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Problem sheet 11

11.1 Magnetism of iron group ions

Please study the part on magnetism of iron group ions in the 11th chapter of the book *Introduction to solid state physics* by Charles Kittel.

11.2 Partial wave decomposition

Free particles can be modeled in the eigenbasis of the momentum operator, i.e. as plane waves, or in the eigenbasis of the angular momentum operator, i.e. as spherical waves.
In scattering theory both basis sets naturally arise: the incoming wave is plane, whereas the outgoing wave is a modulated spherical wave. It is custom to develop the incoming wave in terms of spherical waves. This is actually a decomposition in terms of the irreducible basis functions of angular momentum.
Find the series expansion of a plane wave with momentum along z-direction in terms of spherical waves. For this purpose study the literature, e.g. the books by Cohen-Tannudji *et al.* or Messiah.