

Fundamental Forces

Why are these 4 forces in particular the ones Nature uses?



Force

Gravity

EM

Weak

Strong

Symmetry

Diff(M)

U(1)

SU(2)

SU(3) w/confinement

History

1666 Newton wrote equations for gravity

1767 Priestley shows similar equation for EM

1865 Maxwell unified E w/M, has U(1) sym.

1930s Initial work on weak and strong forces

1960s Electroweak unification w/SU(2)xU(1)

1970s Strong force w/confinement SU(3)

Current Efforts

Groups SU(5) and SU(10) tried, so far failed

Work on strings has no testable predictions so far

My Efforts

Only symmetries, not forces, work for 13 billion years

Symmetries should be baked into the math

Exploring modifications of the quaternion group Q_8