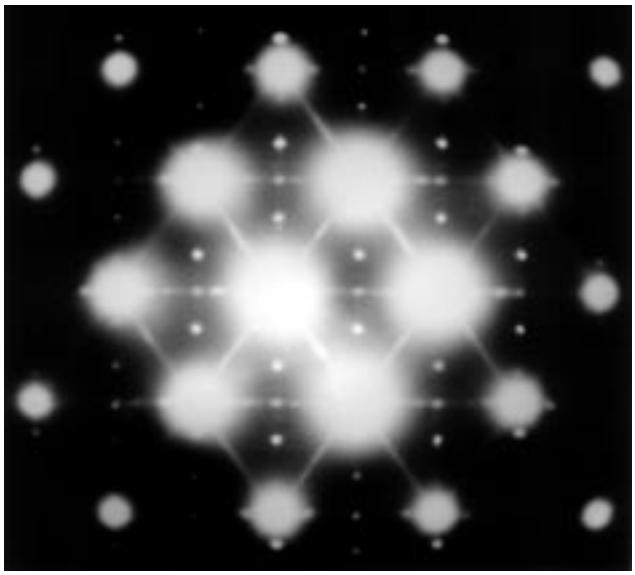
5. Diffraction from Crystals



5.1 Sums of Wavelets from Atoms

Chapters 5–7 are concerned with the angular dependence of the diffracted wave, $\psi(\boldsymbol{\Delta k})$, emitted from different arrangements of atoms. The underlying mechanism is coherent elastic scattering from individual atoms, the topic of Chap. 3. Diffraction itself, however, is a cooperative phenomenon based on phase relationships between the wavelets[1] scattered coherently by the individual atoms. This chapter explains how a translationally-periodic arrangement of atoms in a crystal permits strong constructive interferences between individual wavelets, creating the familiar Bragg diffractions.

[1] We call the outgoing waves from individual atoms "wavelets," to distinguish them from their coherent sum, the total diffracted wave, that is measured at the detector. The "wavelets" are in fact full wavefunctions, but each contributes a small amplitude to the total wave.