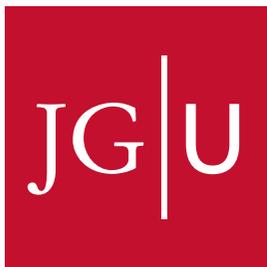


Dipole Moments

Lecture I

Niklaus Berger

Institut für Kernphysik, Johannes-Gutenberg Universität Mainz



Advanced Topics in
Subatomic Physics WS15/16



Cluster of Excellence Precision Physics,
Fundamental Interactions and Structure of Matter

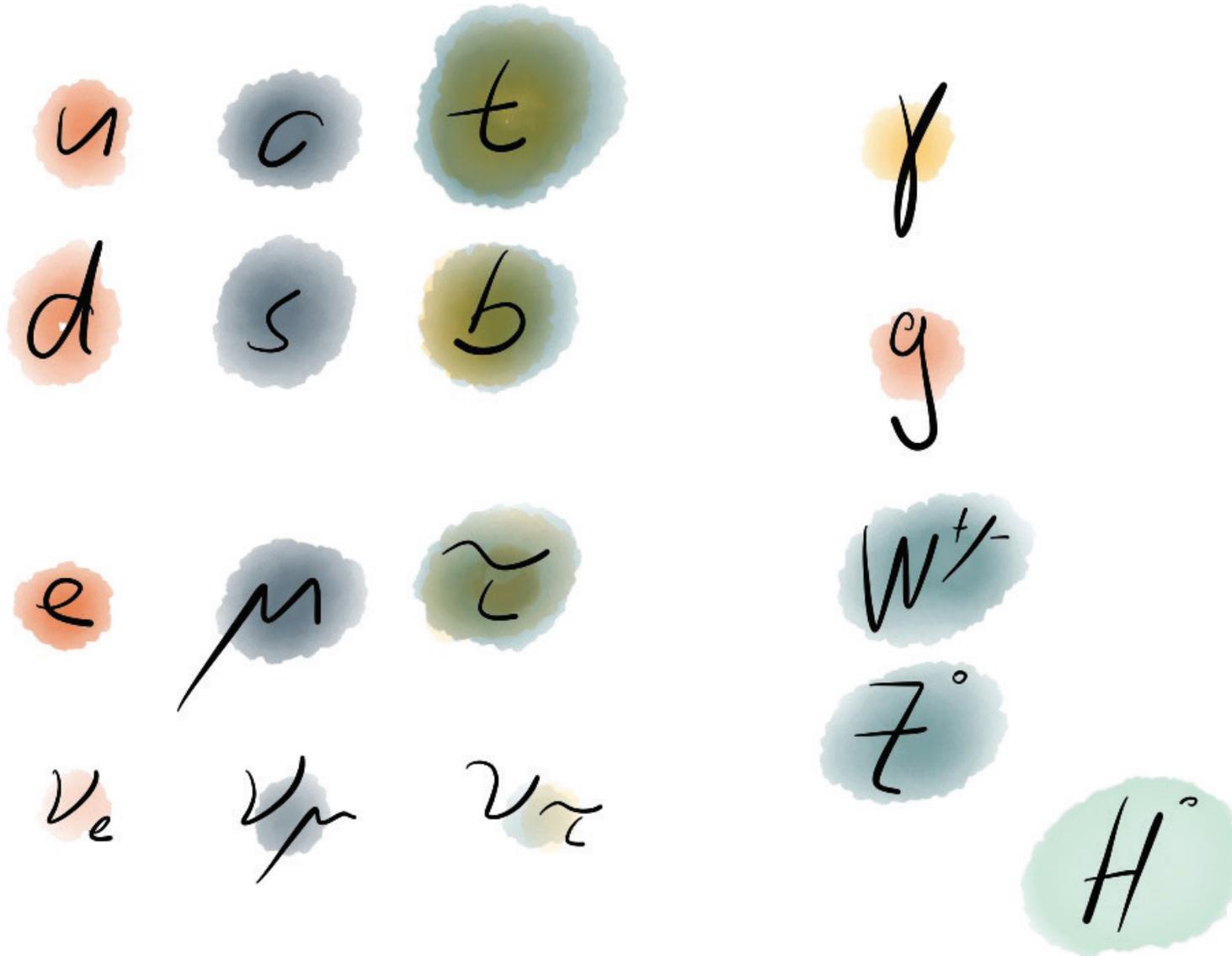
PRISMA

