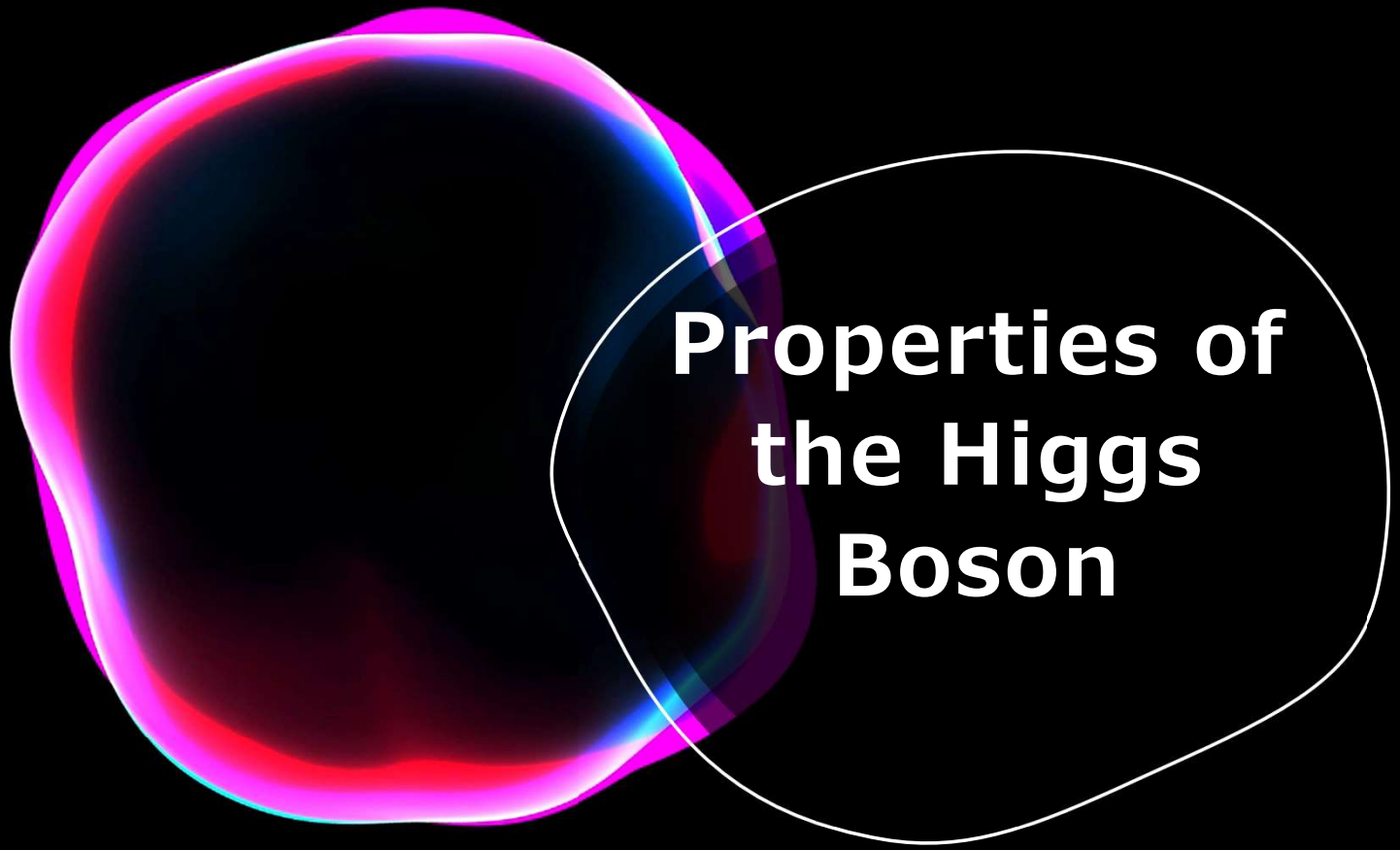
