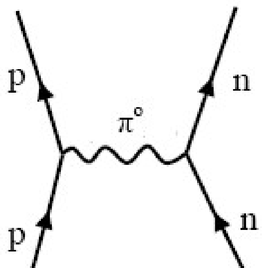
Feynman Diagrams

An American Physicist called Richard Feynman came up with a way of visualising forces and exchange particles. Below are some examples of how Feynman diagrams can represent particle interactions.
The most important things to note when dealing with Feynman diagrams are the arrows and the exchange particles, the lines do not show us the path that the particles take only which come in and which go out.
The arrows tell us which particles are present before the interaction and which are present after the interaction. The wave represents the interaction taking place with the appropriate exchange particle labelled.

Examples



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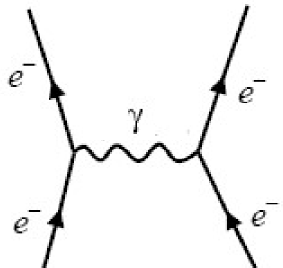

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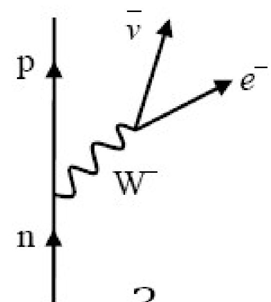

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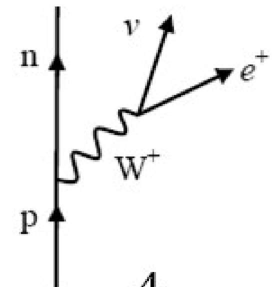

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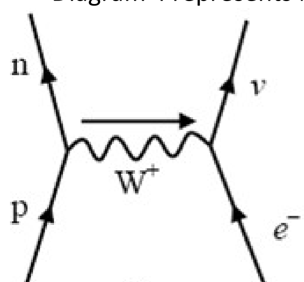
Diagram 1 represents the strong interaction. A proton and neutron are attracted together by the exchange of a neutral pion.
Diagram 2 represents the electromagnetic interaction. Two electrons repel each other by the exchange of a virtual photon.
Diagram 3 represents beta minus decay. A neutron decays due to the weak interaction into a proton, an electron and an anti electron neutrino
Diagram 4 represents beta plus decay. A proton decays into a neutron, a positron and an electron neutrino.



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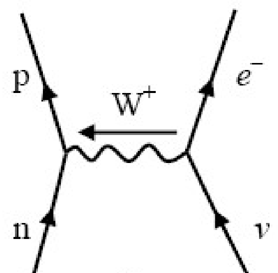

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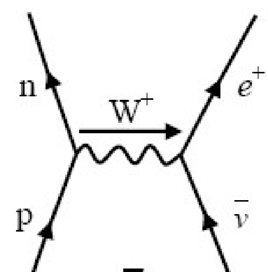

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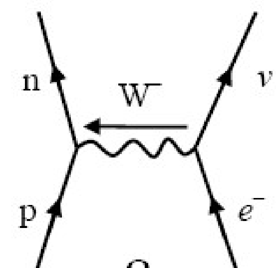

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Diagram 5 represents electron capture. A proton captures an electron and becomes a neutron and an electron neutrino.
Diagram 6 represents a neutrino-neutron collision. A neutron absorbs a neutrino and forms a proton and an electron.
Diagram 7 represents an antineutrino-proton collision. A proton absorbs an antineutrino and emits a neutron and an electron.
Diagram 8 represents an electron-proton collision. They collide and emit a neutron and an electron neutrino.

Getting the Exchange Particle

The aspect of Feynman diagrams that students often struggle with is labelling the exchange particle and the direction. Look at what you start with:
If it is positive and becomes neutral, you can think of it as throwing away its positive charge so the boson will be positive. This is the case in electron capture.
If it is positive and becomes neutral, you can think of it as gaining negative to neutralise it so the boson will be negative. This is the case in electron-proton collisions.
If it is neutral and becomes positive, we can think of it either as gaining positive (W+ boson) or losing negative (W– boson in the opposite direction).