Particle Physics:

What are the fundamental constituents of matter
and how do they interact?

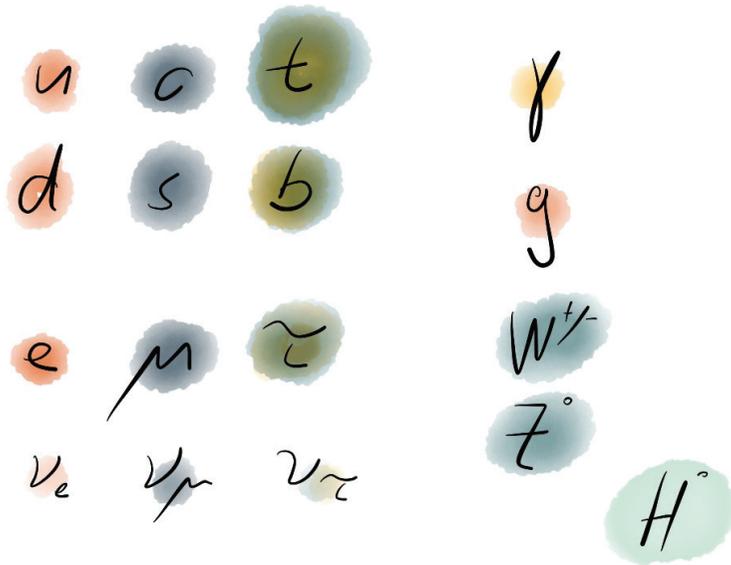


The Standard Model of Elementary Particles





Hugely successful



Magnetic moment of the electron:

- Theory:

$$g_e = -2.002\,319\,304\,363\,56\,(154)$$

(Aoyama et al., PRL 109, 111807 (2012))

