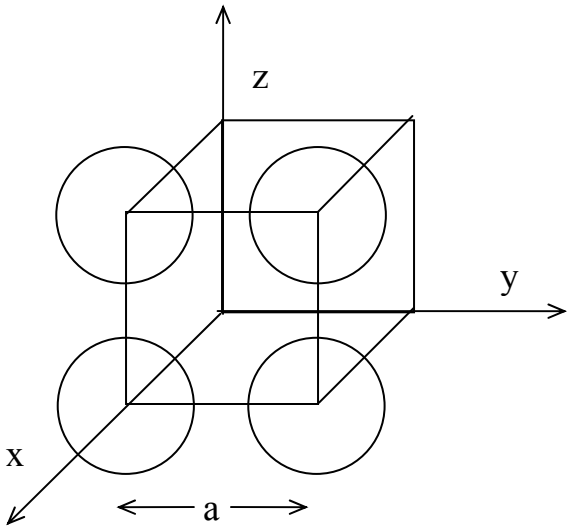
3.091 Fall Term 2002

Homework Quiz #6A

solution outline

Calculate the density of atoms along [011] in molybdenum (Mo). Express your answer in units of *atoms/cm*.



- Mo is BCC

- [011] is the face diagonal

- we see 2 × ½ atoms over a distance of $\sqrt{2}\,a$

- to get the value of a, we use the relationship between the number of atoms in the unit cell and the number of atoms in a molar volume:

$$\frac{2\ atoms}{a^3} = \frac{N_{Av}}{V_{molar}}, \quad \therefore \quad a = \left(\frac{2\,V_{molar}}{N_{Av}}\right)^{1/3}$$

- so now the atom line density is $1/(\sqrt{2}\,a)$ =

$$\frac{1}{\sqrt{2}\left(\frac{2\,V_{molar}}{N_{Av}}\right)^{1/3}} = \frac{1}{\sqrt{2}\left(\frac{2\times 9.41}{6.02\times 10^{23}}\right)^{1/3}} = 2.24\times 10^{7}\ atoms/cm$$