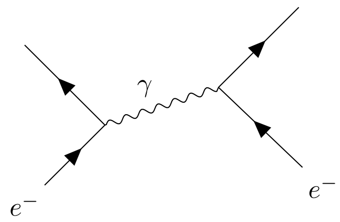

Figure 1: Here, 2 electrons, e^-, "bounce" off each other, or repel each other by transmitting a virtual photon γ. This makes sense, because part of the electromagnetic field is made up of photons. These electrons can also exchange more virtual photons, but each electron exchanged reduces the probability of this happening by 1%. In Figure 4, we will explore the possibility of more photon emissions in more detail.

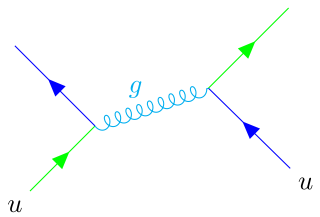

Figure 2: This gives us a simple introduction to quantum chromodynamics. Here, 2 up quarks u bounce off each other by exchanging a gluon. The difference between this and Figure 1 is that the gluon g has a colour charge, unlike the photon γ. The colour charge is essentially the strong force charge of a particle. The quarks, too, are coloured. When coloured particles interact, they exchange coloured particles, such as the gluon. The first up quark is green, and turns blue when it emits the green antiblue gluon. When the second up quark receives this, it turns green.

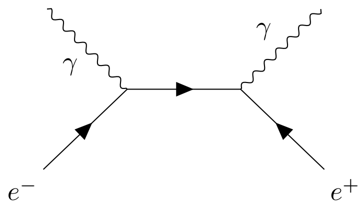

Figure 3: This is a state known as positronium. Here, an electron, e^-, and a positron, e^+, annihilate to create 2 virtual photons, γ. It shows us that $e^-e^+ \rightarrow 2\gamma$. This diagram is sometimes extended to show the virtual photons turning into other particles. This diagram shows us in detail what the interaction between an electron and its antiparticle would be like. The reason why the middle arrow is completely flat, and not at an angle like in the other diagrams is because it shows that that is the point at which they meet. If it were tilted, it would show an electron radiating a photon before meeting a positron, where it annihilated to produce one photon.

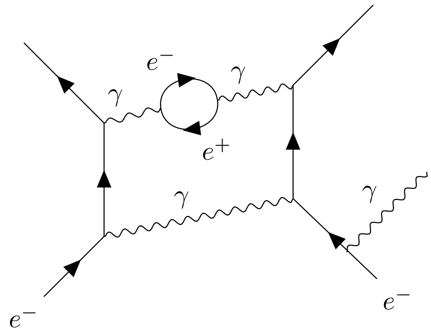

Figure 4: Here, the two electrons (e^-) bounce off each other by exchanging not one, but two virtual photons. Each extra photon emitted would have a 1% less chance of happening, so the probability for this scenario is <0.1%. I say "<" because there's the added probability of the second photon temporarily turning into an electron (e^-) positron (e^+) pair, and then recoalescing into a single photon again, before reaching the second electron. Then, of course, at the very beginning of the Feynman diagram, an electron radiates a photon (γ).

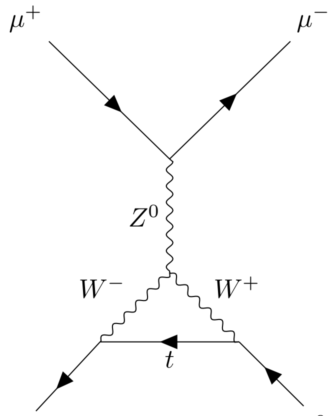

Figure 5: Here, the particles in a B_s^0 (neutral strange B) meson, an anti bottom quark $\bar{b}$ and a strange quark s radiate a W^- and W^+ boson each, respectively. A loss of this charge turns the strange quark into a top quark t with a charge of $\frac{2}{3}$, and it turns the anti bottom quark into an anti top quark. The W bosons that have been radiated collapse into a single Z^0 boson, as the sum of their charges is $1 - 1 = 0$. This virtual Z^0 boson turns into a muon-antimuon pair $\mu^{\pm}$. This shows us the higher-order flavour changing neutral current processes for the decay of the B_s^0 meson. The decay process here is $B_s^0 \to \mu^+\mu^-$, or $\bar{b}s \to \mu^+\mu^-$.