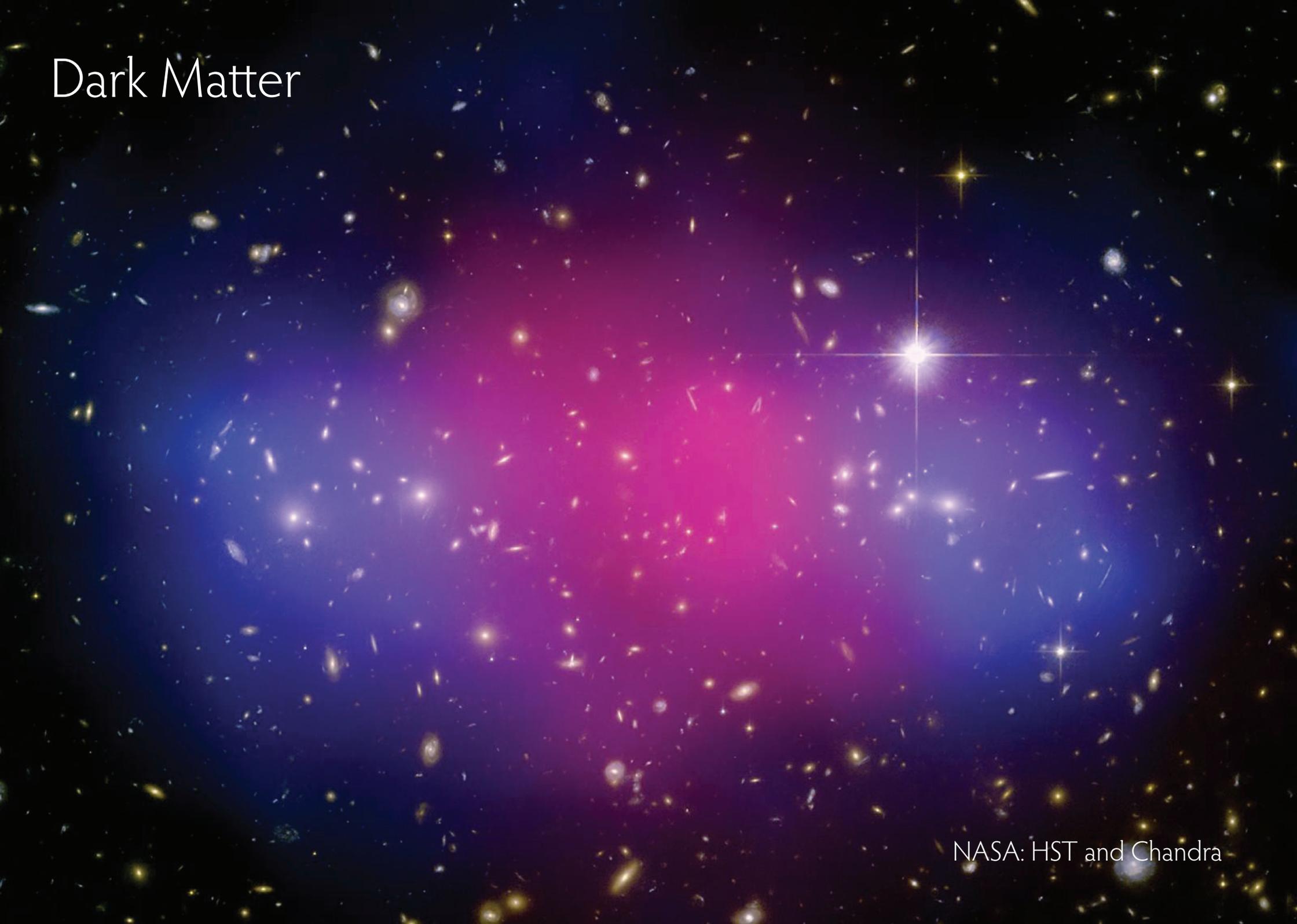
- Experiment:

$$g_e = -2.002\,319\,304\,361\,53\,(53)$$

(Hanneke et al. PRL 100, 120801 (2008))

Open Questions?

Dark Matter

A composite image of a galaxy cluster. The background is a dense field of galaxies, with a central region highlighted in red and pink. A bright white star with a crosshair is visible on the right side.

