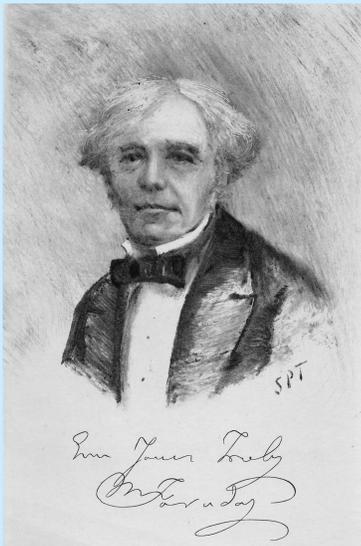
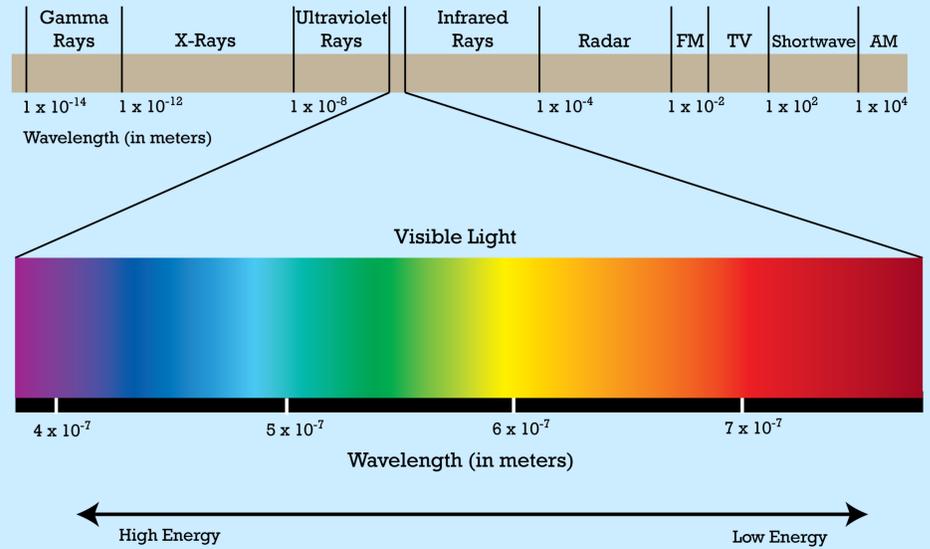


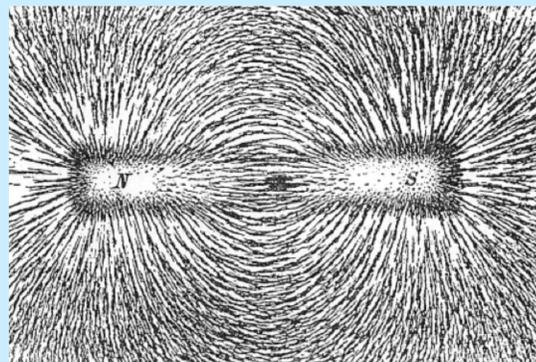
Maxwell gave us electromagnetic radiation

❖ Of course we had light and radiant heat before Maxwell but no-one knew these were examples of **electromagnetic radiation**

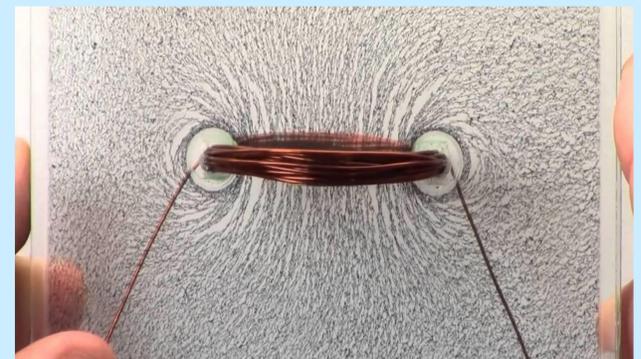
- ❖ Maxwell was inspired by the tentative ideas of Michael Faraday
- ❖ Faraday had spent many years in the 1830s and 1840s experimenting with electricity and magnetism
- ❖ Faraday discovered electromagnetic induction, electro-chemistry, how to make a simple electric motor and more
- ❖ Faraday tried to understand his results with the concept of *lines of magnetic force*



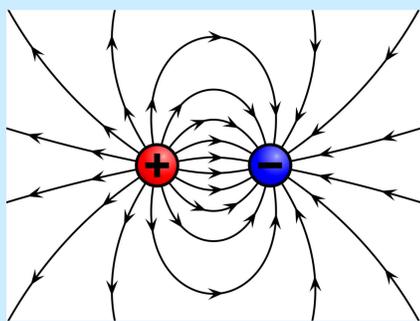
Michael Faraday



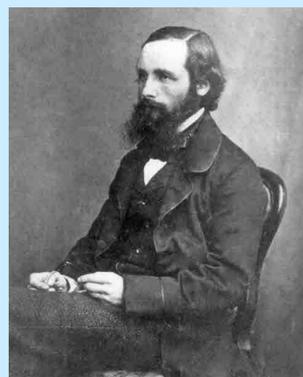
Faraday's line of force made visible round a magnet by iron filings



