

1. Symmetriegruppen

1. Punktgruppen
2. Raumgruppen

2. Kristallsysteme

1. Translationsgitter
2. 7 Kristallsysteme
3. 14 Bravais-Gitter

3. Einfache Kristallgitter

sc, bcc, fcc, hexagonal
Beispiele

4. Wigner-Seitz-Zelle

Keine flächendeckende Anordnung für 5-, 7-, oder 8-Ecke

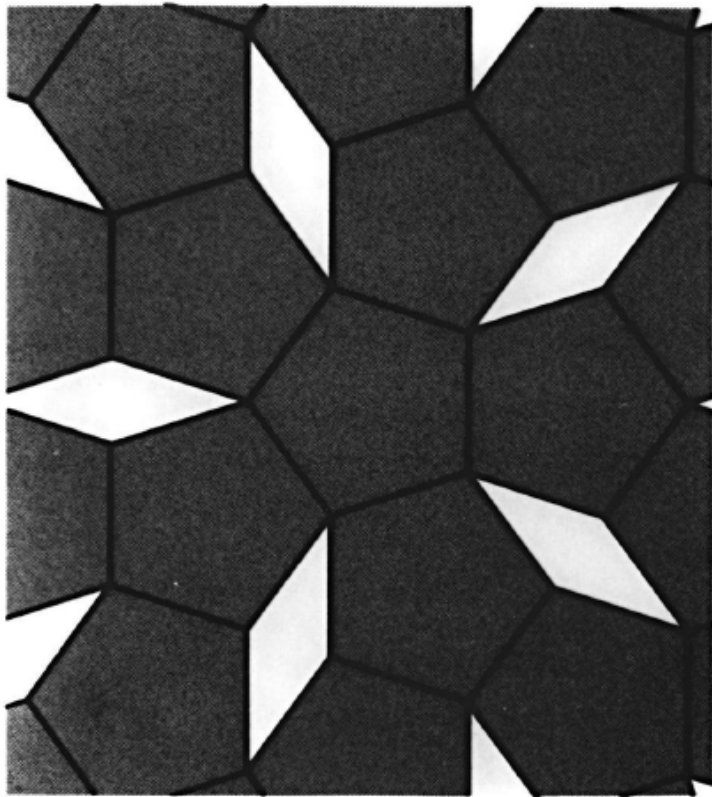


Figure 9a A five-fold axis of symmetry cannot exist in a lattice because it is not possible to fill all space with a connected array of pentagons. In Fig. 32 we give an example of regular pentagonal packing which does not have the translational invariance of a lattice.

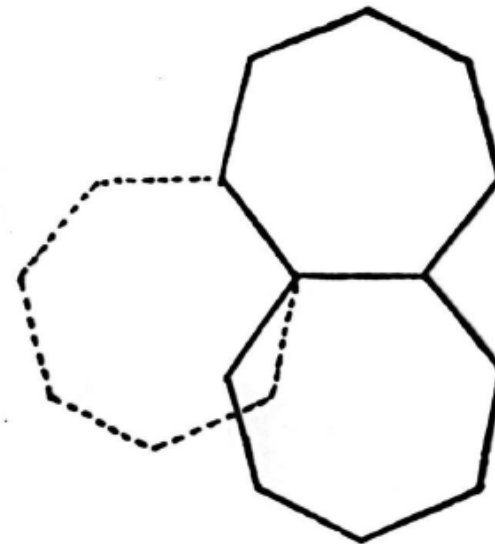


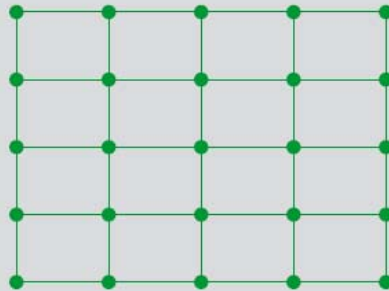
Figure 9b Kepler's demonstration (*Harmonice mundi*, 1619) that a seven-fold axis of symmetry cannot exist in a lattice. (*Gesammelte Werke*, Vol. 6, Beck, Munich, 1940.)

