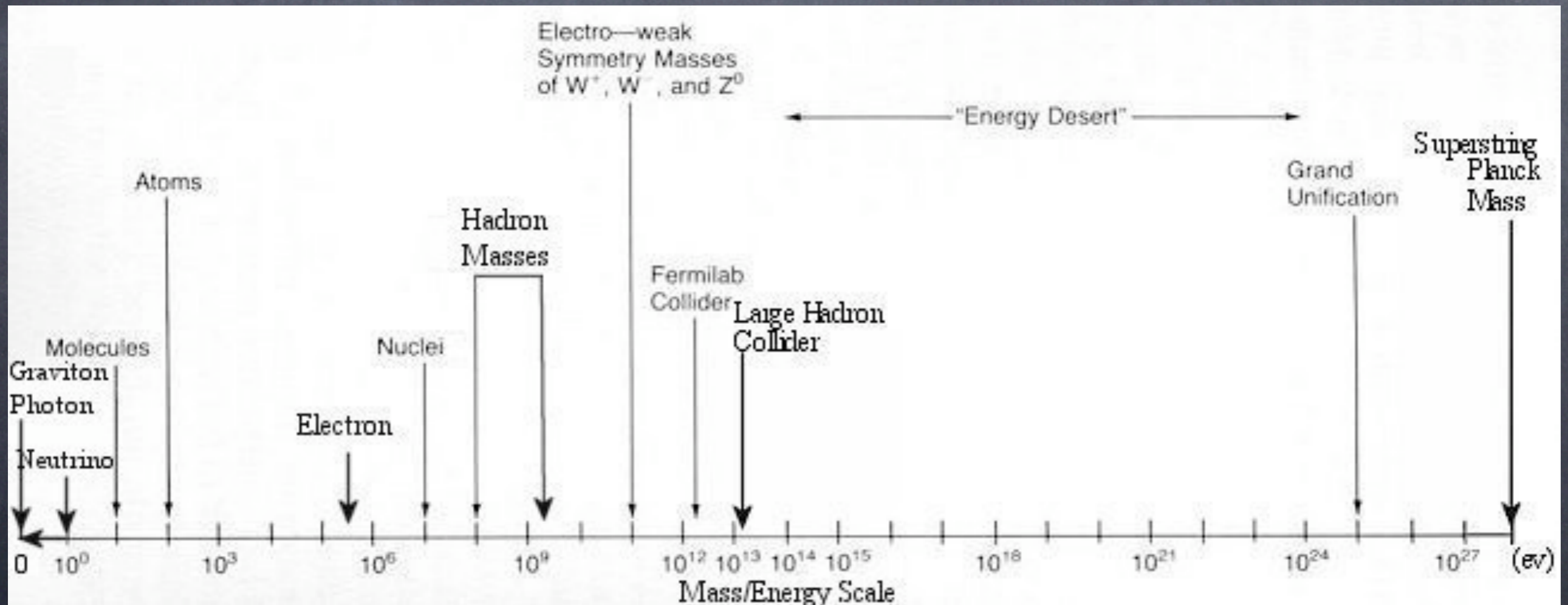# Chapter 12:
Hierarchy Problem
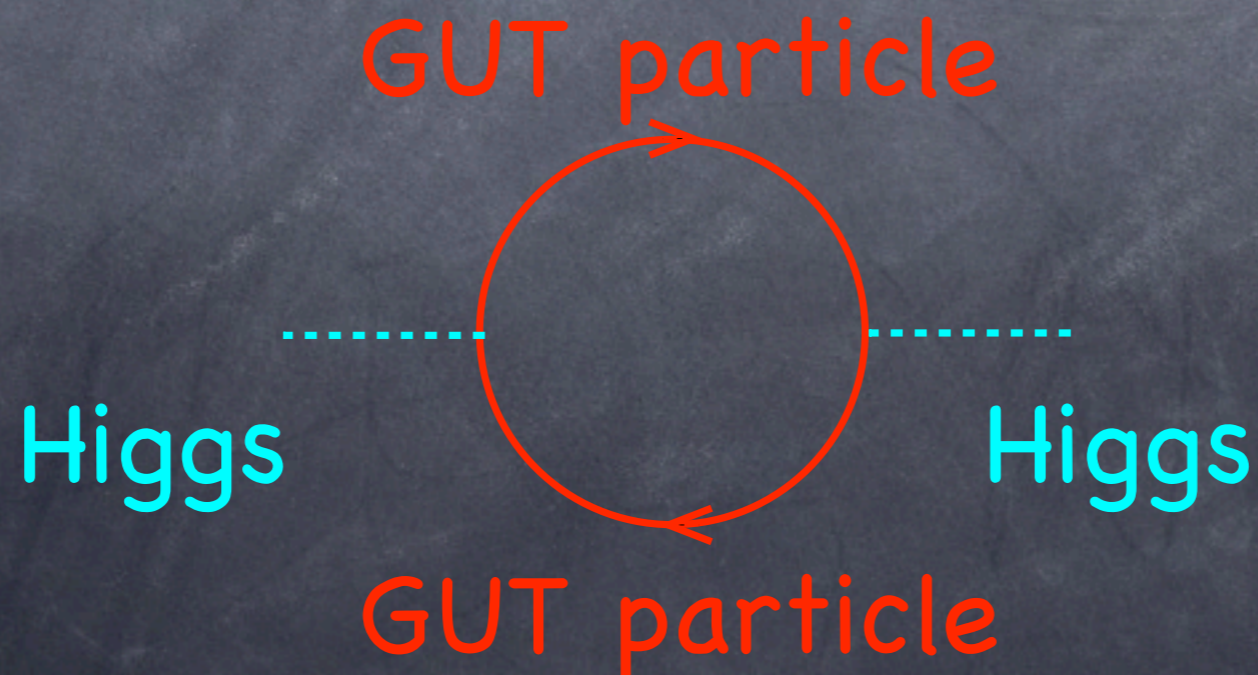
Hierarchy of Scales