NASA: HST and Chandra

Dark Matter



NASA: HST and Chandra



Matter-Antimatter Asymmetry

10'000'000'000

Antimatter

10'000'000'001

Matter

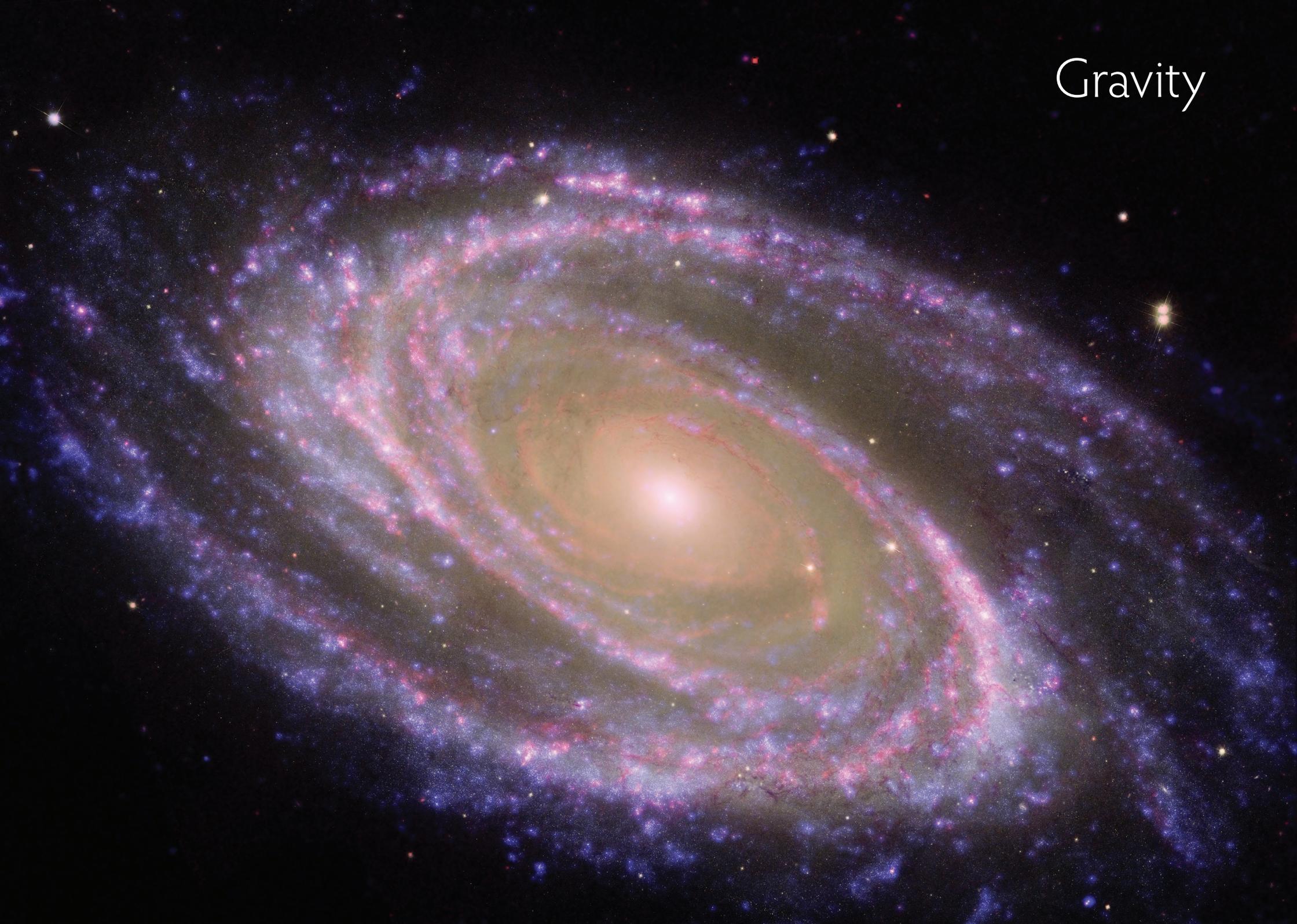
Matter-Antimatter Asymmetry

Radiation

■
1

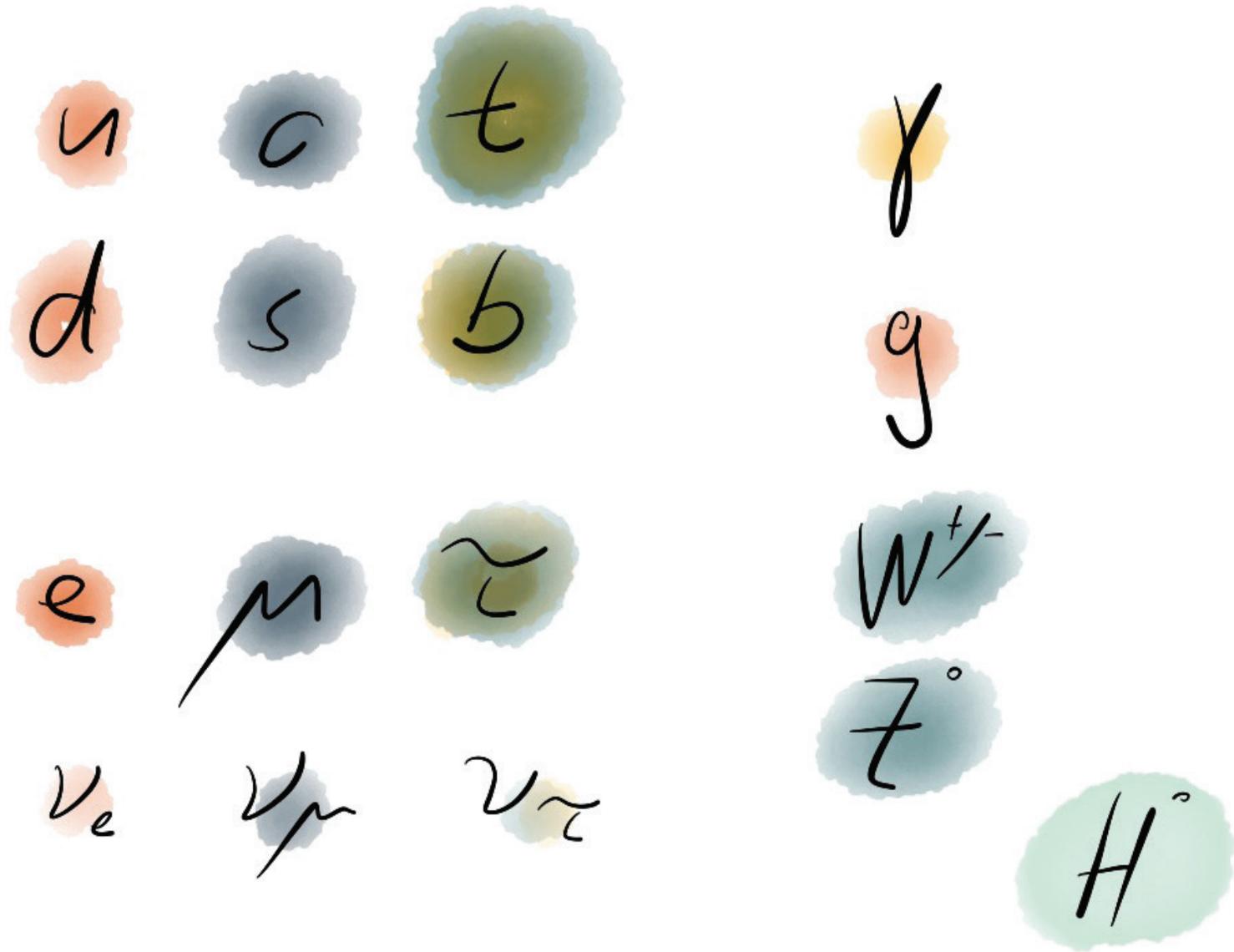
Us

Gravity