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Kristallstruktur = Gitter + Basis

Rechteckgitter

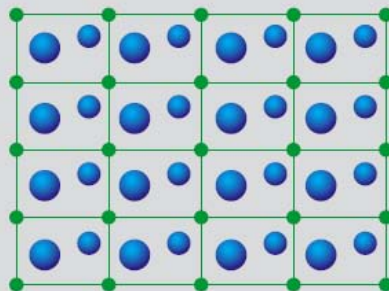
Gitter



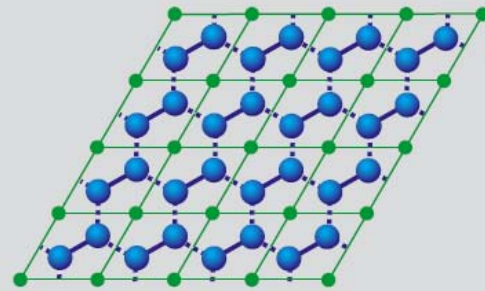
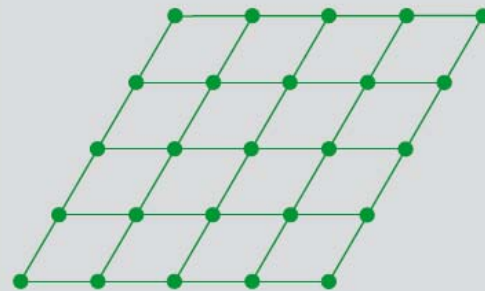
Basis



