

# Electricity and Magnetism

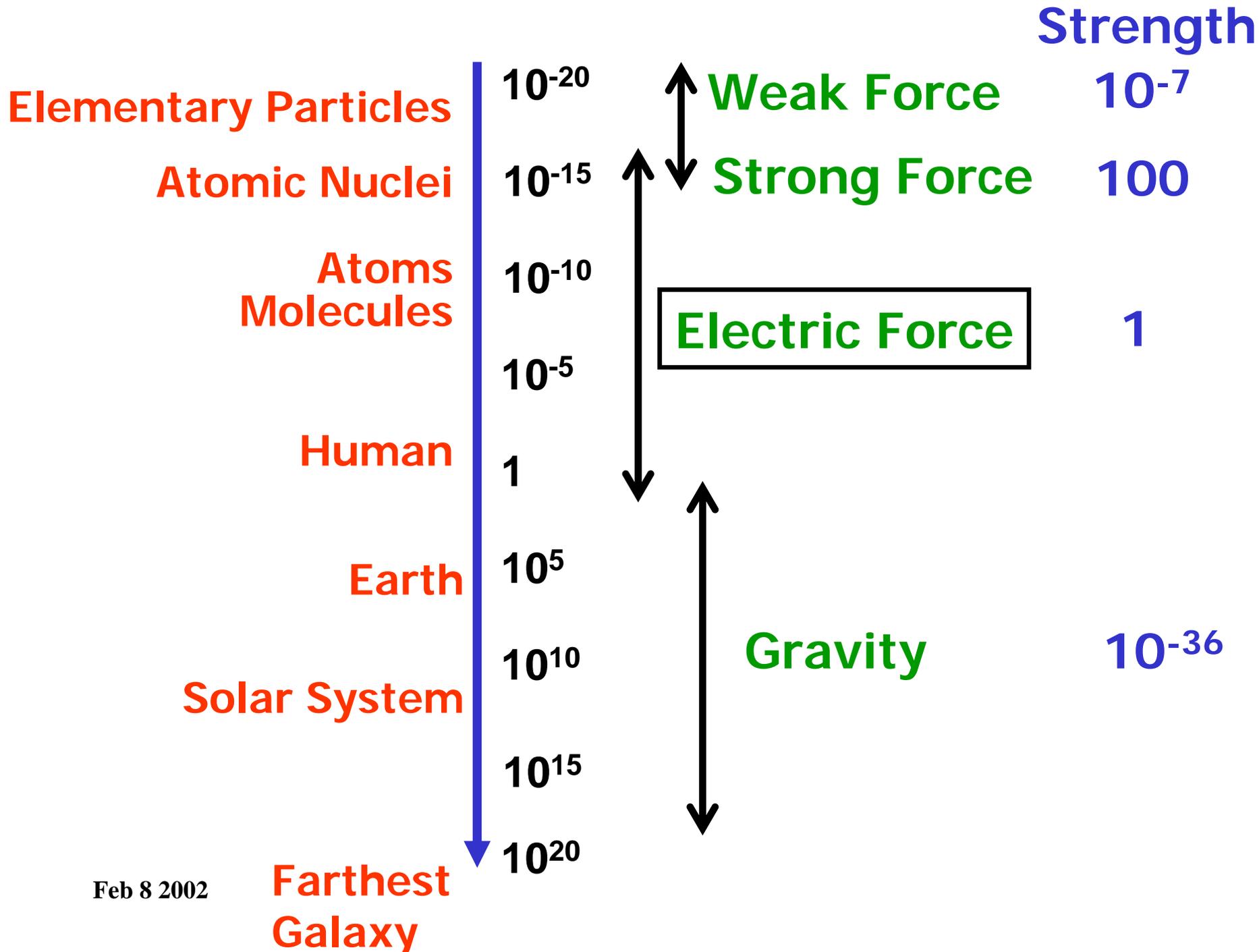
- i. i. Recap: Electric Charge and Electrostatic Force
- ii. Fundamental Forces
  - i. Strength and Range: Coulomb's Law
- iii. Electrostatic Induction

# i. Recap: Electrostatic Force

- New Property of Matter: Electric charge
  - comes in two kinds: '+' and '-'
  - connected to a force
- Electrostatic Force
  - attractive (for '+ -') or repulsive ('- -', '+ +')
- Charge is conserved

## ii. Fundamental Forces cntd.

- How does the Electric force compare to the other fundamental forces?
  - Gravity
  - Strong force (Atomic nuclei)
  - Weak force (Radioactivity, Star 'fuel')
- **How strong?**
- **What Range?**



# Some Questions:

- What determines the range of the interaction?
- How can one have 'Action at a distance'?



**In-Class Demo**

# Modern View (>1930)

- Interactions 'mediated' by exchange of particles ('gauge bosons')
  - Weak interaction: Vector bosons ( $m$  large)
  - Strong interaction: Gluons ( $m=0$ )
  - Electric Force: Photons ( $m=0$ )
  - Gravity: Graviton ( $m=0$ )
- For infinite range (e.g. Gravity, EM)
  - Exchanged particle must be massless!

# Strength of Electrostatic Force

- How does it depend on charge?
- How does it depend on distance?



**Charles Augustin de Coulomb  
(1736-1806)**

**Coulomb's Law (1780)**