Supersymmetric Grand Unification

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2009	University of Michigan	PhD
2009-2012	University of Tokyo/IPMU	Project Researcher
2012-2015	University of Minnesota/FTPI	Research Associate
2015-2019	Korea Inst. For Adv. Study	Assistant Professor
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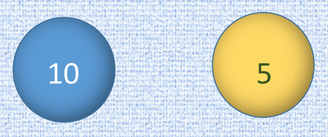
Matter of Early Universe

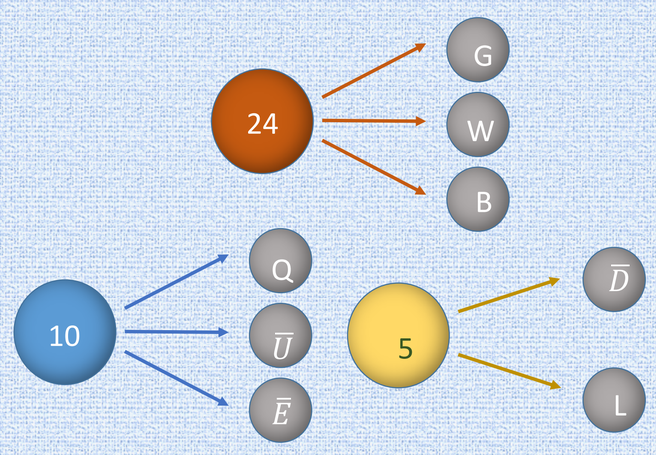
- In the Beginning …
  - One Force

  - Two Fermions

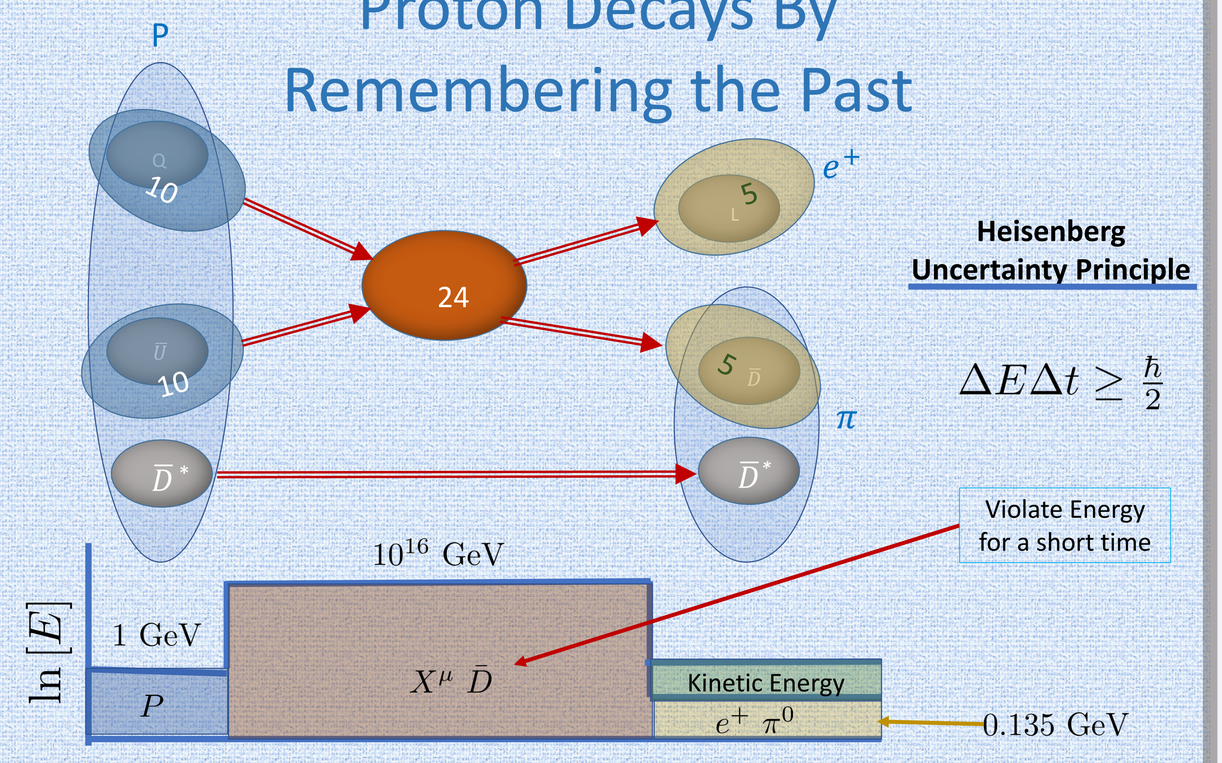


  - Three Generations

Then There Were Many

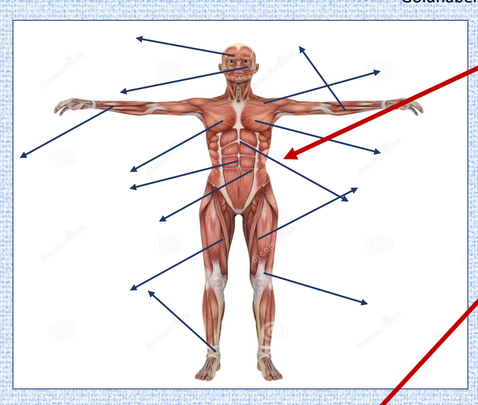


Proton Decays By Remembering the Past



First Proton Lifetime Constraint: Human Body

First measurement of τ_P was anthropic Goldhaber



- Bag of Protons

$$n_P \sim \frac{m_H}{m_P} \sim 10^{29}$$

- Body Radiated (J/kg^{-1})

