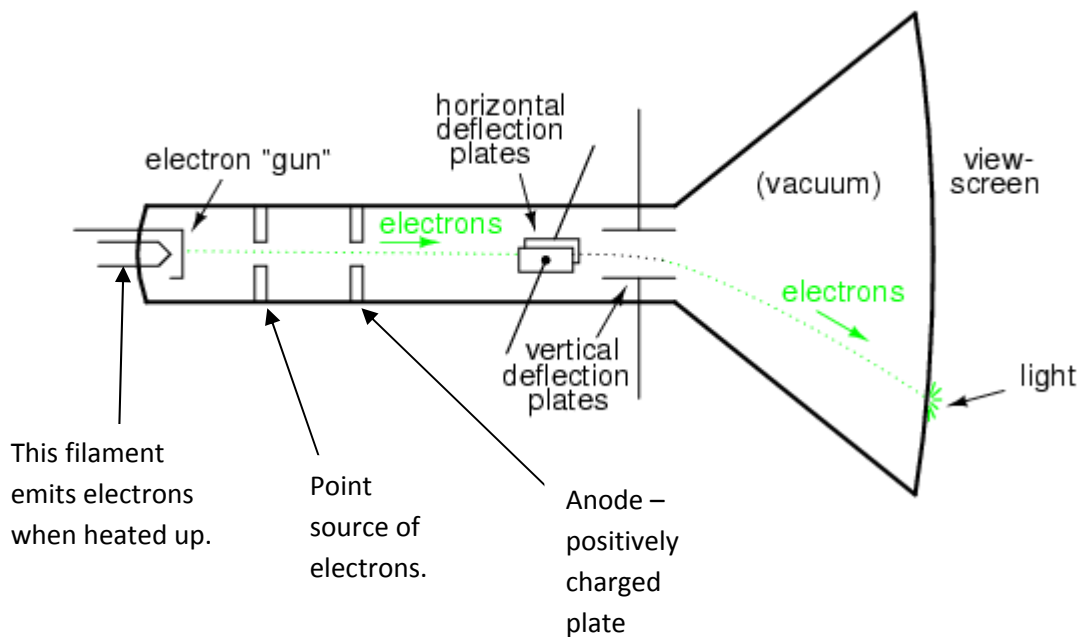


## Cathode Ray Tube (CRT)

It was discovered that if a filament was heated up to very high temperatures in a vacuum, this filament would emit electrons. A vacuum is created inside a sealed tube (T). A source or plate that is negatively charged is called a cathode, so the electron-emitting filament is a cathode (C). The electrons accelerate away from each other and a very few make it through a small opening and form a small stream of electrons..or a 'ray' (R).

How does it work?

<http://www.youtube.com/watch?v=8Pv-91GJHcg> is a youtube that's informative



The heated filament is the source of emitted electrons. They will fly away from each other in all directions as like charges repel. Only a select few make it through the hole in the first plate, thus creating a 'point' source of electrons. The ones that don't make it through are not shown in this diagram for simplicity.

The second plate (with a hole in it too) is positively charged (anode) and this accelerates the electrons. The  $\Delta V$  (electric potential difference) between the filament and the anode is usually between 500-1000V ! Compare that to a 'D' 1.5 V battery. The electrons will accelerate according to Newton's 2<sup>nd</sup> law:  $F_{net} = ma$ .

This stream of electrons will now be directed in 2 dimensions by a vertical pair of plates (electromagnets actually) and a horizontal pair of plates. Ironically, the horizontal pair direct the beam up and down while the vertical pair direct the electrons left and right.

The electrons hit the screen and the phosphors embedded there. They emit light for a brief moment. Coloured TV has 3 coloured phosphors: red, green and blue. Combinations of these 3 primary colours give all the colours in the rainbow. See the University of Colorado's website: Einstein's Legacy to play around with this idea.

<http://www.colorado.edu/physics/2000/tv/colortv.html>

Painting the screen top to bottom, back and forth very quickly with 'still' light images fools our eyes into seeing pictures and movement. Again, check our 'Einstein's Legacy'

[http://www.colorado.edu/physics/2000/tv/big\\_picture.html](http://www.colorado.edu/physics/2000/tv/big_picture.html)

In fact, if you go through the whole story, you can also see how the deflectors control where the electron beam goes! It's written with 'talking' heads and imaged images and simulations. Take a look! <http://www.colorado.edu/physics/2000/tv/index.html>