Kristallstruktur

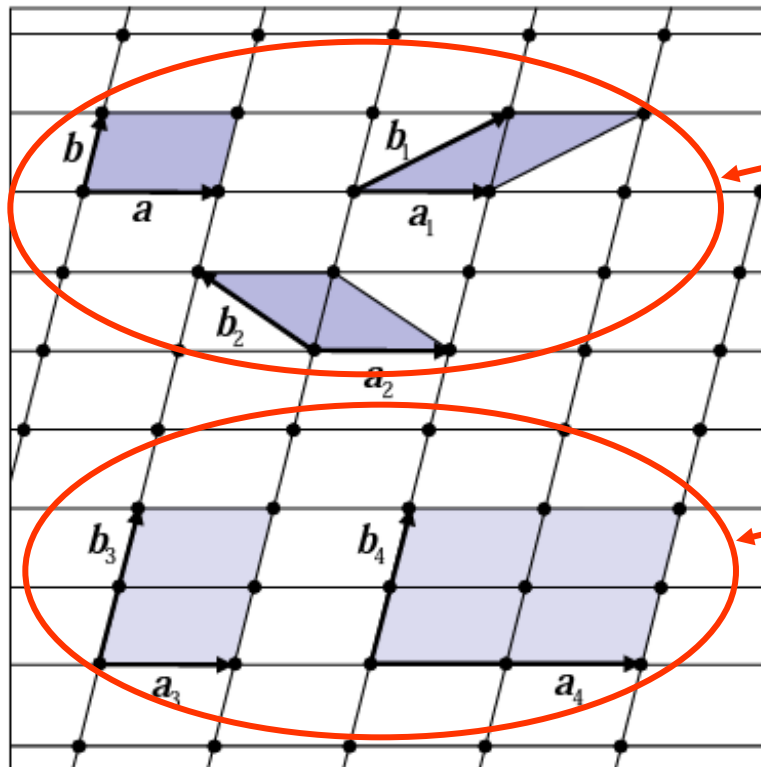


Wabengitter



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Primitive Elementarzelle

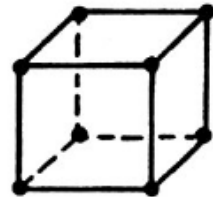


primitive Elementarzellen

nicht-primitive
Elementarzellen

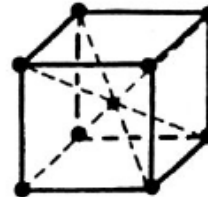
Rechtwinklige Kristallsysteme

kubisch
 $a=b=c$
 $\alpha=\beta=\gamma=\pi/2$



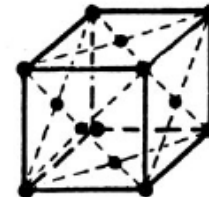
sc

primitiv



bcc

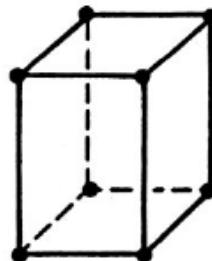
raumzentriert



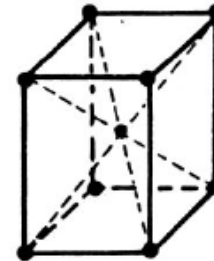
fcc

flächenzentriert

tetragonal
 $a=b \neq c$
 $\alpha=\beta=\gamma=\pi/2$

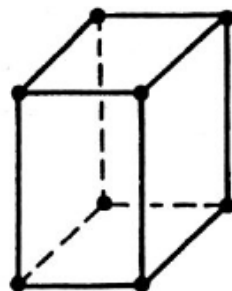


primitiv

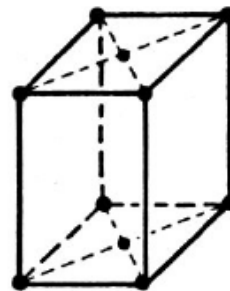


raumzentriert

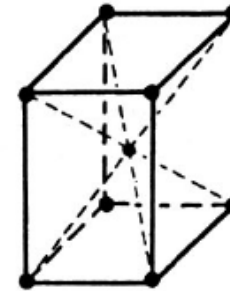
orthorhombisch
 $a \neq b \neq c$
 $\alpha=\beta=\gamma=\pi/2$



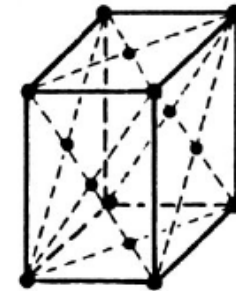
primitiv



basiszentriert



raumzentriert



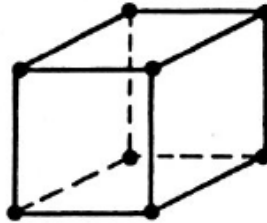
flächenzentriert

Schiefwinklige Kristallsysteme

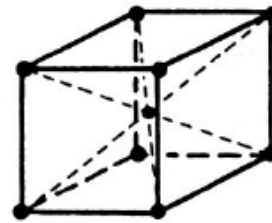
monoklin

$$a \neq b \neq c$$

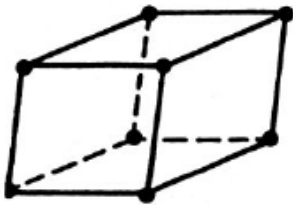
$$\alpha = \beta = \pi/2 \neq \gamma$$



primitiv



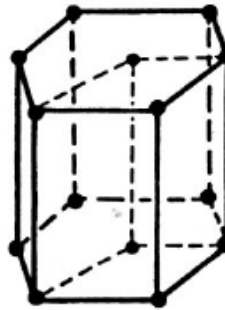
raumzentriert



triklin

$$a \neq b \neq c$$

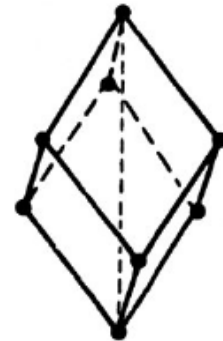
$$\alpha \neq \beta \neq \gamma \neq \pi/2$$



