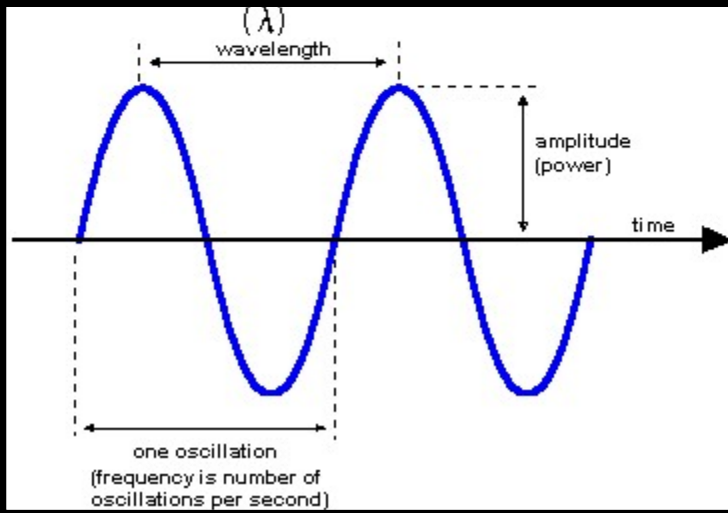
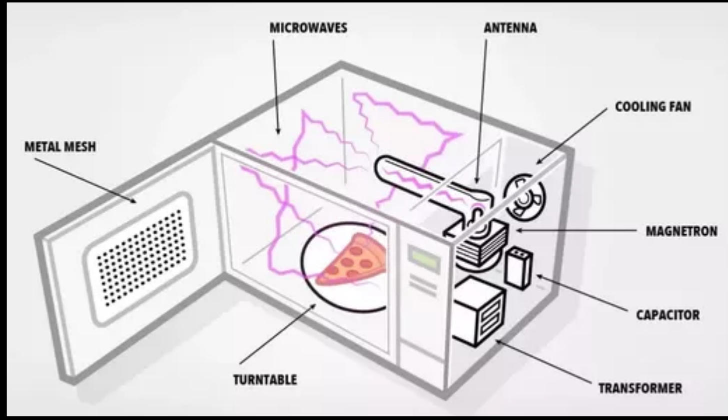
SEARCH FOR EXTRA-TERRESTRIAL INTELLIGENCE

LAB DUE THURSDAY, NOVEMBER 21ST , BY 5 PM

1: MEASURING THE SPEED OF LIGHT

- Knowing this fundamental constant is important for finding ETI's, as this is how fast our messages can travel.
- Today, we will be using a kitchen microwave to measure wavelength using chocolate shavings!
- The places where the peak of different microwaves coincide are hotter, and therefore, will cook food faster (or melt chocolate faster).
- Hot spots are spaced λ/2 in microwaves.
- Speed = frequency x wavelength
- We know for microwaves f = 2.45e9 waves/s, therefore, by measuring the wavelength, we can calculate c.

