

# Research Update

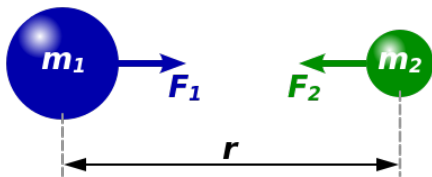
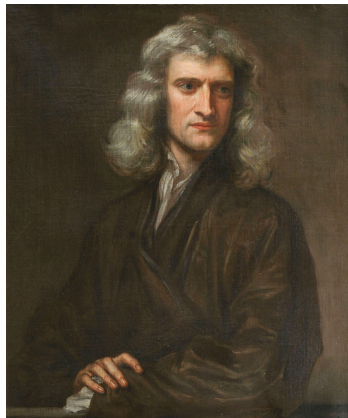
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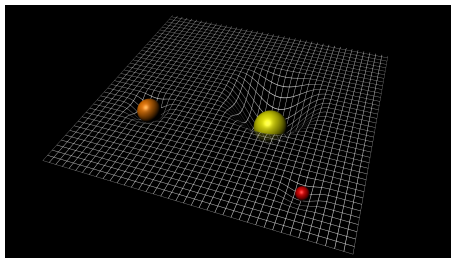
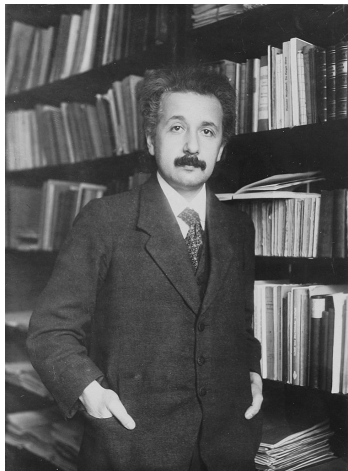
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$$F_1 = F_2 = G \frac{m_1 \times m_2}{r^2}$$

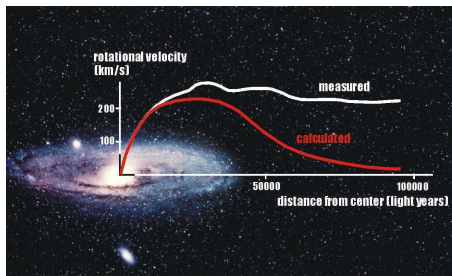
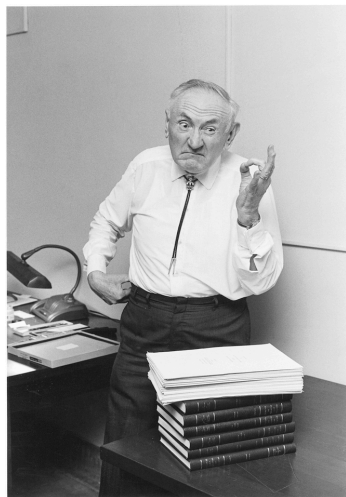
Problems:

- ① Force is instantaneous
- ② Unable to explain perihelion precession of Mercury
- ③ No *why* gravity

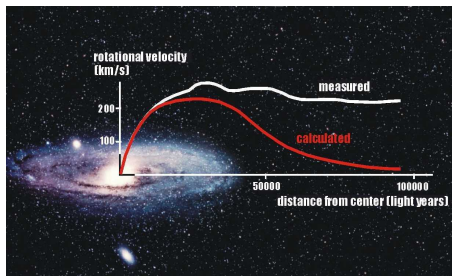
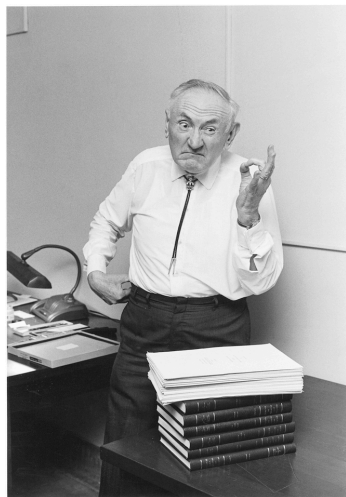


Problems:

- ① Singularities (QG)
- ② Dark energy ( $\Lambda$ ?)
- ③ Dark matter



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Changing the fundamental theory  $\implies$  more equations to be analyzed  $\implies$  work for a math thesis

- “Large numbers **hypothesis**”
- Strength of gravity  $G$  may not be constant
  - $G$  is assumed to be constant in GR

$$\frac{\text{Electric force between electron and proton}}{\text{Gravitational force between electron and proton}} = \frac{e^2}{Gm_p m_e} \approx 10^{40}$$

$$\frac{\text{Age of universe}}{\text{time taken for light to cross atom}} = \frac{t_U}{e^2/4\pi\epsilon_0 m_e c^3} \approx 10^{40}$$

- Assume  $m_p, e, c$  are constant, then:

$$\implies G \propto \frac{1}{t_U} ?$$

- Applying 3+1 decomposition to Scalar-Vector-Tensor Gravity (SVTG)
- SVTG adds two new variables  $\phi$  &  $A_\mu \implies$  2 new sets of equations
- 3 projections needed to fully decompose theory  $\implies$  9 projections I need to compute in SVTG
- **I have carried out the spatial-spatial projection  $\gamma_i^\mu \gamma_j^\nu$  for  $g_{\mu\nu}$  field equation in SVTG. 8 more to go.**

“Don’t modify gravity - *understand* it!”  
- Nima Arkani-Hamed