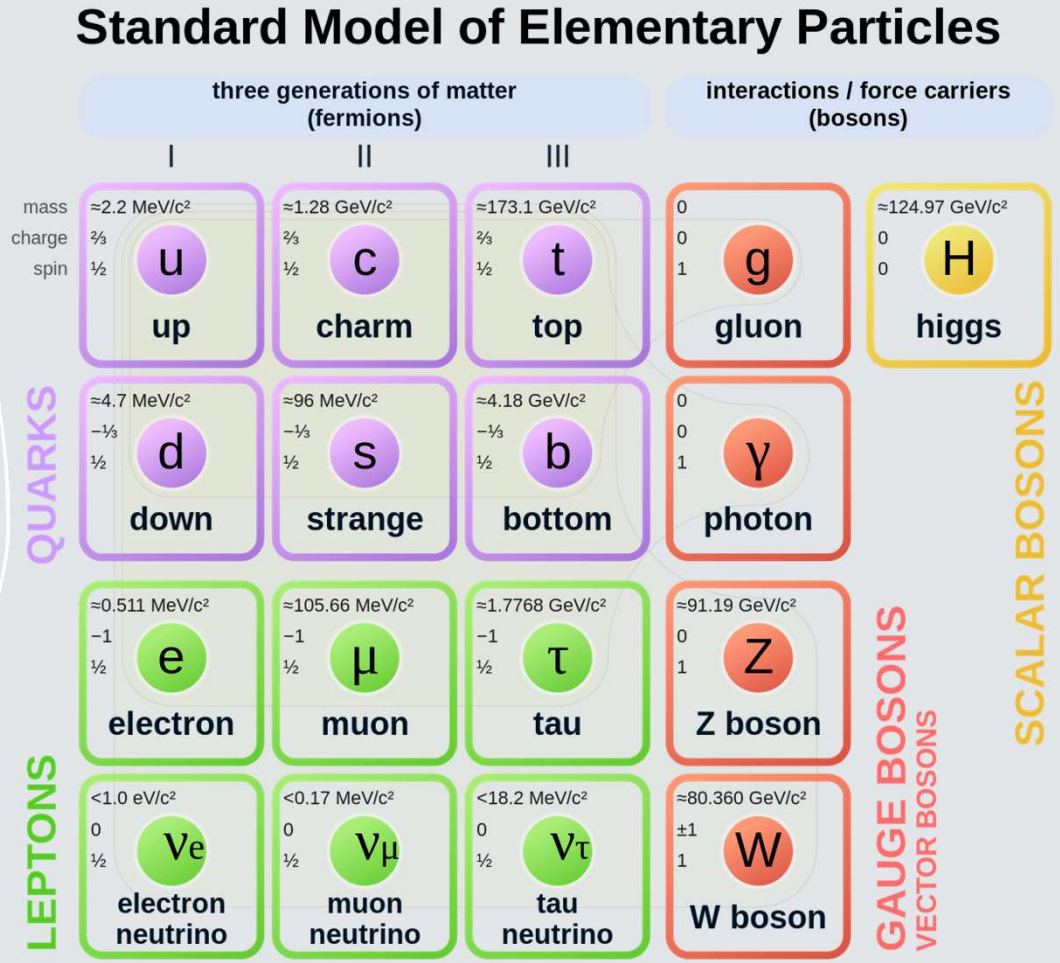