$$R = \Delta E \frac{n_P}{m_H} \left(\frac{t}{\tau_P}\right)$$

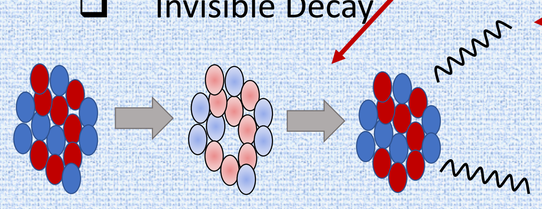
- To See or Not to See

$$\Delta E_{P\to inv} \sim MeV \quad \Delta E_{P\to SM} \sim GeV$$

- Life Goes On

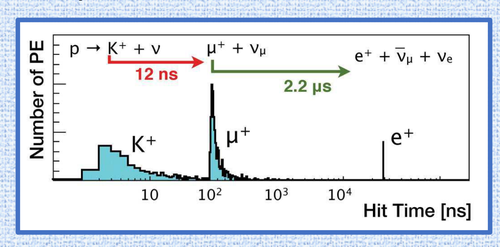
$$\tau_{P\to inv} \gtrsim 10^{16} yrs \quad \tau_{P\to SM} \gtrsim 10^{19} yrs$$

- Invisible Decay



JUNO Experiment(China): Proton Decay

- JUNO: Also a bag of protons
- Liquid scintillator detector

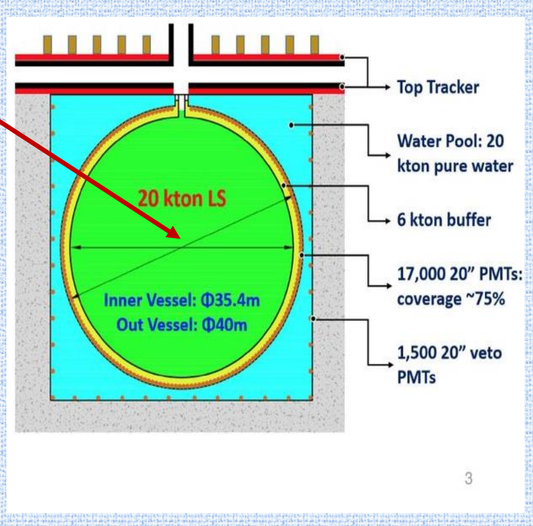


- JUNO's capabilities

$$\tau_{p\to K^+\nu} > 1.9 \times 10^{34} \text{ yrs} \quad (90\% \text{ CL})$$

- Hyper-Kamiokande capabilities

$$\tau_{p\to K^+\nu} > 3.2 \times 10^{34} \text{ yrs} \quad (90\% \text{ CL})$$



- Achievements
  - First ever precision calculation of proton lifetime for GUT models
  - Most complete survey of proton lifetimes for GUT models

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