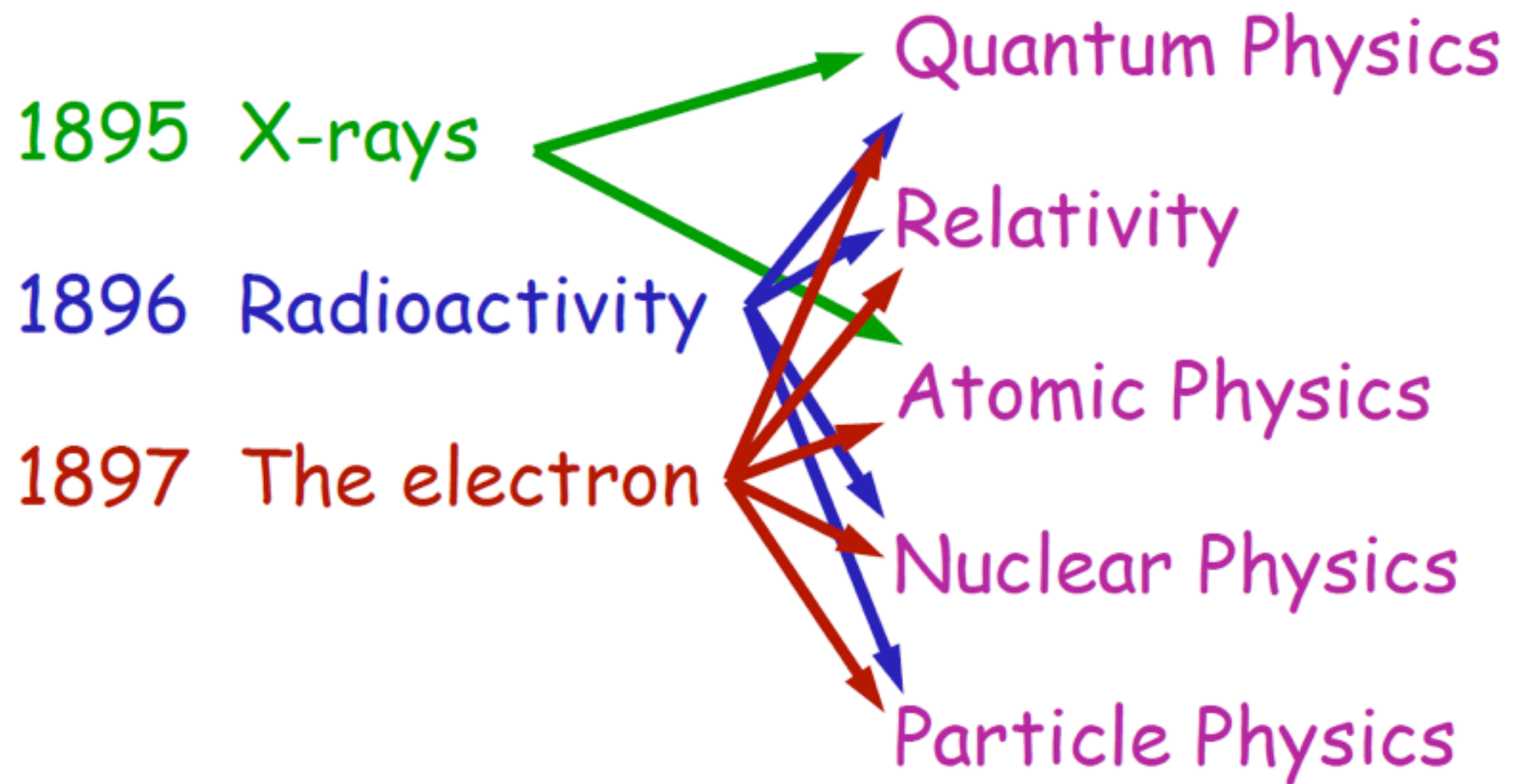


Experiments



The Electron!