Properties of the Higgs Boson

Overview Over the Properties



Mass: ~125.1 GeV/c^2 (c.f. **little Higgs**)

Charge: 0

Spin: 0

Parity: Positive

Decays: mostly into particle pairs.

Lifetime: ~10^-22 seconds.

Self-Interaction: Yes.

Coupling: Proportional to particle masses.

VEV: Non-zero

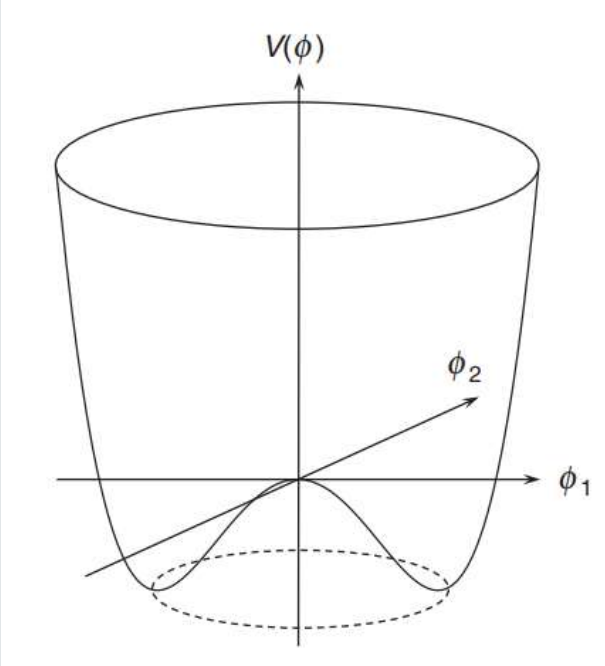
The Higgs Mechanism

Starting point: gauge symmetry of the electro-weak force **U(1)**X**SU(2)**

Predicts the W-Bosons, the Z-Boson and the Photon, but all massless

Solution: Interaction with the *Higgs field*

The Higgs field is a complex scalar field and has a Sombrero shaped potential



The degenerated non-zero vacuum state of the sombrero potential leads to spontaneous symmetry breaking of the Higgs field

Two different oscillations around that vaccum state, that correspond to two different Bosons: The Higgs Boson and a so-called *Goldstone Boson*

The Goldstone can be absorbed into the gauge field when coupling to other particles, but it leads to a new mass term, which used to be the VEV of the Higgs field

This gives mass to the W and Z Bosons, thus breaking the electroweak force into the electromagnetical and the weak force

Fermions acquire their mass in very similar way via the Yukawa coupling

Decay of the Higgs Particle

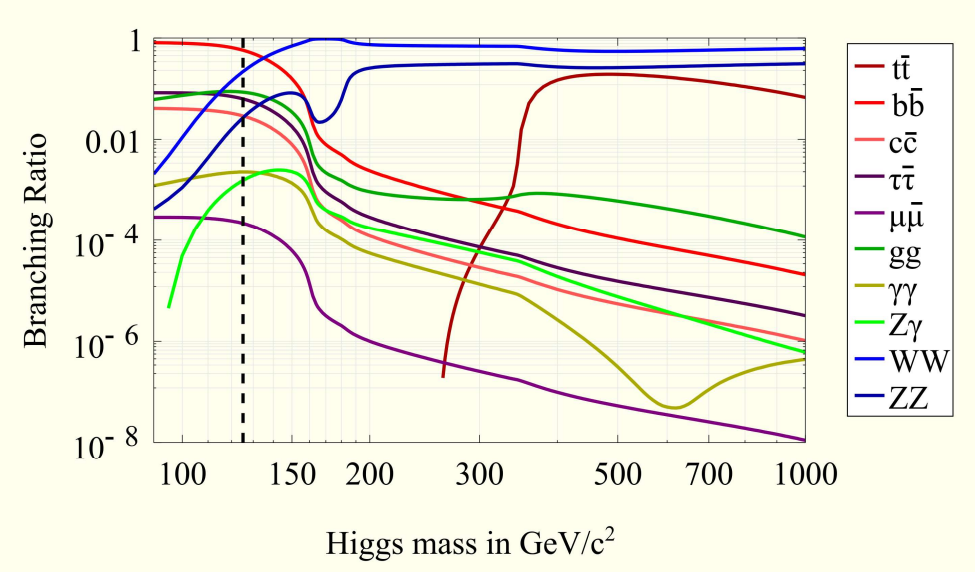


Table 17.1 The predicted branching ratios of the Higgs boson for $m_H = 125$ GeV.

Decay mode	Branching ratio
$H \to b\bar{b}$	57.8%
$H \to WW^*$	21.6%
$H \to \tau^+\tau^-$	6.4%
$H \to gg$	8.6%
$H \to c\bar{c}$	2.9%
$H \to ZZ^*$	2.7%
$H \to \gamma\gamma$	0.2%

Thank you for your attention!

Pictures are taken from Mark Thomson - Modern Particle Physics and Higgs boson – Wikipedia.