Similar line of force made visible round a coil carrying a current

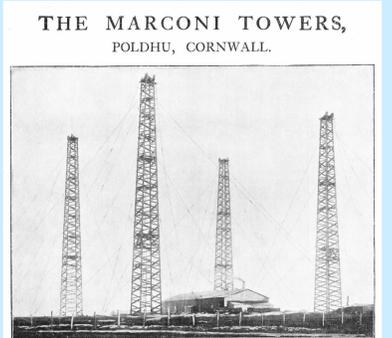


Electric field lines between 2 charges



James Clerk Maxwell about the time he was working out his electromagnetic equations. Courtesy James Clerk Maxwell Foundation

- ❖ Maxwell turned Faraday's ideas into the electric field (symbols **E** and **D**) and magnetic field (symbols **H** and **B**)
- ❖ He realised that the fields were the fundamental realities of electricity and magnetism
- ❖ His theory with its 4 basic equations was the first-ever field theory in physics



Following Maxwell and the experimental work of Heinrich Hertz, Marconi's 215 ft wooden aerial towers at Poldhu in Cornwall inaugurated transatlantic radio in 1901



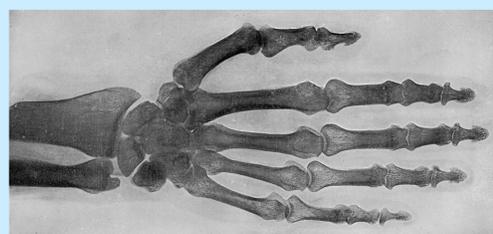
Laser lights were invented over 50 years ago but it was at least two decades before they started to be used widely. Image courtesy Midnight Conspiracy



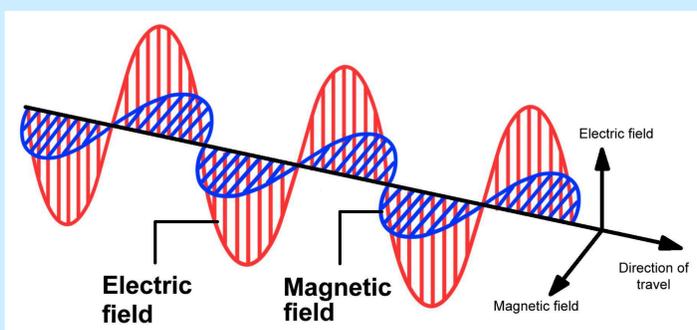
Portable 'radiotelephones' were used in the 2nd world war but cellular mobile phone networks using GHz frequencies were an innovation of the 1980s



John Logie Baird was one of the pioneers of television, transmitting a TV picture on short wave radio over the Atlantic in 1928. This TV from the mid 1940s used all electronic technology

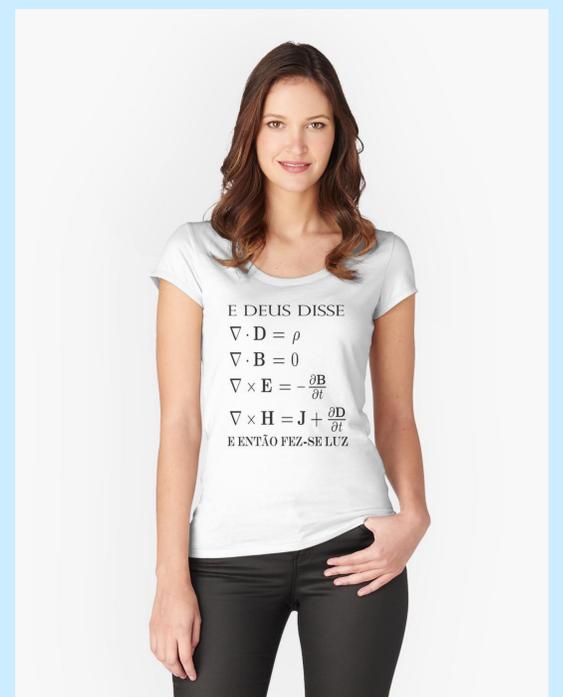


When this X-ray was taken over 100 years ago, X-rays were not recognised as electromagnetic radiation. They were later proved to be high energy radiation



The electromagnetic wave in space

- ❖ Maxwell's equations predict the behaviour of electric and magnetic fields in all circumstances
- ❖ Maxwell's equations on the T-shirt are the same in any language



E DEUS DISSE
 $\nabla \cdot \mathbf{D} = \rho$
 $\nabla \cdot \mathbf{B} = 0$
 $\nabla \times \mathbf{E} = -\frac{\partial \mathbf{B}}{\partial t}$
 $\nabla \times \mathbf{H} = \mathbf{J} + \frac{\partial \mathbf{D}}{\partial t}$
 E ENTÃO FEZ-SE LUZ.