hexagonal

$$a = b \neq c$$

$$\alpha = \beta = \pi/2, \gamma = 2\pi/3$$



trigonal

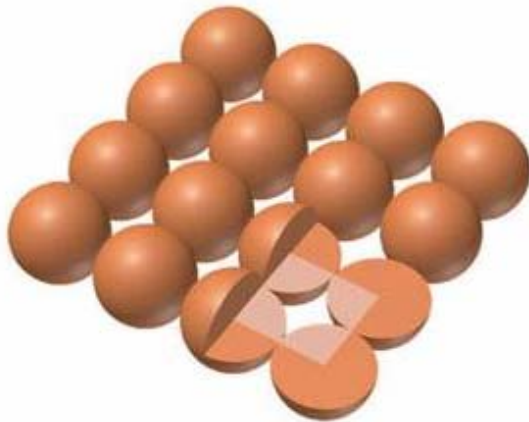
$$a = b = c$$

$$\alpha = \beta = \gamma \neq \pi/2$$

Kubische Kristalle

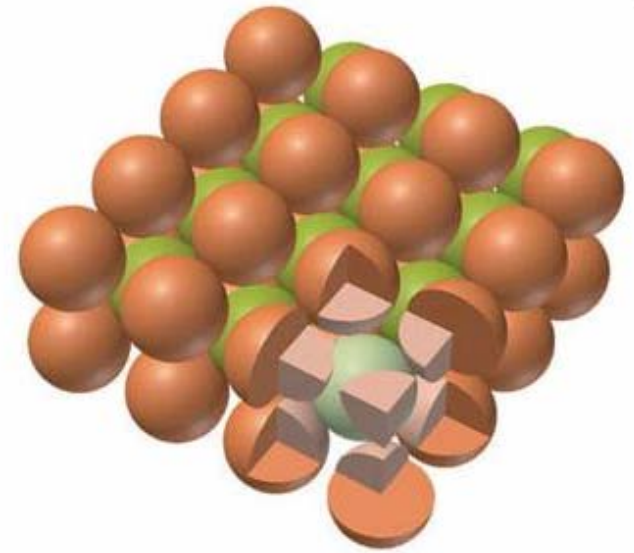
sc und bcc

sc



Simple cubic (52%)

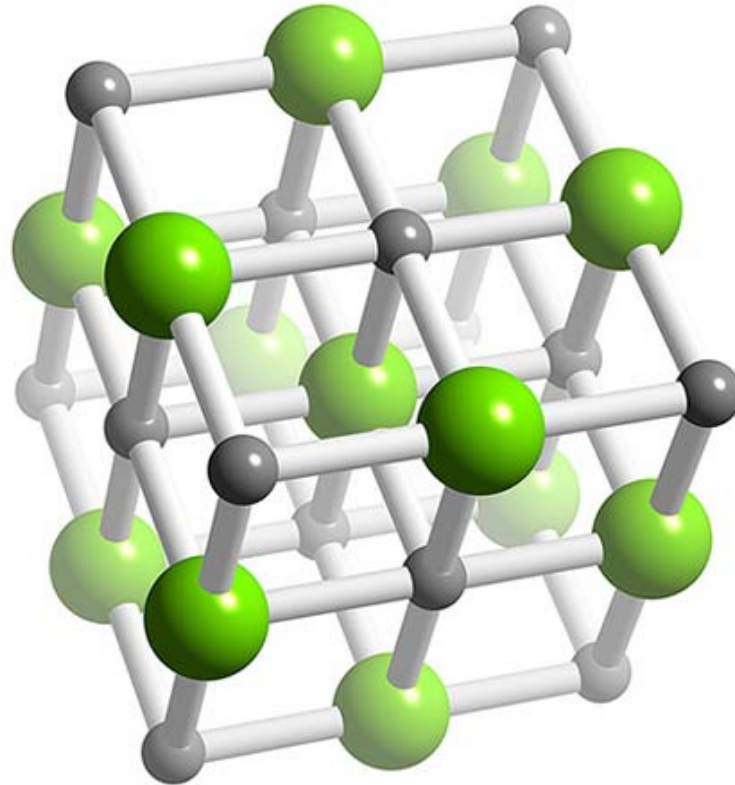
bcc



Body-centered cubic (68%)

