Classification of particles: Leptons

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Specific Charge

The word 'specific' has a special meaning in physics. It means 'per unit of something' (often mass).

Examples are specific heat capacity, specific volume, specific enthalpy, specific surface area.

The specific charge is the charge per unit mass of an object or particle. In SI units it is measured in $\mathrm{C\,kg^{-1}}$

Leptons

There are twelve different leptons, which do not experience the strong interaction (and uncharged leptons do not feel the electromagnetic force either). They are the electron, the and the , each has an associated neutrino, and they all have antiparticles. The standard model, a collection of related gauge theories currently used in particle physics, suggests that these are the only leptons which exist. The electron and positron are stable.

The muon (μ^-) was discovered in in , and has the same charge as the electron, but is times heavier. The neutrino which accompanies its reactions was found to be different from the neutrino in electron reactions in 1962.

The tau (τ^-) was discovered in 1978, and is also the same charge as the electron, but is around times more massive. The neutrino that accompanies the tau was only discovered in 2000, though its existence was assumed in the standard model long before this (leaving the as the last particle in the standard model yet to be observed).

Both the muon and the tau decay into electrons.

To help identify which reactions may take place, all particles are assigned a series of numbers:

Name	Symbol	Charge (Q) / e	Lepton numbers		
			L_e	L_μ	L_τ
electron	e^-		1	0	0
positron	e^+		−1	0	0
electron neutrino	ν_e			0	0
antielectron neutrino	$\bar{\nu}_\mathrm{e}$			0	0
muon	μ^-	−1	0	1	0
		+1	0	−1	0
muon neutrino	ν_μ	0	0	1	0
antimuon neutrino	$\bar{\nu}_\mu$		0	−1	0
tau			0	0	1
antitau	τ^+	+1	0	0	−1
			0	0	1
antitau neutrino	$\bar{\nu}_\tau$	0	0	0	−1

Notes

1. Baryon number B and strangeness S are zero for all leptons.

2. Only leptons have lepton numbers, and lepton number must be conserved (remain unchanged) in all particle interactions or decays.