31.3.2012.

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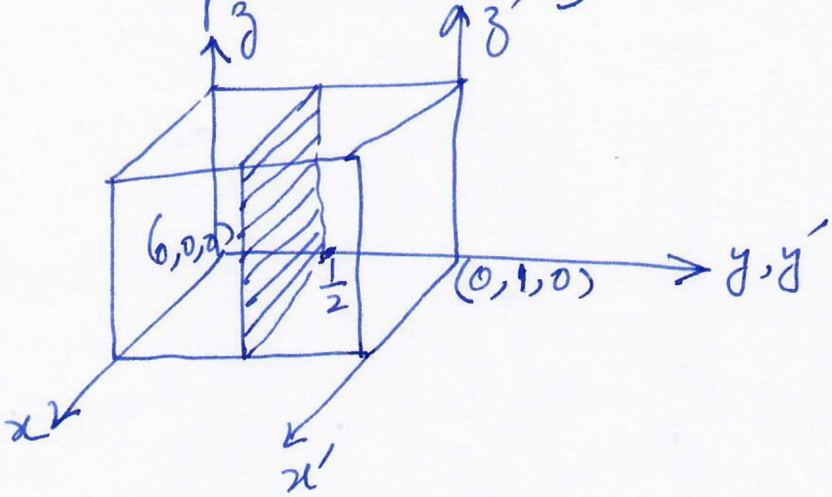
Several important aspects of Miller Indices for planes should be noted.

1. Planes and their negatives are identical (this was not the case for directions)



As an example, consider Fig. above. The shaded plane has the indices (0 2 0) If the x, y and z coordinates are used but has the indices $(0\,\bar{2}\,0)$ if the x', y', z' ~~cor~~ coordinates are used. But we consider the same plane!

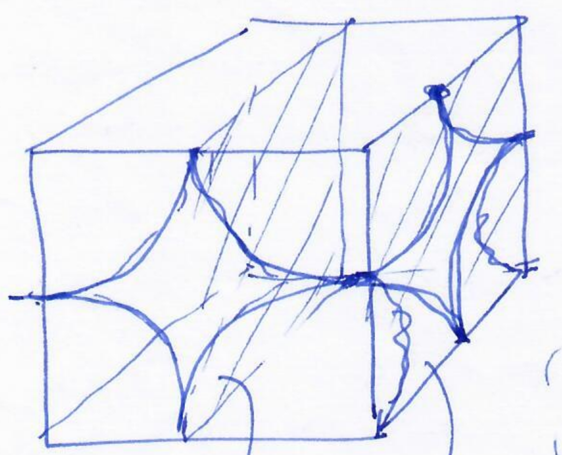
Therefore $(0\,2\,0) = (0\,\bar{2}\,0)$

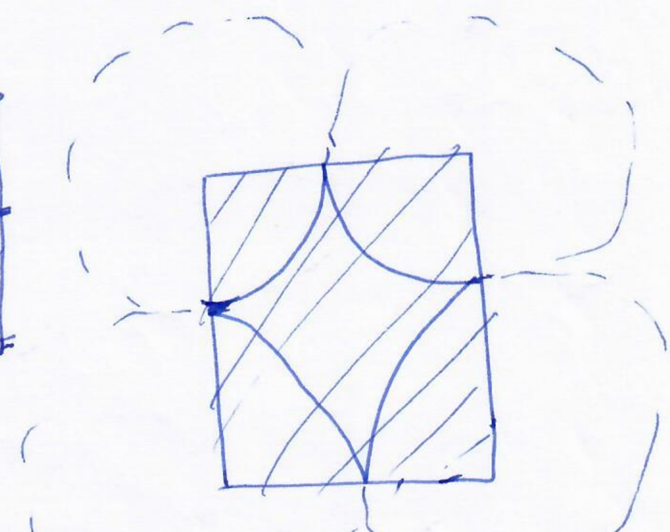
2. Planes and their multiples are not identical (again, this is the opposite of what we found for directions). We can show it by defining planes distinctions and

and planar packing fraction's. The planar density is the number of atoms per unit area, whose centers lie on the plane. The packing fraction is the fraction of that plane actually covered by ~~that~~ these atoms.

Example

Calculate the planar density and planar packing fraction's for the (0 1 0) and (0 2 0) planes in simple cubic polonium, which has a lattice parameter of 3.34×10^{-8} cm.





The planar densities of (010)

The planar packing fraction is given by

$$\text{Packing fraction } (010) = \frac{\text{area of atoms per face}}{\text{area of face}}$$

$$= \frac{(1 \text{ atom})(\pi r^2)}{(a_0)^2}$$

$$= \frac{\pi r^2}{(2r)^2} = 0.79$$

However no atoms are centered on the (020) planes. Therefore the planar density and the planar packing fraction are both zero. The (010) and (020) planes are not equivalent.

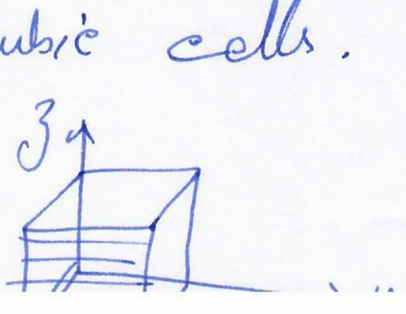
2. In each unit cell, planes of a form represent groups of equivalent planes that have their particular indices because of the orientation of the coordinates. We represent these groups of similar planes with the notation { }. The planes of the form {110} in

Planes of the form $\{110\}$ in cubic systems

$$\{110\}\begin{cases}(110)\\(101)\\(011)\\(1\bar{1}0)\\(10\bar{1})\\(01\bar{1})\end{cases}$$

The negative of the planes are not unique planes

3. In cubic systems, a direction that has the same indices as a plane is perpendicular to that plane. Fig. shows a unit cell containing a (100) plane and a [100] direction and clearly indicates this property. This not always true for non cubic cells.



A direction in a cubic unit cell is perpendicular