

Wifi visualizer

Tiger



Who am I?

I am a fourth year physics student at UBC

Taking a project course



Why this project?

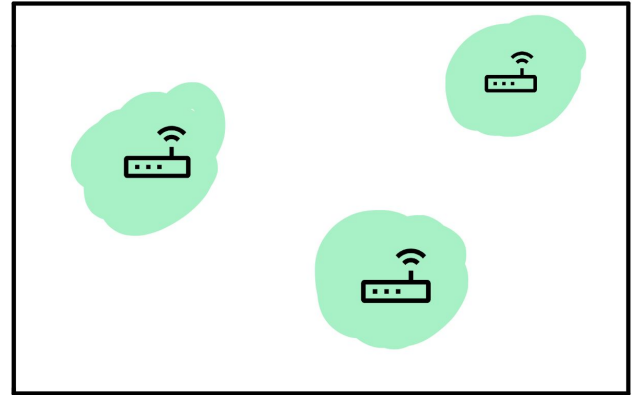
Humans are able to see light but that is only a little part of the electromagnetic spectrum. I want to shine some light on other parts of the spectrum to show how they are similar and different.



<https://webstockreview.net/explore/flash-clipart-flash-light>
<https://www.svgrepo.com/svg/162328/router-connected-to-the-network>

What does the project do?

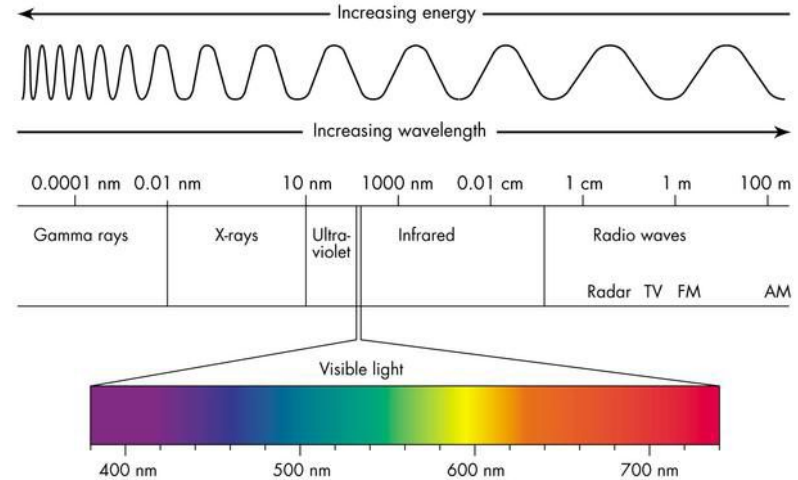
I want to create a receiver such that with the help of a computer, it should allow me see the different router's wifi signal visually.



Background on EM spectrum

A spectrum of different wavelength, all have different energy levels as well as some property differences.

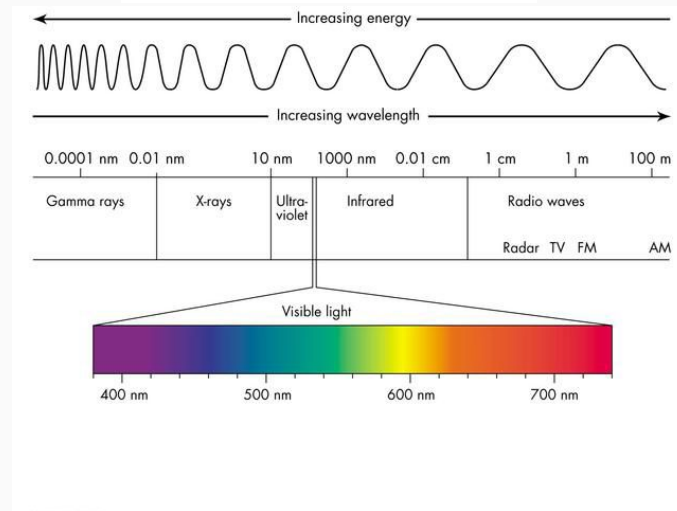
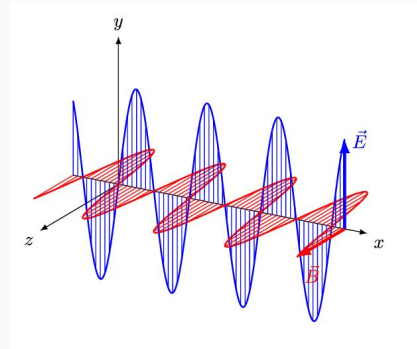
Wifi is a radio wave!



What is light?

It is an electromagnetic wave that humans can see.

Its wavelength is around 380 to 740 nanometers or around 4×10^{14} to 8×10^{14} Hz.



