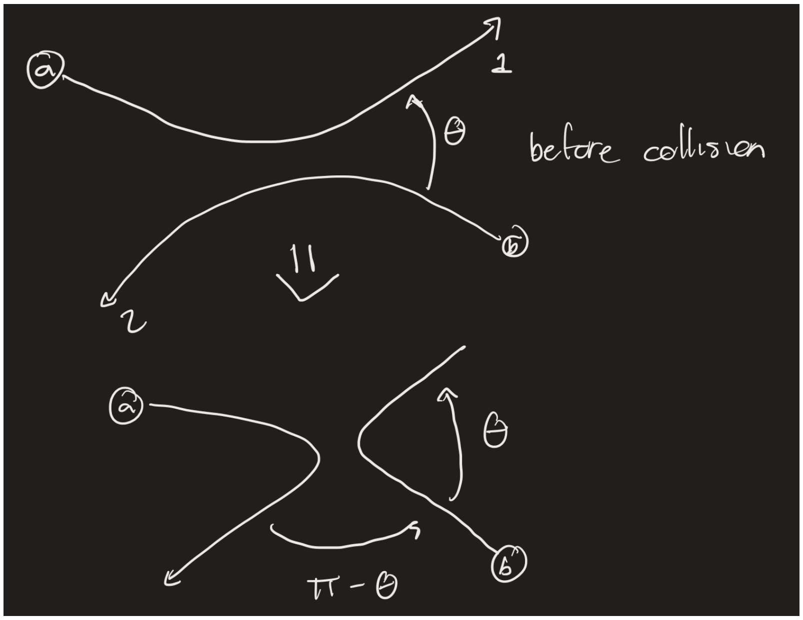
Fermi and Bose Particles

As mentioned in Basics of Quantum Mechanics, when two or more identical particles, such as electrons, are part of the same system, they cause interference. But why? Because they are indistinguishable!

Imagine two particles: a and b, colliding in two different directions:



The amplitude for this experiment should be θ so density of probability is proportional to $|f(\theta)|^2$ and only if the phenomenon is not affected by a spin, probability is also defined by $|f(\pi - \theta)|^2$. It can be, however, easily assumed that amplitude after the collision will be $f(\pi - \theta)$, though it can be affected by a phase factor and still be correct: $e^{i\phi}f(\pi - \theta) \Longrightarrow |f(\pi - \theta)|^2$

Assume now a and b are identical: since amplitude for a was $e^{i\phi}f(\pi - \theta)$, now it can be affected by b's phase factor (amplitude exchange), now $e^{i\phi}$ is either a +1 or a -1 but for the probability calculation, should still be a 1. These +1 or -1 contributions are assigned to particles in nature: Bose and Fermi Particles.

Bose Particles include photons, mesons, and gravitons (a hypothetical particle that mediates the interaction due to gravity). Fermi ones, on the other hand, are electrons, muons, neutrons, nucleons, and baryons.