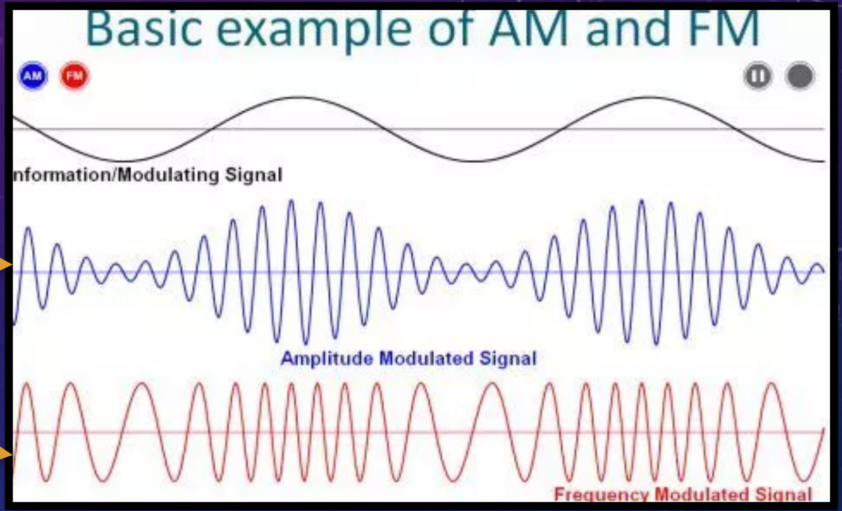


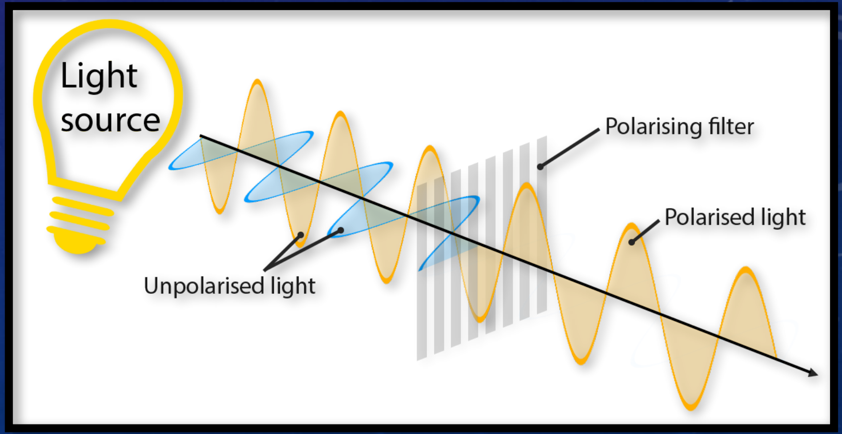


PART 2: DECODING THE ARECIBO MESSAGE

There are several ways we can encode messages using light waves:

- Changing the amplitude.
- Changing the frequency.
- Polarization.





PART 2: DECODING THE ARECIBO MESSAGE

- In 1974, Arecibo was used to send a message into space.
- It was directed at the Globular Cluster M13, 25,000 light years away.
- Used frequency modulation to encode information.
- Total information contained 1679 bits.
- 1679 is called a “semiprime” as it is the product of two prime numbers.

PART 2: DECODING THE ARECIBO MESSAGE

- For this part you will use the lab computers to decode the message.
- Follow the instructions in your lab manual:
  1. (i.) Open an xterm window.
  2. (ii.) Type “cd a200/seti/” and press Enter.
  3. (iii.) Type “sm” and press Enter.
  4. (iv.) Type “macro read arecibo.sm” and press Enter.
  5. (v.) Type “message [width] [your name]” where width is your guess for the width of the grid (hint there are only two options to try), and press Enter.
  6. (vi.) A window will open up with the message. If it looks like gibberish, exit out and try the other width value.
  7. (vii.) If it looks like an actually message, use the tool “Screenshot” on your computer, to take an screenshot of your message which you can then email to yourself.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00000010101010000000000001010000010100000001001000100010001001011001010
10101010101001001000000000000000000000000000000000000011000000000000000000
00110100000000000000000001101000000000000000000001010100000000000000000000111
11000000000000000000000000000000000110000111000110000110001000000000000000011
00100001101000110001100001101011111011111011111011111000000000000000000000
00000010000000000000000001000000000000000000000000000001000000000000000000011
11110000000000000011111000000000000000000000000001100001100001110001100010000
00010000000000100001101000011000111001101011111011111011111011111000000000
00000000000000000100000011000000000100000000000110000000000000000100000110
00000000011111100000110000001111100000000001100000000000000100000000100000
00010000001000000110000000100000001100001100000010000000000011000100001100 0
00000000000011001100000000000000011000100001100000000011000011000000100000 0
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00000100000000100000100000000100000001000000010000000000001100000000001100 00
00001100000000001000111010110000000000001000000010000000000000001000001111 10
00000000000100001011101001011011000000100111001001111111011100001110000 01
10111000000000010100000111011001000000101000001111110010000001010000011000
00010000001101100000000000000000000000000000000000001110000010000000000000001
11010100010101010101001110000000001010101000000000000000000101000000000000 00
01111100000000000000000111111111000000000000011100000000111000000000110000 00
00000110000000110100000000001011000001100110000000110011000010001010000010
10001000010001001000100100010000000001000101000100000000000001000010000100 0
00000000010000000001000000000000000100101000000000000111100111110100111100 0
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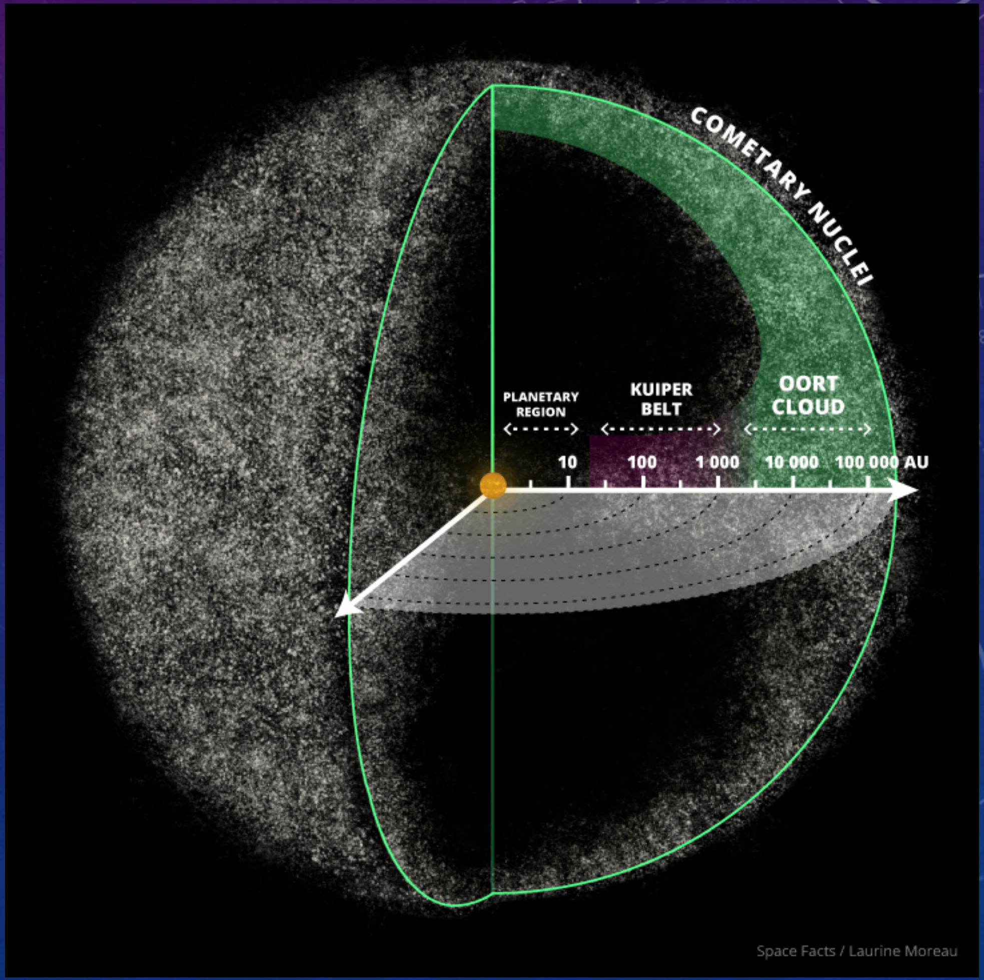
PART 3: GIANT IMPACTS: HOW LONG DO CIVILIZATIONS SURVIVE?