J.J. Thomson (1856-1940)

- In 1897 he proved conclusively that cathode rays were indeed streams of **negatively-charged particles**.
- obtained better vacuum
- deflected the rays by both electric and magnetic fields.
- able to calculate

$$\frac{\text{Charge}}{\text{Mass}} = \frac{e}{m} = 1.7 \times 10^{11} \text{ Coulombs/kg}$$

(about 2000 times larger than that of Hydrogen atom)

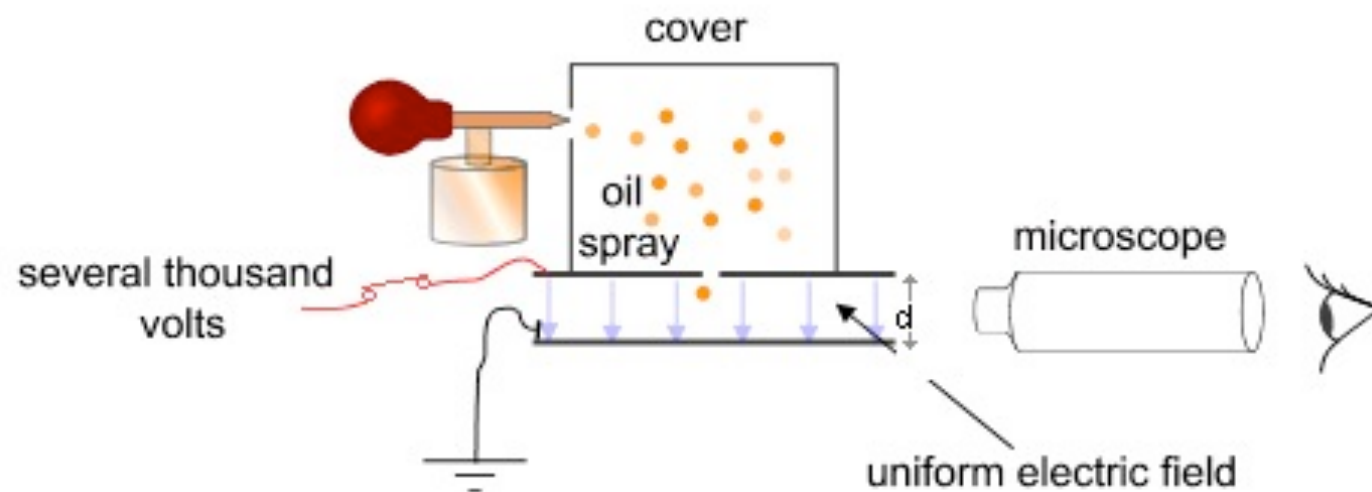
large charge or
small mass!



J J Thomson
1856-1940
Nobel Prize: 1906

Image: <http://en.wikipedia.org>

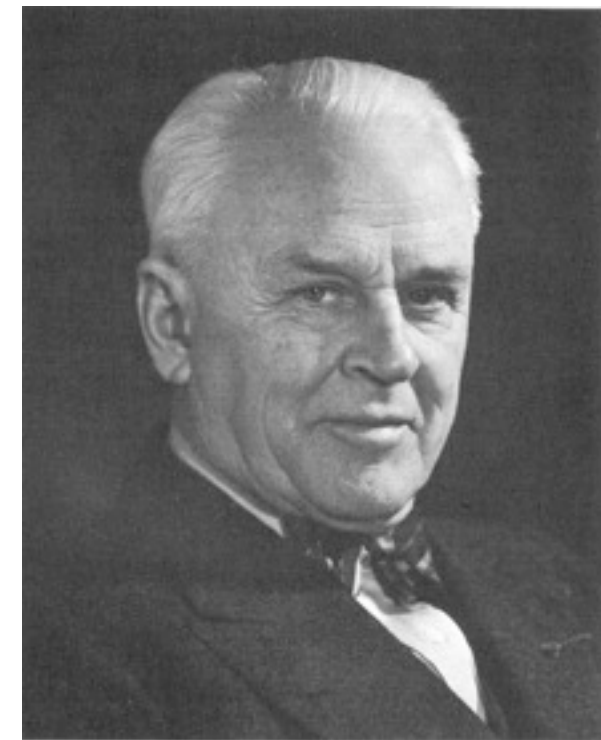
Charge of the Electron



Oil Drop Experiment (1909)