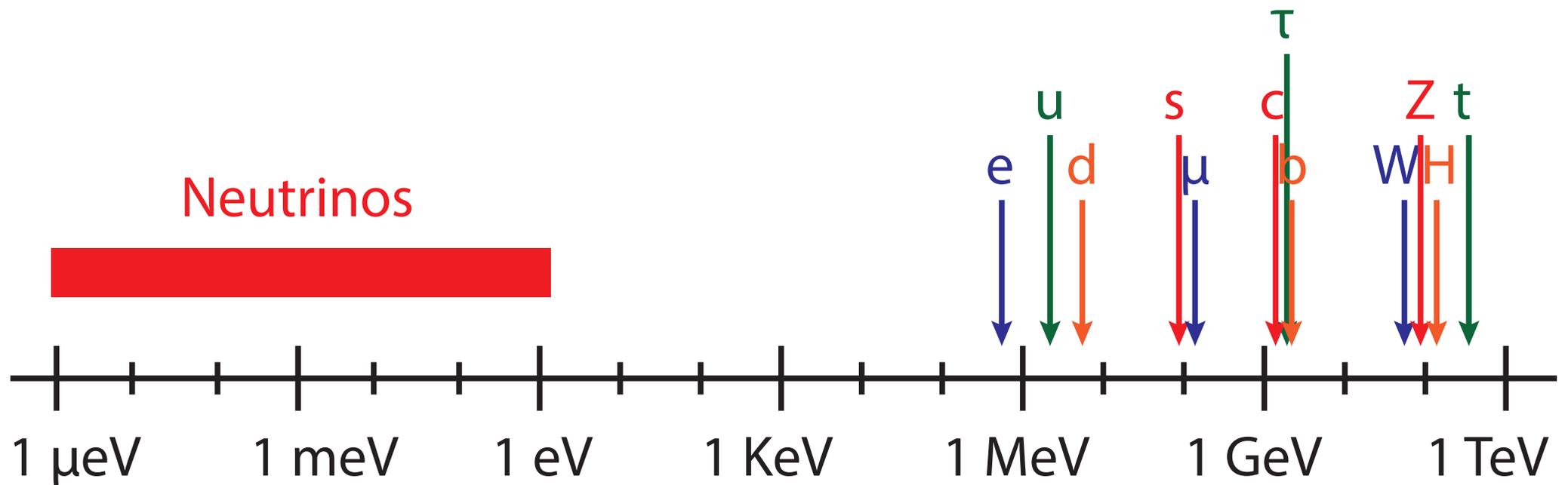


The Structure of the Standard Model



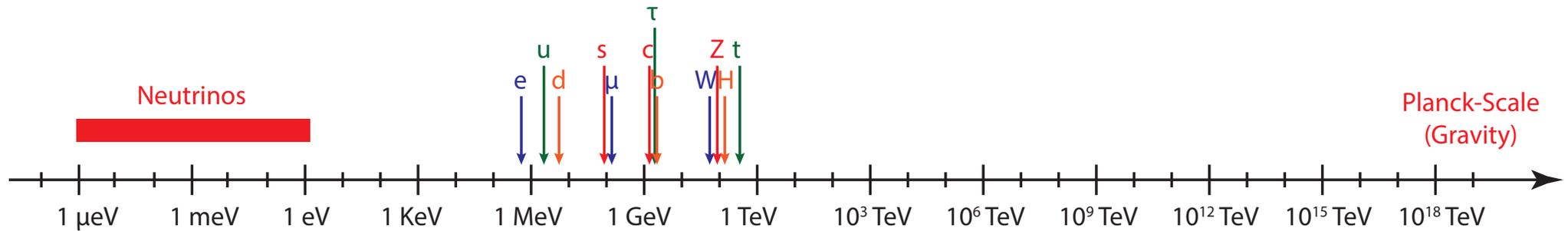


The Structure of the Standard Model