<https://commons.wikimedia.org/wiki/File:EM-Wave.gif>
<https://sites.google.com/a/coe.edu/principles-of-structural-chemistry/relationship-between-light-and-matter/electromagnetic-spectrum>

Sources of light?

What can emit visible light?

Sources of light

Many different items could produce light. Pretty much always cause by the excitation of electrons.

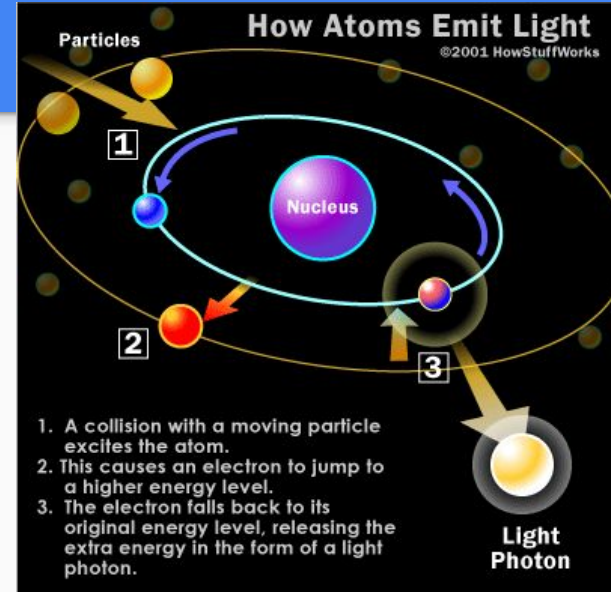


Sources of light

Many different items could produce light. Pretty much always caused by the excitation of electrons.

How we excite the electron differs.

https://javalab.org/en/spectrum_of_hydrogen_e_n/

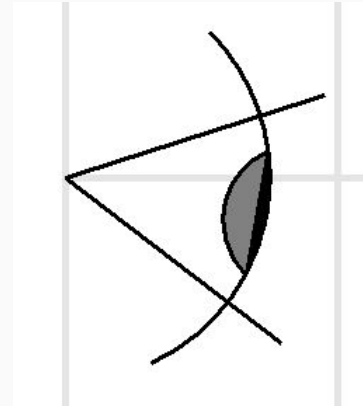


How we detect light

We can use a device to sense light like a solar panel or our eyes!



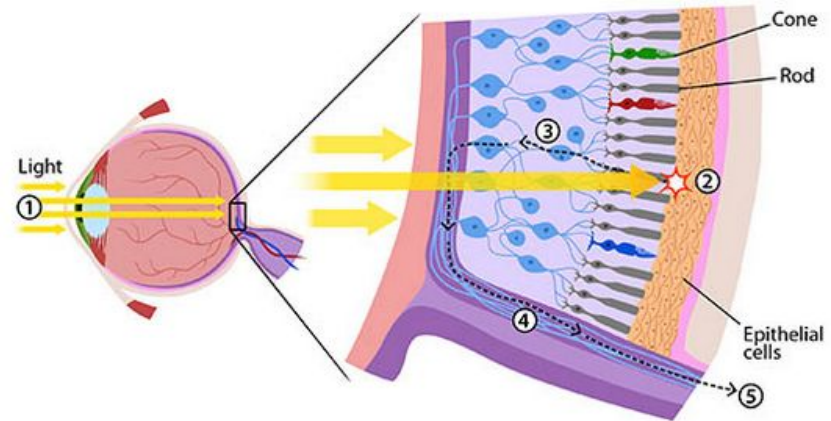
alamy stock photo



How does human see light?

Rods and cones in the human eye

have photopsins. But wait...these are stuck in the back of the retina. That means that the light is absorbed closer to the outside of the eye. Aren't these set up backwards? What is going on here?

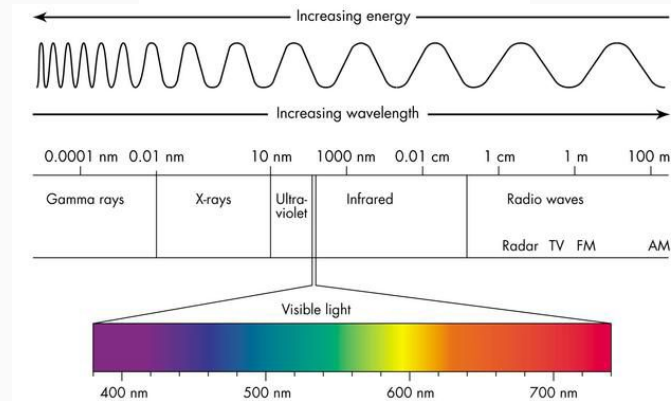


Light moves through the eye and is absorbed by rods and cones at the back of the eye.
Click for more information.