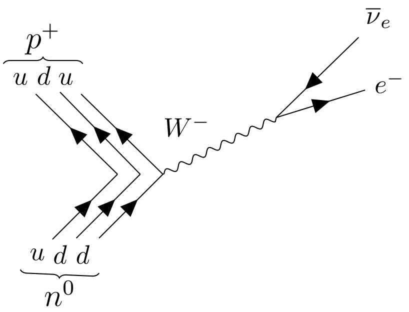

Figure 6: This Feynman Diagram shows us how a neutron (n^0) radiates a W^- boson, which collapses into an electron antineutrino ($\overline{\nu}_e$) and an electron (e^-). The loss of the boson, with a charge of -1, results in the charge of the neutron becoming $0-(-1)=1$, effectively turning it into a proton. Another way of looking at this is by subtracting one from the charge of the down quark d, which is $-\frac{1}{3}$. $-\frac{1}{3}-(-1)=\frac{2}{3}$, the charge of an up quark. So the down quark turns into an up quark (u), turning the neutron into a proton (p^+). Thus, according to this diagram, $n^0 \rightarrow p^+\overline{\nu}_e e^-$.

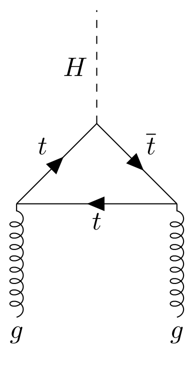

Figure 7: This diagram shows us how two gluons, g, turn into two particles each: A top-antitop quark pair $t^{\pm}$. Two of these quarks, with a charge of $\frac{2}{3}$ and $-\frac{2}{3}$ respectively, combine to form the elusive Higgs Boson. Continuations of this diagram normally show the Higgs Boson decaying into the $W^{\pm}$ boson pair, as the Higgs H only exists for a fraction of a second before it decays. $2g \rightarrow H$

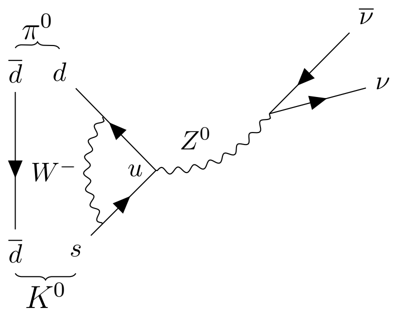

Figure 8: The Kaon K^0 (or K meson) is a meson made up, in this case, of an antidown quark $\overline{d}$ and a strange quark s. This diagram shows one of the possible scenarios of Kaon decay. The antidown doesn't have any interactions with other particles, and moves forward in time. The strange, on the other hand, radiates a W^- boson. Because of this, it loses a charge of -1, turning it into an up quark u. Other versions of the diagram replace the up quark with u, c, t, which means that the particle at that vertex can be either an up, charm, or top quark, as all of them have the same charge. Then, this up quark radiates a virtual Z^0 boson, which turns into a neutrino-antineutrino pair $\nu\overline{\nu}$. The W^- boson that the former strange quark s has emitted get's re-absorbed into the particle, restoring the charge of -1, and turning it into a down quark ($\frac{2}{3} - 1 = \frac{1}{3}$, the charge of the down quark d). The antidown-down quark pair $d\overline{d}$, in turn, make up a pion π^0, another kind of meson. Thus, $K^0 \rightarrow \nu\overline{\nu}\pi^0$.

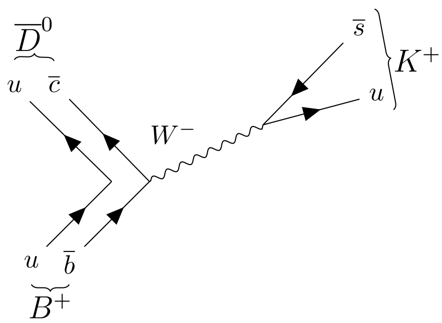

Figure 9: Here, the B^+ meson at the bottom is made up of an up quark u and an antibottom quark $\overline{b}$. The antibottom radiates a W^- boson which causes it to lose a charge of -1, turning it into an anticharm quark $\overline{c}$. Thus, the B^+ meson turns into a $\overline{D}^0$ meson, made up of an up quark and an anticharm. The radiates W^- boson turns into an ant strange $\overline{s}$ and an up quark u. These, in turn, constitute a K^+ meson. This is a clear example of meson mixing, where $B^+ \rightarrow \overline{D}^0 K^+$.