

HOME EX. 3: RECIPROCAL LATTICE

1.

Hexagonal lattice: define the lattice $a_1 = a\hat{x}$, $a_2 = a(\hat{x}/2 + \sqrt{3}/2\hat{y})$, $a_3 = c\hat{z}$.

1. Find the reciprocal lattice vectors
2. Draw the planes defined by the Miller indices $(1, 0, 0)$, $(0, 1, 0)$, $(0, 0, 1)$.
3. What is the Miller index for a plane that goes through the three points \vec{a}_1 , $2\vec{a}_2$, $3\vec{a}_3$. What is the distance of this plane from the origin?
4. Is there a parallel plane which is closer to the origin? If there is one, what is its distance from the origin?

2.

For BCC, FCC and cubic lattice:

1. Define primitive vectors a_1, a_2, a_3 . Find the corresponding reciprocal vectors b_1, b_2, b_3 .
2. Write an equation for a plane that is defined by the miller index $(1,1,1)$ and is at distance d from the origin.
3. What is the distance between adjacent lattice planes in this direction? Write the equation for the plane that is closest to the origin (but doesn't go through the origin).
4. At what point does this plane touch the line $t\vec{a}_1$ ($-\infty < t < \infty$) ?

שאלה 3

הראו כי נפח תא יחידה פרימיטיבי בסריג ההופכי שווה $\frac{(2\pi)^3}{V}$, כאשר V הוא נפח תא היחידה הפרימיטיבי בסריג המרחבי.

לנוחיותכם, נתונה הזהות הוקטורית הבאה:

$$\vec{p} \times (\vec{q} \times \vec{r}) = (\vec{p} \cdot \vec{r}) \vec{q} - (\vec{p} \cdot \vec{q}) \vec{r} \quad \text{מתקיים: } \vec{p}, \vec{q}, \vec{r}$$