**Electron – Crystal Interaction**

**The Model**

We’ll start with intrinsic semiconductors – i.e. those which haven’t been doped with impurities. Examples are found in Group 14 especially.

Table

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For instance, Carbon, Silicon, Germanium, each forms a diamond structure with itself, 2 atoms per basis.

Chart, bubble chart

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Other examples of intrinsic semiconductors include compounds of Groups 13 and 15 atoms, like GaAs, which also forms a diamond structure? These substances arrange themselves in a periodic lattice, of course. And we’ll be interested in the properties of the atoms’ valence electrons (e.g. the 3s23p2 electrons for Si), as we were in the Metal folder. We as yet assume these electrons are non-interacting. And additionally we presume the lattice ions are immobile. Then, as in the metal folder, we can write down the Hamiltonian as:



where,



is the number density of the valence electrons, and Vcrystal is the potential of the ionic cores. So we basically just have a bunch of electrons traveling in a single particle potential.



Don’t need to recapitulate all the other stuff from the Metals folder, as it still applies.