Pg 415 Addition

At end of section titled “How We’ll Go About It”, insert the following.

Another way of thinking (somewhat classically) of the external source photon as having zero energy is that its source is (effectively) fixed. To impart energy to the photon, it would have to exert a force over a distance on the photon. But it is immovable so distance moved is zero, and thus, so is the energy imparted to the photon. 3-momentum is the integral of force over time, so the photon can pick up 3-momentum from the fixed source.

Similar (classical, heuristic) thinking can be applied to spin. If the photon source is immovable, it should impart no spin, so the external photon spin is zero. The external source photon is virtual, so this is OK. Just as a virtual particle may be off-shell, so our external source photon may be “off-spin”, and indeed, in this case, it is. Thus, we will analyze the interaction of the RHS of Fig. 16-3 as the outgoing electron spin equaling the incoming electron spin.

The formal analysis of this entails scattering calculation tools we do not develop until Chap. 17, so, in what follows, we presume the electron does not change its spin. Indeed, we compare our result to the NRQM Born approximation, which presumes no change in spin of the scattered particle, and we need to compare “apples-to-apples”.

As an aside, it turns out that at relativistic energies, the scattering can actually change the spin of the electron. For more on this topic, see Mandl and Shaw (2010), pg. 151.

Pg 416 Addition

In the last two lines:

Change “$r = 1$” to “$r = r' = 1$”, since it is the low velocity limit. Note that throughout the remainder of the section, we work in the low velocity limit, so r' always equals r.