

Seesaw Mechanism

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When spin 1/2 fermions are massless, there are two independent fermions. One is the left-handed fermion and the other the right-handed fermion. If they couple with each other, they may have a mass m , together, as a devoted couple. In this way the electron has a mass. However, in the case of neutrinos there is an anomaly, since they are electrically neutral. The right-handed neutrino can have a mass together with its anti-particle, since it is left-handed and neutral. This mass M with an anti-particle may be very large compared with the normal mass m . The left-handed neutrino will then feel alone. If the mass M is infinity, practically speaking it is as if the right-handed neutrino has gone away and the left-handed neutrino remains massless. However, the mass M is finite and hence the left-handed neutrino has a small mass m^2/M . This mechanism which generates small neutrino masses is called the seesaw mechanism.



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$$(\text{neutrino mass}) \simeq m^2 / M$$