Lecture 5: Bloch Theorem

The Bloch theorem is stated and a formal proof is given. The notion of the Brillouin zone is introduced. It is shown that each zone contains N states, where N is the number of Bravais lattice unit cells in the sample.

A second proof of the Bloch theorem is given by casting the Schrodinger equations in Fourier space. It is shown that a plane wave with momentum $\vec{k}$ is coupled only to plane waves with momentum $\vec{k}+\vec{G}$ where $\vec{G}$ is a reciprocal lattice vector. The problem is reduced to the diagonalization of a large matrix. The notion of band gaps on the zone faces is introduced.

Reading: Marder 7.2