

## CLASS 2: BRAVAIS LATTICE

1.

For the following lattices, find primitive vectors, primitive unit cell and describe as a cubic lattice+basis: cubic, BCC, FCC.

## שריג מלבני

נתונים שני וקטורים (לא קולינאריים) במישור:  $\vec{a} = a\hat{x}$   $\vec{b} = b\hat{y}$  (נניח  $a < b$ ).

1. ציירו את הסריג הנפרש על ידי הוקטורים.
2. מצאו שני זוגות וקטורים נוספים הפורשים את אותו השריג.
3. בנו על כל זוג וקטורים תא פרימיטיבי והראו כי שטח התאים שווה בגודלו.
4. ציירו את תא ויגנר זייטס של הסריג.

3.

A (2D) collection of + and - atoms is arranged in lines as in the drawing (left). Each atom touches only four other atoms. Define  $x \equiv \frac{r_+}{r_-}$ , and use  $x$  in your answers.

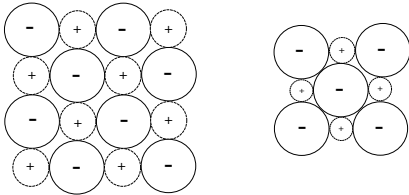


FIG. 1. Left: each atom touch four other atoms. Right: the big atoms touch each other

- (a) Describe the system using primitive vectors and a basis
- (b) What is the packing density?
- (c) Define the appropriate 3D system, what is the packing density?
- (d) returning to 2D:  $x$  is now decreased until the big atoms touches each other (right drawing). What is the value of  $x$ ? What is the packing-density for this  $x$ ?
- (e)  $x$  is now further decreased, until  $x = 0$ . Plot the the packing ratio as a function of  $x$  for  $0 < x < 1$ . Why would you expect that  $x = 1$  and  $x = 0$  would give the same result?

4.

Diamond structure:

- (a) Describe the Diamond structure as a cubic with basis
- (b) What is the (maximal) packing-ratio if all atoms are of equal radius ?
- (c) Diamond can also be described as two FCC lattices. Find these two lattices.