GUT Hierarchy Problem

$$M_W \approx 100 \, \text{GeV}$$
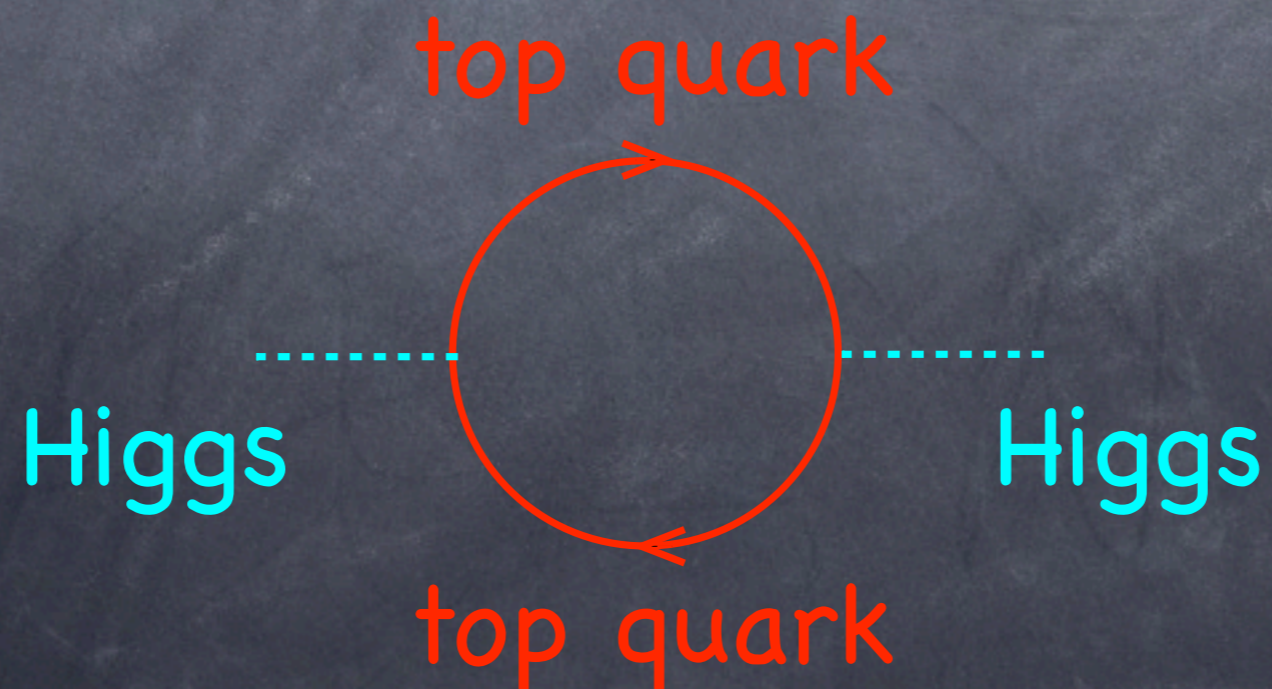
$$M_{GUT} \approx 1000000000000000000 \, \text{GeV}$$

GUT particle

Higgs   Higgs

GUT particle

Hierarchy Problem

$$M_W \approx 100\,\text{GeV}$$

$$M_{Planck} \approx 1000000000000000000\,\text{GeV}$$

top quark

Higgs   Higgs

top quark

16 Digit Fine Tuning

16 Digit Fine Tuning

$$m^2 =$$

$$100^2 = 16419971512763993607881093447038089115$$
$$-19402031160008016677277886179991476752$$
$$+24412810990665599549438182257396637142$$
$$+54077854817746311445297450721375145$$

16 Digit Fine Tuning

Fine Tuning

Fine Tuning Solutions

supersymmetry
new strong interactions
extra dimensions
magnetic monopoles

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LHC will look for these too!

All solutions predict new particles in reach of LHC

ATLAS Detector Under construction
October 2005