Suspend charged oil drops falling in gravity with electrostatic field

- Measure Radius
- Suspend Drop in E field



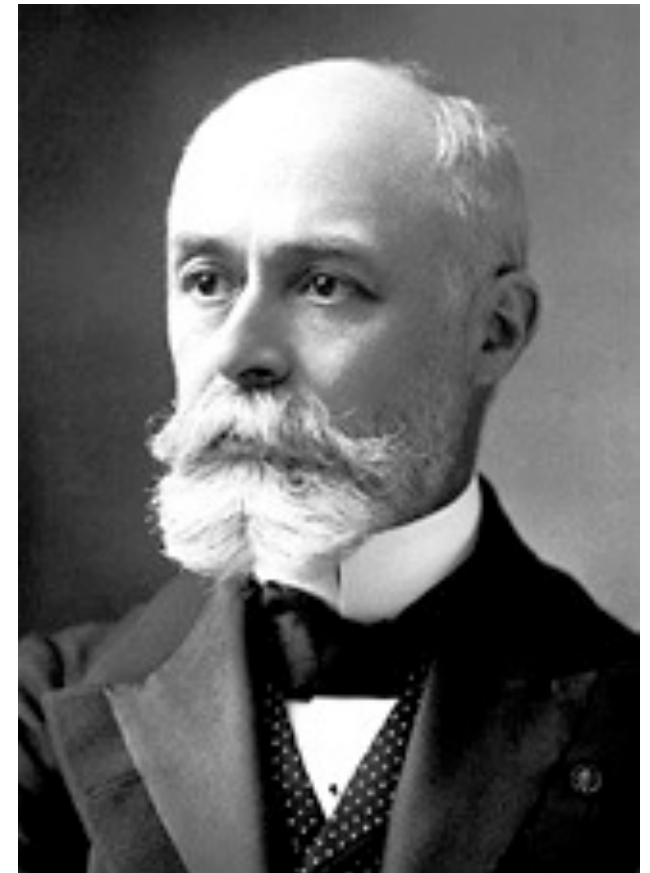
Robert Millikan
1868-1953
Nobel Prize 1923

$$e = 1.602\,176\,53(14) \times 10^{-19} \text{ C}$$

electron charge: $-e$

Radioactivity I

- **Becquerel (1896)** was testing various fluorescent materials to see if they emitted X-rays.
- He sealed a photographic plate in black paper and sprinkled a layer of **Uranyl Potassium sulfate** onto the paper.
- He wanted to expose the salt to sunlight in order to make it fluoresce, but that day Paris was gray and overcast.
- Despite this images exposed with great intensity.
- The new phenomenon was named "**radioactivity**" by Marie Curie.



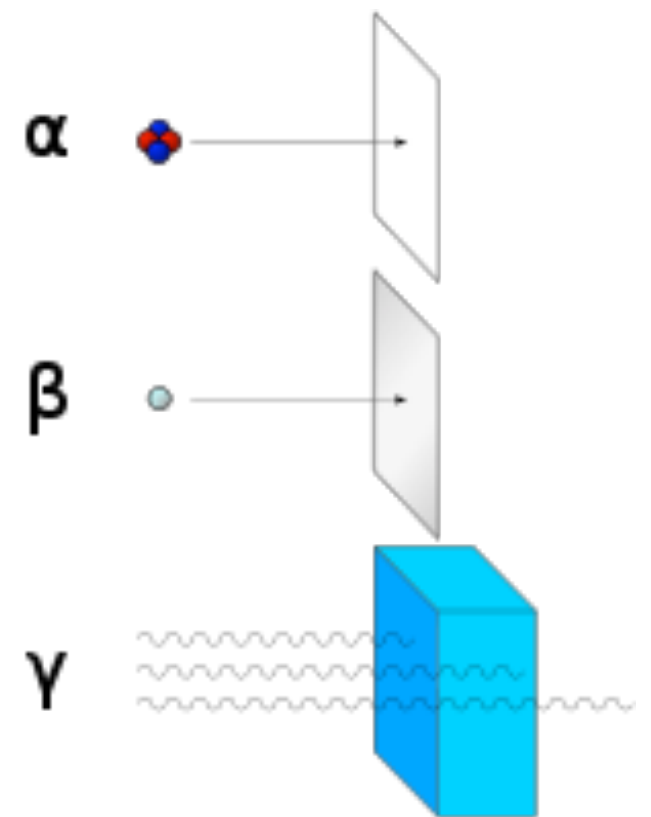
Antoine Henri Becquerel
1852-1908
Nobel Prize 1903

Radioactivity II

β -rays: electrons (Becquerel, 1900). They have a range of energies and are fast and penetrating. Can be absorbed by ~ 1 mm of lead.

α -rays: Helium nuclei (Rutherford, et al). They are heavy, slow, positively-charged particles. Absorbed by \sim few cm of air.

γ -rays: Electromagnetic radiation, with a higher frequency, lower wavelength, even than X-rays.



Transmutation

Pierre and Marie Curie found new radioactive elements, including Thorium, Polonium, and Radium.

A considerable amount of chemistry detective work, especially by the Curies, Rutherford, and Soddy led to a remarkable conclusion:

Every Radioactive decay is a transmutation of the elements, a change from one element to another.

Images: <http://en.wikipedia.org>
<http://www.ocrwm.doe.gov>



Marie Skłodowska-Curie
1867-1934
Nobel Prize 1903, 1911

