3 minutes talk

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Research Area: Theoretical Particle Physics

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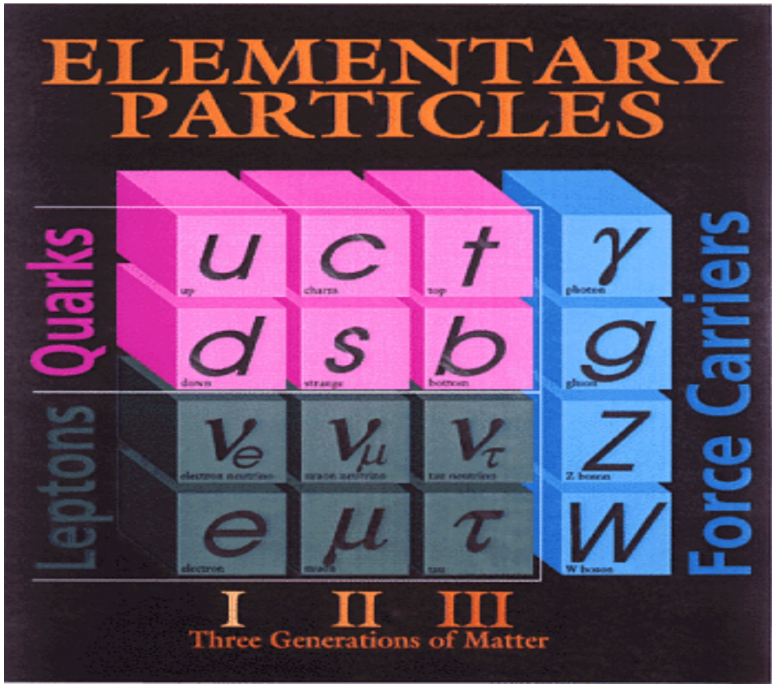
Particle physics: where are we

SM proposed by
Glashow, Weinberg, Salam
during the sixties



+ Higgs boson

- Standard Model (SM) theory successfully describes EW interactions between fundamental matter constituents: quarks and leptons
- All SM particles acquire masses by the Higgs mechanism
- SM predicts the Higgs boson (spin-0), but not its mass !
- Higgs boson was the last missing piece of SM to be discovered
- discovered in 2012 at the Large Hadron Collider (LHC) at CERN with mass ~ 125 GeV

Particle physics: where are we

- New discovered particle perfectly consistent with SM Higgs boson predictions → small room for any New Physics contribution

Why do we need New Physics ?

- Light New Physics (NP) degrees of freedom can cure the problem of large quantum corrections to the Higgs boson mass → naturalness
- Most popular NP scenarios: Supersymmetry, composite Higgs, large extra-dimensions ...not seen yet at LHC ! Maybe NP is more exotic..
- but SM does not explain:
  - Dark Matter (missing particle candidate)
  - large mass hierarchy of fermions
  - origin of neutrino masses (and why so small ?)
  - barion-antibarion asymmetry in the Universe (requiring add. CP violation)

My research activity

- Analyzing the phenomenology of New Physics scenarios at the LHC and future e+e- colliders
- Higgs boson physics at the LHC (new processes, exotic decays)
- Top quark physics (polarized processes, rare decays) → very sensitive to NP contributions
- Exploring NP models that can naturally explain the hierarchy of SM fermion masses and solve the naturalness problem in the Higgs sector
- searching for Dark Matter scenarios at the LHC
- From more theoretical side: investigating formal aspects of quantum field theory and gravitational interactions