What is radio wave?

It is an electromagnetic wave that humans can create and use.

Wifi specifically has a frequency around 2.4GHz and a wavelength of about 12.5 cm.

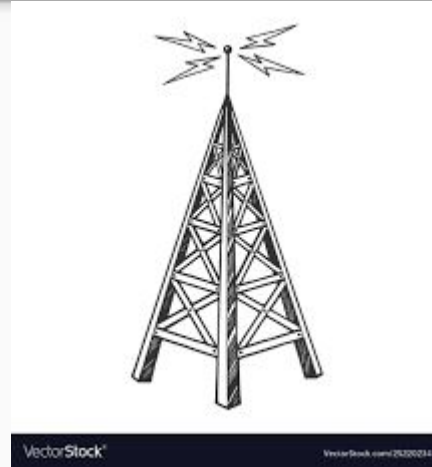


Radio wave sources?

What can emit radio waves?

Radio wave sources

Radio tower that can send out radio waves for radio. A router can also send out radio waves.



Radio wave receiver

A radio can receive the radio wave as well as our smart phone.

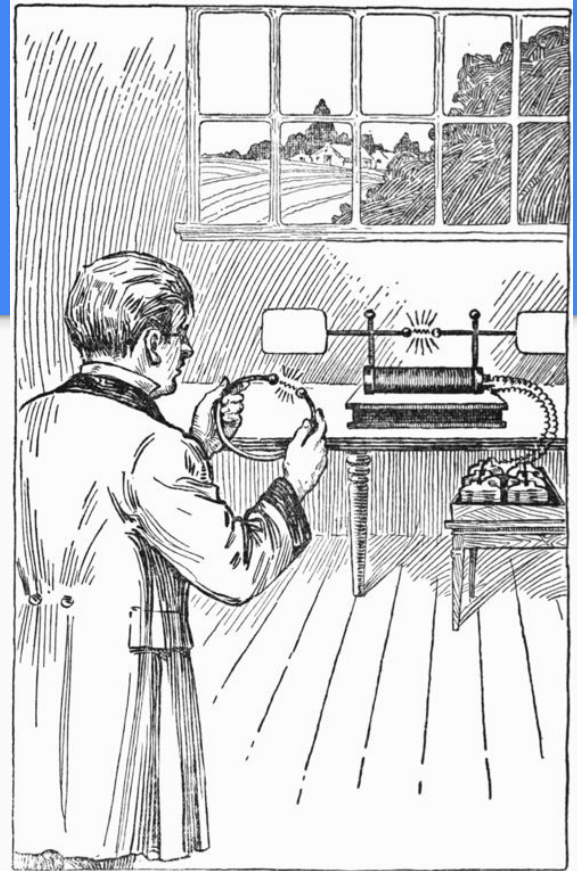


https://www.flaticon.com/free-icon/radio-black-tool-symbol_54516

https://pngtree.com/freepng/smartphone-icon_5064150.html

Discovery of radio waves

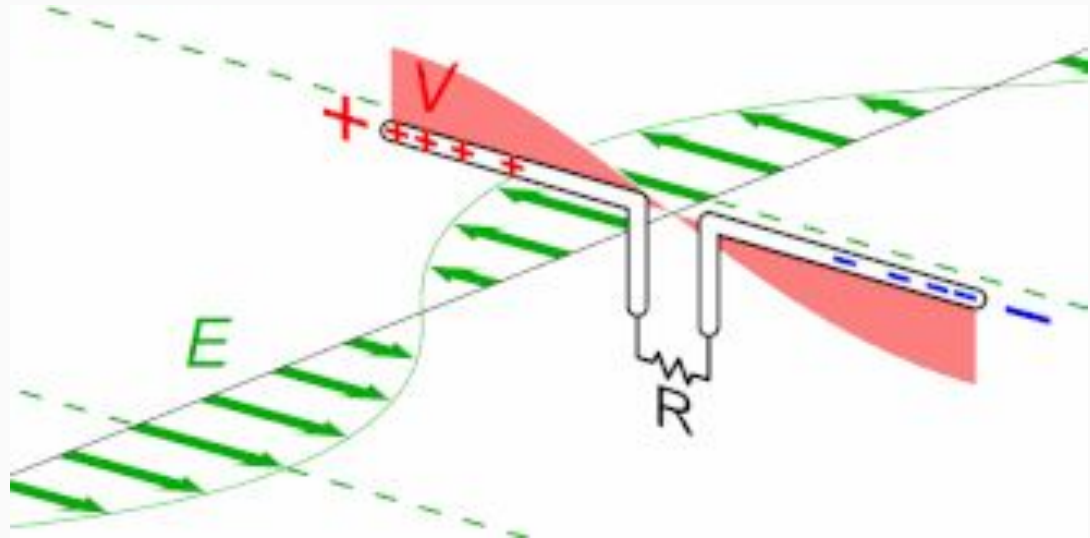
Heinrich Hertz's experiment in 1880s



https://commons.wikimedia.org/wiki/File:Heinrich_Hertz_discovering_radio_waves.png

How does electronics receive radio waves?

