A search for new physics at the LHC: Top partners into same-sign leptons.

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Physics beyond the Standard Model

- What is the Standard Model of particle physics?
- Why do physicists like it?
- Why are we not completely satisfied with it?

Modern physics and the Standard Model

What was "old" physics like?

1. Theory + experiment $\longrightarrow$ force or potential energy. $[\vec{F} = -\vec{\nabla} U(x)]$
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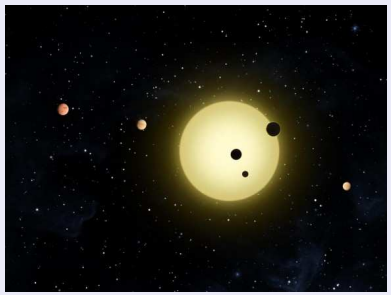
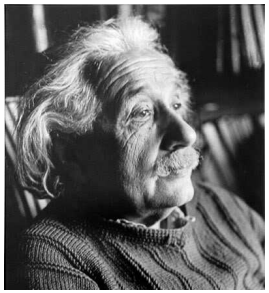
Gravity


+

$\longrightarrow U(r) = -\frac{GMm}{r}$.

Depends only on the distance r, simmetry under rotations.
Angular momentum is constant.
Easy equation, the orbits are ellipses.

Simmetries and modern physics

A first success: the birth of special relativity



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$$\nabla \times \vec{B} = \frac{\partial \vec{E}}{\partial t} + \vec{J}$$

$$\dots$$

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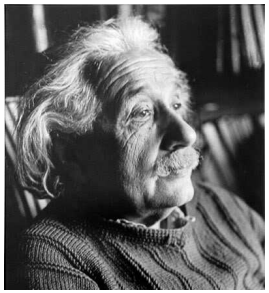

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Lorentz transformations

- space and time translations;
- space rotations;
- Lorentz boosts: $t' = \dfrac{t - vx/c^2}{1 - v^2/c^2}$.

Simmetries first!

- Space and time are homogeneous: no privileged points.
- Space is isotropic: no privileged direction.

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Unification of mechanics and electromagnetism, under the same simmetry principle.