Natriumchlorid-Struktur

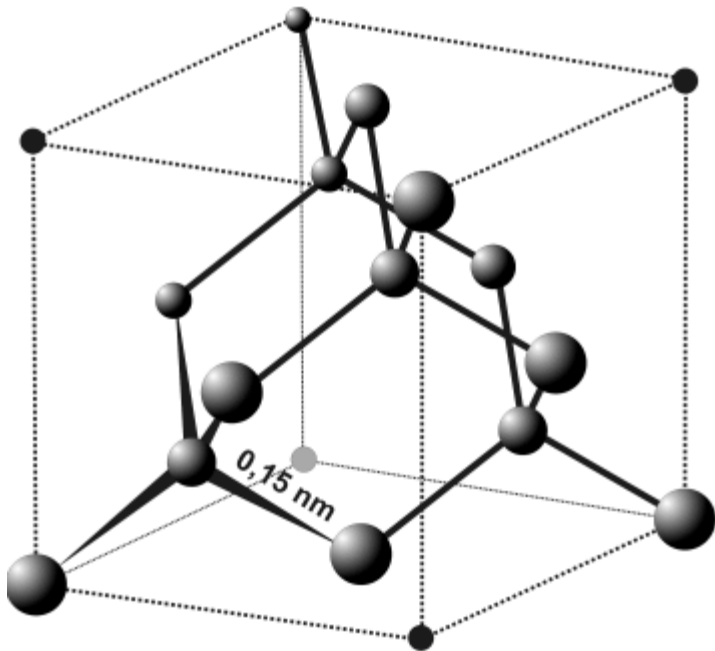
fcc



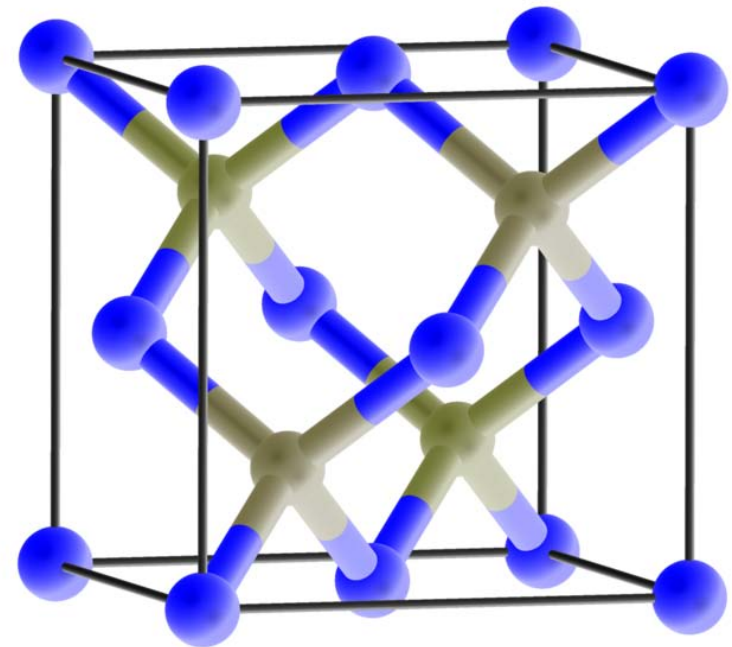
Diamant- und Zinkblende-Strukturen

fcc