Antennas



Induction

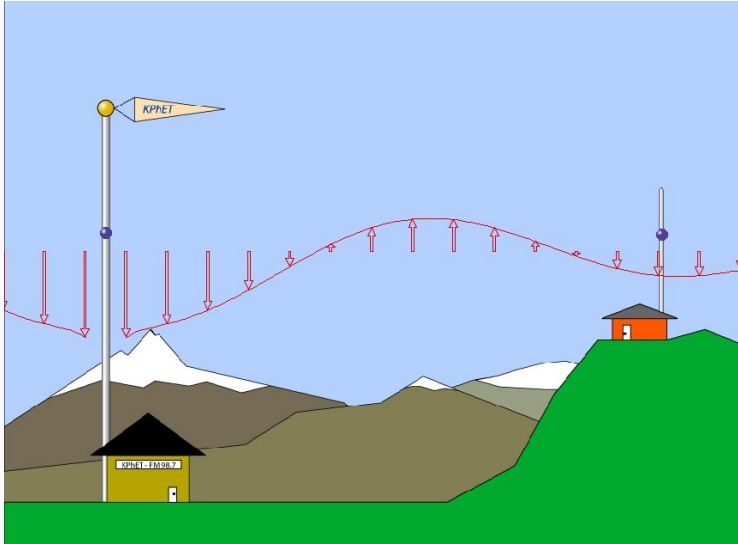
Accelerating charges creates EM waves.

EM waves induce current on conductors.

Induction stove works the same way.

https://commons.wikimedia.org/wiki/File:Heinrich_Hertz_discovering_radio_waves.png

Basics of antenna simulation



<https://phet.colorado.edu/sims/cheer/pj/radio-waves/latest/radio-waves.html?simulation=radio-waves>

List some of the differences of light and radio waves

List some of the differences of light and radio waves

Energy differs

How we generate it seems to differ

List some of the differences of light and radio waves

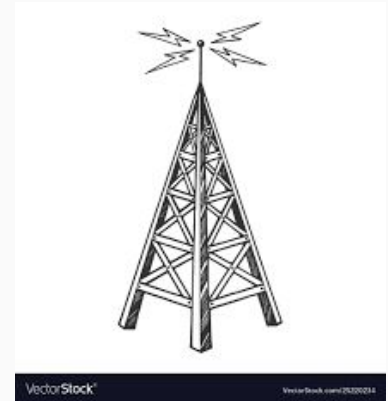
Energy differs

How we generate it seems to differ

Radio waves seems to be able to pass through walls but light cannot.

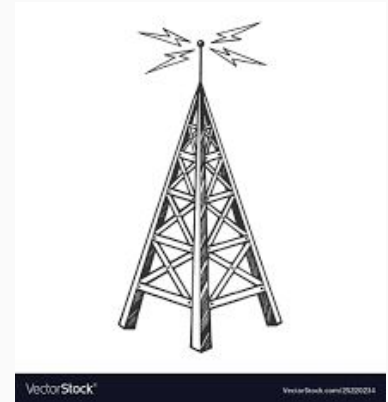
List some of the differences of light and radio waves

How we generate it seems to differ



List some of the differences of light and radio waves

Could antenna create light or candle create radio waves?



Major antenna types

WIFI ANTENNA EXAMPLES



DIPOLE



PATCH



GRID

What do you think would be the antenna type in a cell phone?

WIFI ANTENNA EXAMPLES



DIPOLE



PATCH

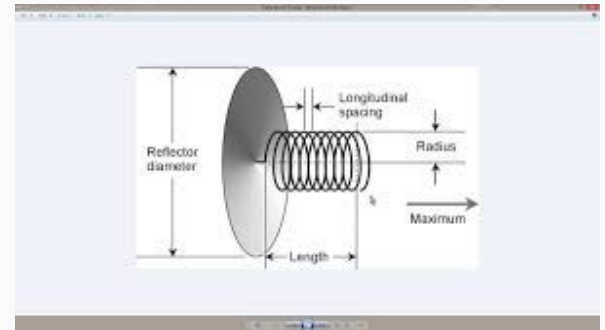


GRID

Helical Antenna

Highly directional

Also simple to make!



Live demo