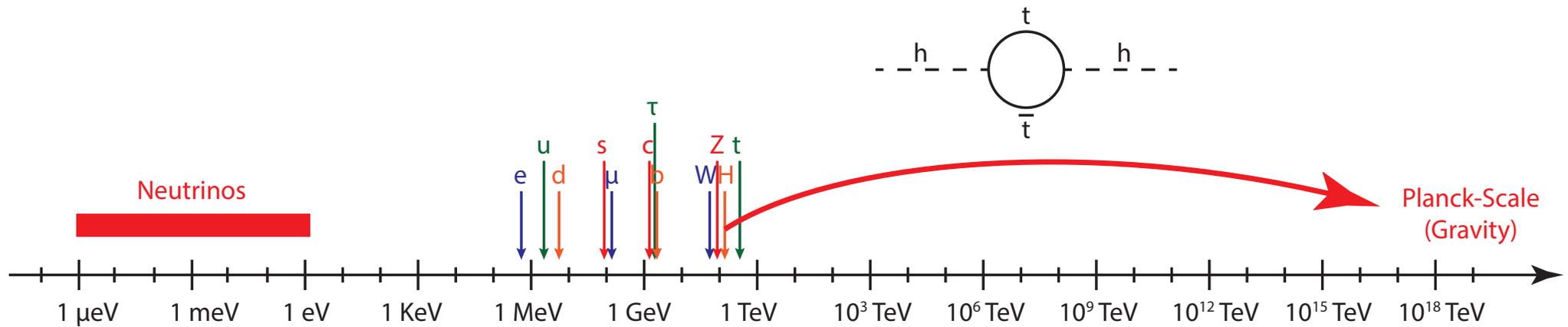


The Structure of the Standard Model



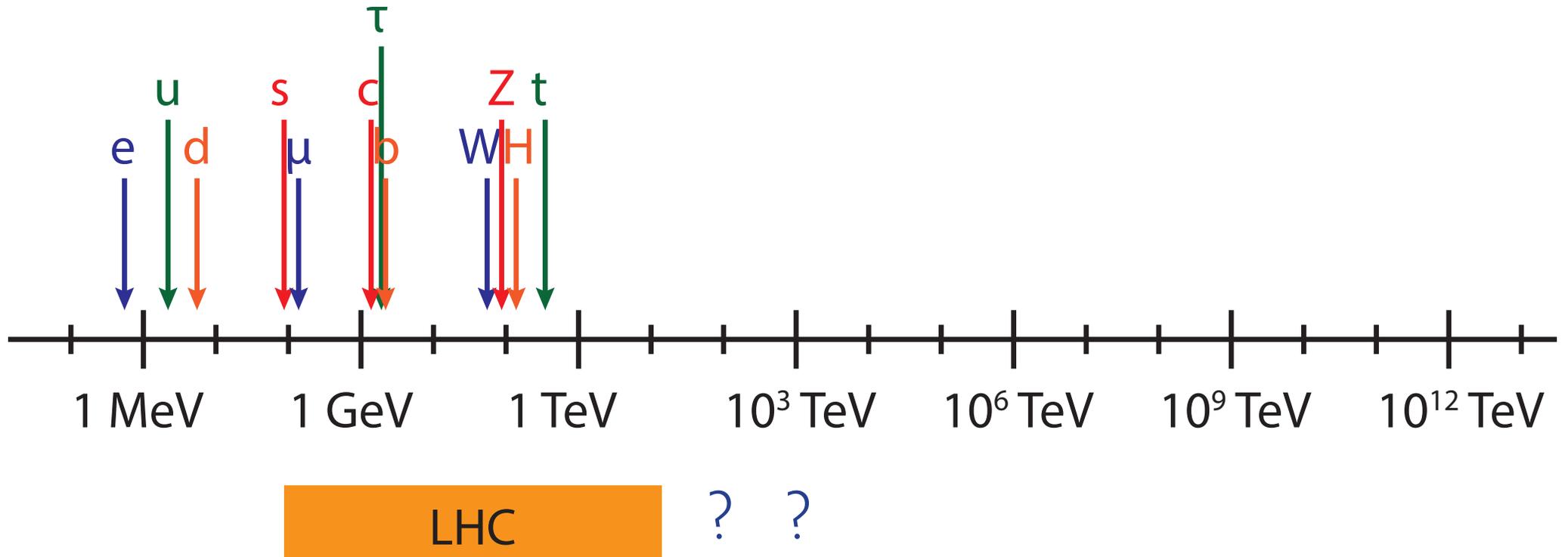


The Structure of the Standard Model