Diamant C

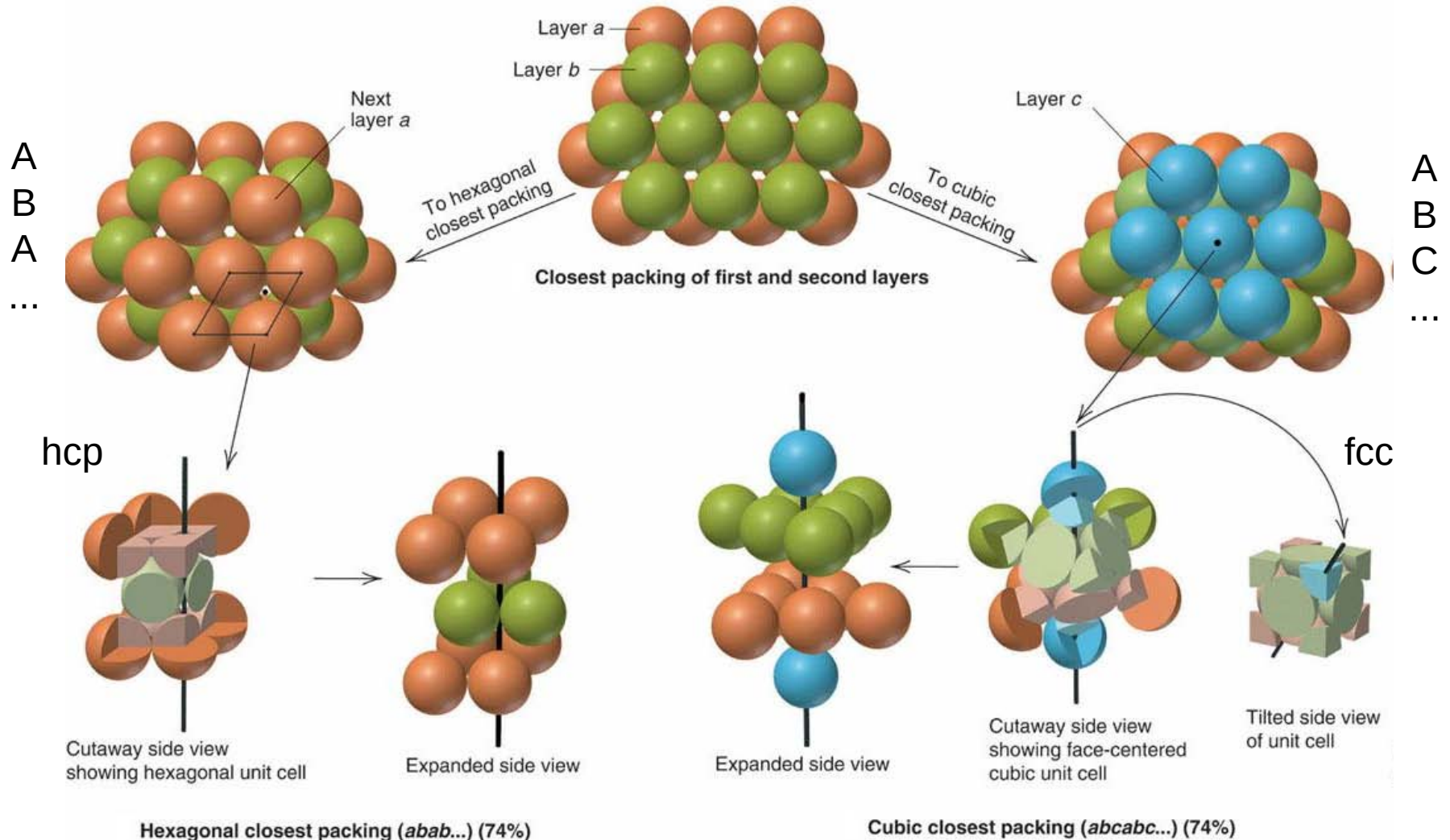


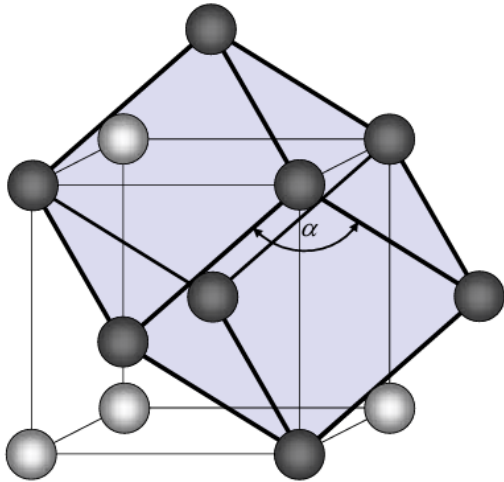
Zinkblende ZnS



Kugelpackung: hexagonal oder kubisch?

