The Single Top Quark Coupling to the Higgs Potential

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Outline

- Background Physics
- Why the Top quark is of Importance
- The Single Top Quark and its specific uses
- Production and Decay of the Illusive Single Top Quark
- Current efforts and the plans for the future
- The rewards of our efforts and what impact this could have on the field in the future

Background Particle Physics

- The Standard Model
    - Quark Families
    - The Higgs Boson
- Symmetries
    - Charge Conjugation
    - Parity
- The Top Yukawa Coupling

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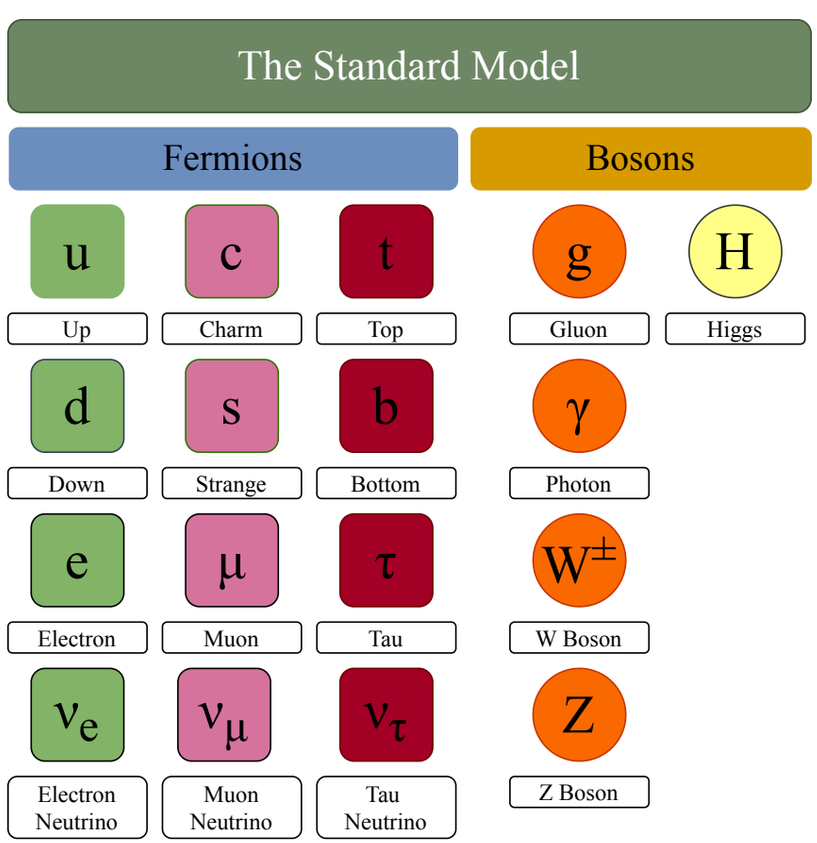
The Standard Model



The Importance of the Top Quark

- Yukawa Coupling Magnitude
    - ElectroWeak Scale
- Limit of Current Experimental Results
- An Indicator for Beyond Standard Model Physics
    - SUSY Particle
- Single Top Quark Measurements
    - Cross-Section Measurements
    - Phase
    - CP Violation

The Production and decay of Single Tops

- Productions Channels
  - t-channel
  - s-channel
  - tW production
  - Neutral Boson Production
- Identification of Top Quarks
  - bW Decay
  - b-tagged Jets
  - Hadronic Jets

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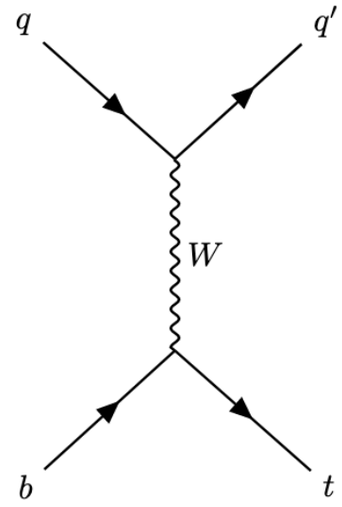

Figure 1: t-channel production of a single Top Quark

Current Searches and Future Prospects

- Run 1 and 2 Data
- Run 3 Analysis
    - Published results
    - What the entire dataset may tell us
- HL-LHC
    - How does this help
- FCC, do we really need a bigger Collider?

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Run 1	7 & 8 TeV
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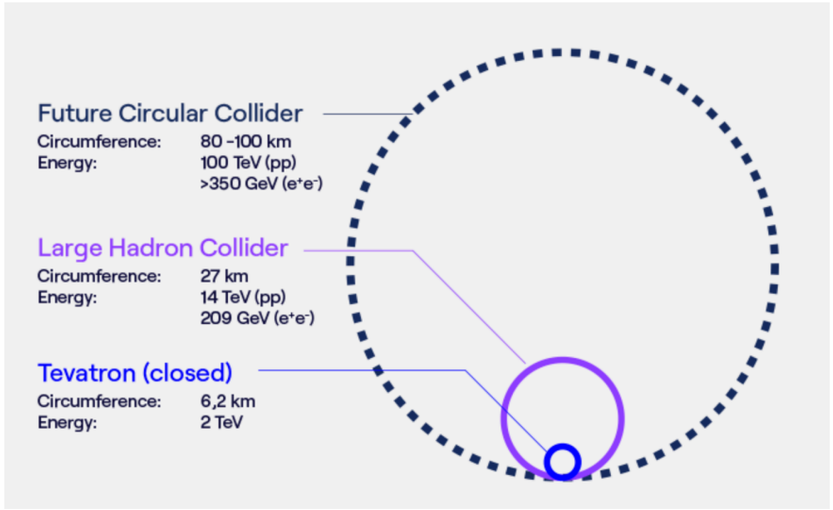

What this Means for BSM Physics

- Returning to CP Violation
- A Probe for higher energy physics
    - Beyond the TeV Scale
    - Recombination of the ElectroWeak Symmetry
    - Baryogenesis

Summary

- The Yukawa Coupling
- The Top Quark As the current limit of Particle Physics
- Production and why this is difficult
- What we can do in the Future to improve data collection
- How the Top Quark is a leading candidate for BSM Physics