

Scattering of Photons

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Contents

Chapter 1	Scattering of Photons	Page 2
1.1	Scattering of Photons	2

Chapter 1

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1.1 Scattering of Photons

In the scattering of photons, for example from an atom, an initial state photon with wave-number \vec{k} and polarization $\hat{\epsilon}$ is absorbed by the atom and a final state photon with wave-number \vec{k}' and polarization $\hat{\epsilon}'$ is emitted. The atom may remain in the same state (elastic scattering) or it may change to another state (inelastic). Any calculation we will do will use the matrix element of the interaction Hamiltonian between initial and final states.

$$\mathbf{H}_{ni} = \left\langle n; \vec{k}' \hat{\epsilon}^{(\alpha')} \left| \mathbf{H}_{int} \right| i; \vec{k} \hat{\epsilon}^{(\alpha)} \right\rangle$$
$$\mathbf{H}_{int} = -\frac{e}{mc} \vec{A}(x) \cdot \vec{p} + \frac{e^2}{2mc^2} \vec{A} \cdot \vec{A}.$$