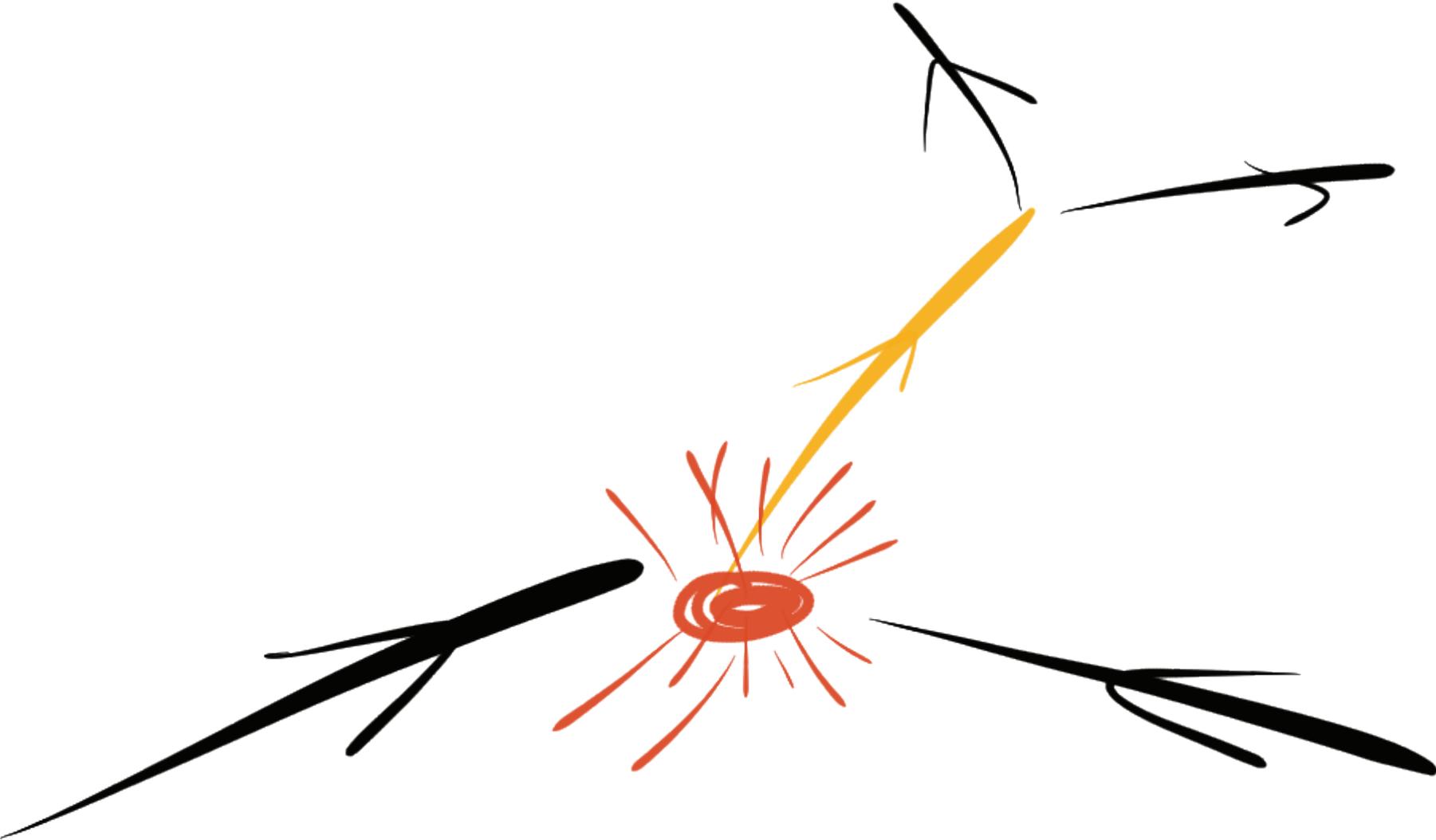




The Structure of the Standard Model



Direct production



Indirect effects in quantum loops

