The Fascination of Crystals and Symmetry

Unit 2.4

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The 7 primitive lattices...

- **triclinic**
- **monoclinic**
- **orthorhombic**
- **tetragonal**
- **trigonal**
- **trigonal/hexagonal**
- **cubic**

- **primitive = simple**
- **there are lattice points only at every corner of the unit cell, but not inside the cell or at the faces or edges**
- **a primitive unit cell comprises exactly 1 motif (1/8 * 8 = 1)**
- **the primitive unit cell is the smallest possible unit cell**
- **it is always possible to find such a primitive unit cell**
Is the smallest possible unit cell always the best cell?
The choice of the unit cell...
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- The unit cell should be as small as possible; short lattice vectors!
- At the same time it should represent the symmetry of the crystal; this means that the lattice vectors should run parallel to symmetry axes or perpendicular to symmetry planes.
- The axes should be, if possible, orthogonal (or hexagonal)!

5 possible primitive unit cells, all with the same 'volume'
The choice of the unit cell...

- Due to symmetry reasons it is sometimes advantageous to choose not the smallest possible unit cell!
- **Centered** cells contain additional lattice points.
- The purpose is to describe the crystal in a *higher symmetric system of coordinates*!
- But note: The crystal system does not change!
- The centered unit cell possess the *same symmetry* as the primitive one, but the symmetry becomes more evident!
The choice of the unit cell... ...can be difficult!