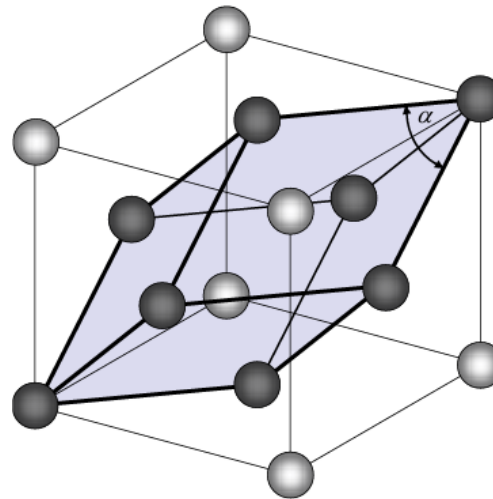
hcp und fcc





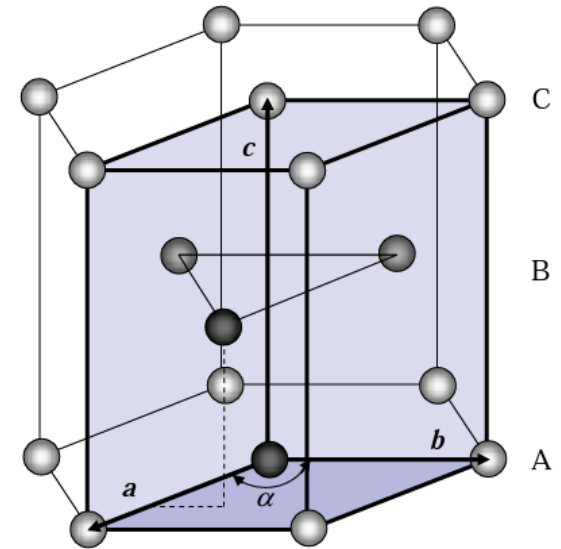
bcc

kubisch raumzentriertes
Gitter



fcc

kubisch flächenzentriertes
Gitter

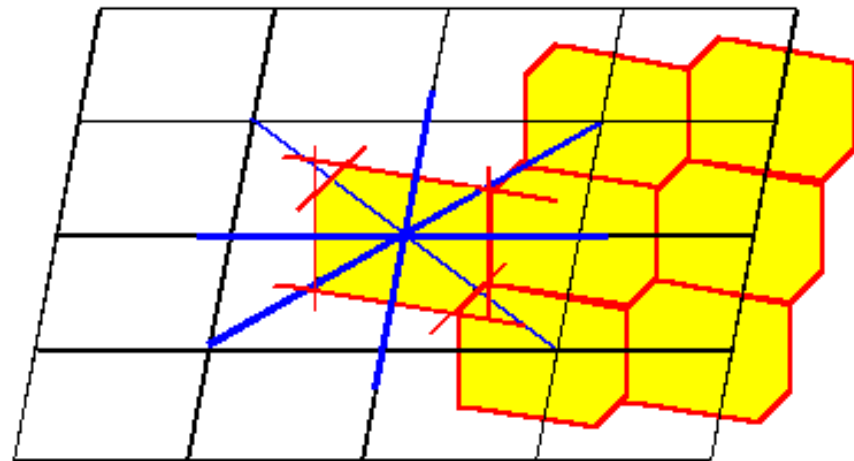
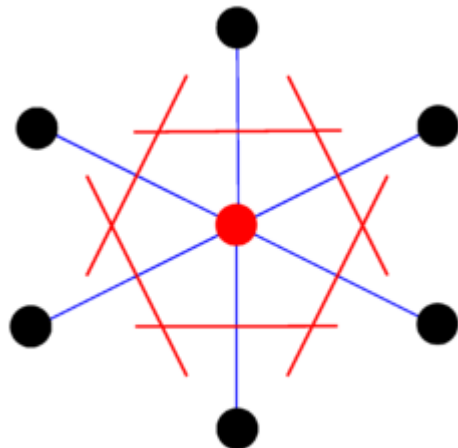


hcp

hexagonal dichtesten
Kugelpackung

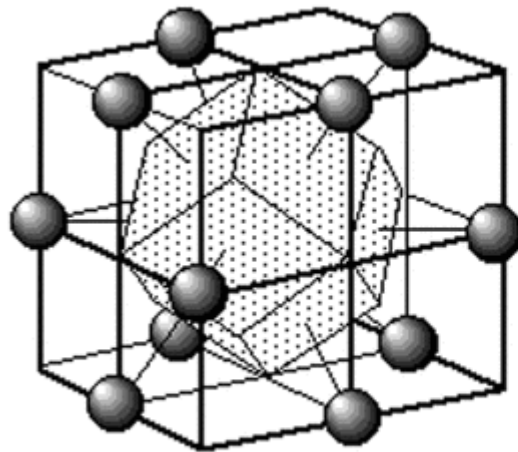
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Zur 2D Konstruktion einer Wigner-Seitz-Zelle



fcc

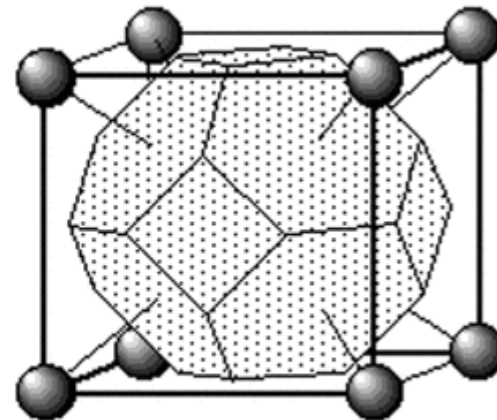
kubisch flächenzentriertes
Gitter



rhombic dodecahedron

bcc

kubisch raumzentriertes
Gitter



truncated octahedron