1, .5, .5}, {1, -.5, .5}, {0, -.5, .5}, {0, .5, .5}}}]},
   {Black, Thickness[.01], Line[α /@ {{0, 0, -.53}, {0, 0, .53}}]},
   {Blue, EdgeForm[], Polygon[α@{{0, 0, .52}, {0, .3, .52}, {.8, 0, .52}, {0, -.3, .52}}]},
   {Brown, EdgeForm[],
    Polygon[α@{{.8, -.52, 0}, {0, -.52, .3}, {0, -.52, 0}, {0, -.52, -.3}}]},
   {Yellow, Polygon[α@{{0, 0, -.52}, {0, .3, -.52}, {.8, 0, -.52}, {0, -.3, -.52}}]},
   {Green, Polygon[α@{{.8, .52, 0}, {0, .52, .3}, {0, .52, -.3}, {0, .52, -.3}}]},
   {Orange, Polygon[α@{{.8, 0, .52}, {1, -.5, .52}, {1, .5, .52}}],
    Polygon[α@{{1, .5, .52}, {0, .3, .52}, {0, .5, .52}}],
    Polygon[α@{{1, -.5, .52}, {0, -.3, .52}, {0, -.5, .52}}],
    Polygon[α@{{.8, 0, -.52}, {1, -.5, -.52}, {1, .5, -.52}}],
    Polygon[α@{{1, .5, -.52}, {0, .3, -.52}, {0, .5, -.52}}],
    Polygon[α@{{1, -.5, -.52}, {0, -.3, -.52}, {0, -.5, -.52}}],
    Polygon[α@{{.8, .52, 0}, {1, .52, .5}, {1, .52, -.5}}],
    Polygon[α@{{0, .52, .5}, {0, .52, .3}, {1, .52, .5}}],
    Polygon[α@{{0, .52, -.5}, {0, .52, -.3}, {1, .52, -.5}}],
    Polygon[α@{{.8, -.52, 0}, {1, -.52, .5}, {1, -.52, -.5}}],
    Polygon[α@{{0, -.52, .5}, {0, -.52, .3}, {1, -.52, .5}}],
    Polygon[α@{{0, -.52, -.5}, {0, -.52, -.3}, {1, -.52, -.5}}]}}
```

In[•]:=
```
Graphics3D[{DHBbox[ι]}, Boxed → False]
```

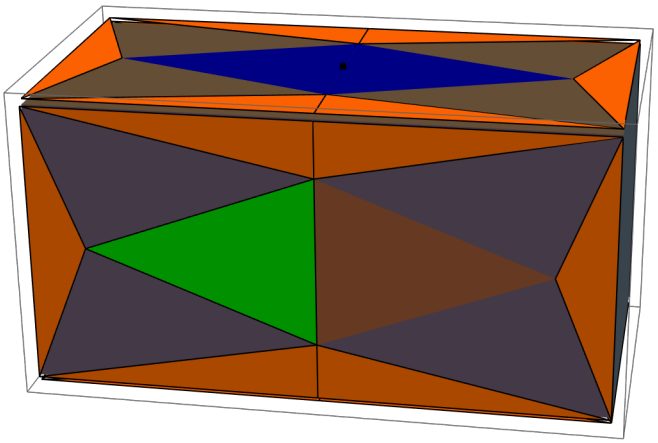
Out[•]=



Note that our full box is

In[•]:=
```
Graphics3D[{DHBbox[τbx@*ηz], DHBbox[τbx]}]
```

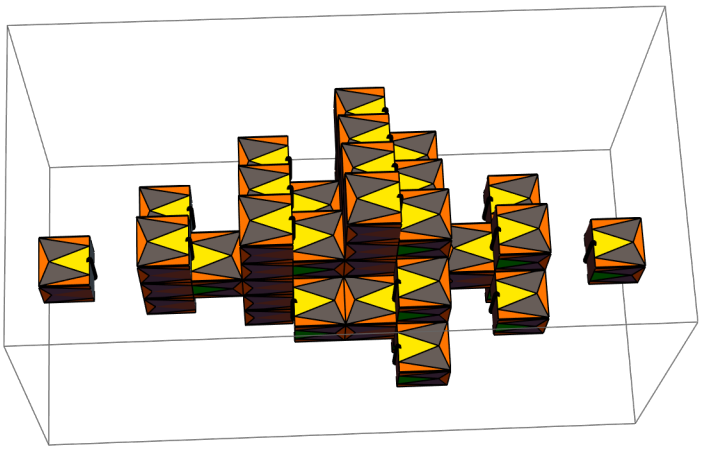
Out[•]=



Then we have the GC[3] orbit of our half box

In[•]:=
```
Graphics3D[Table[DHBbox[TasTF[g, tasC2]], {g, GC2[3]}]]
```

Out[•]=



Or we could draw my logo by

In[•]:=
```
LC2 = {{5, 3}, {4}, {4, 1}, {1}, {4, 1, 1}, {1, 1}, {3, 5, 3}, {3, 4},
    {3, 4, 1}, {3, 1, 4, 1}, {3, 1}, {3, 4, 1, 1}, {3, 1, 1}, {3, 3, 5, 3}, {3, 3, 4},
    {3, 3, 4, 1}, {3, 3, 1, 4, 1}, {3, 3, 1}, {3, 3, 4, 1, 1}, {3, 3, 1, 1}};
```

In[•]:=
```
Graphics3D[Table[DHBbox[TasTF[g, tasC2]], {g, LC2}]]
```

Out[•]=