There are two astronomical events that could potentially wipe out life on Earth or other habitable planets:

1. Comet Showers:

- There is a reservoir of comets encircling the sun in the outer solar system call the Oort Cloud.
- A passing nearby star could potentially disrupt this cloud and send comets into the inner solar system.
- Time between close encounters = $\frac{1}{\sqrt{2} \times v \times A \times n}$, where v is the random velocity of nearby stars, A is the cross-sectional area of the solar system, and n is the number of stars per cubic parsec.



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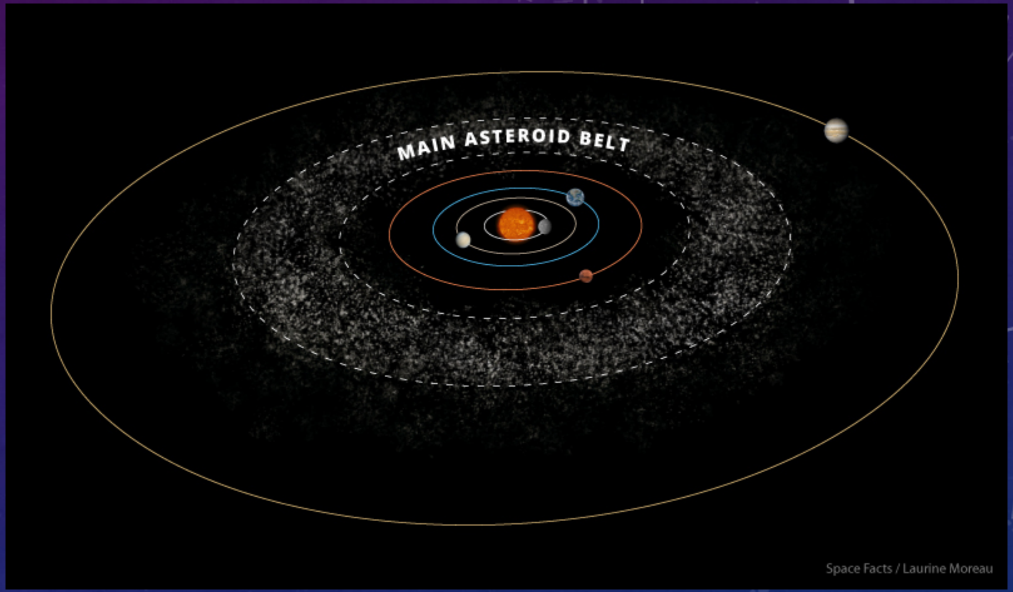
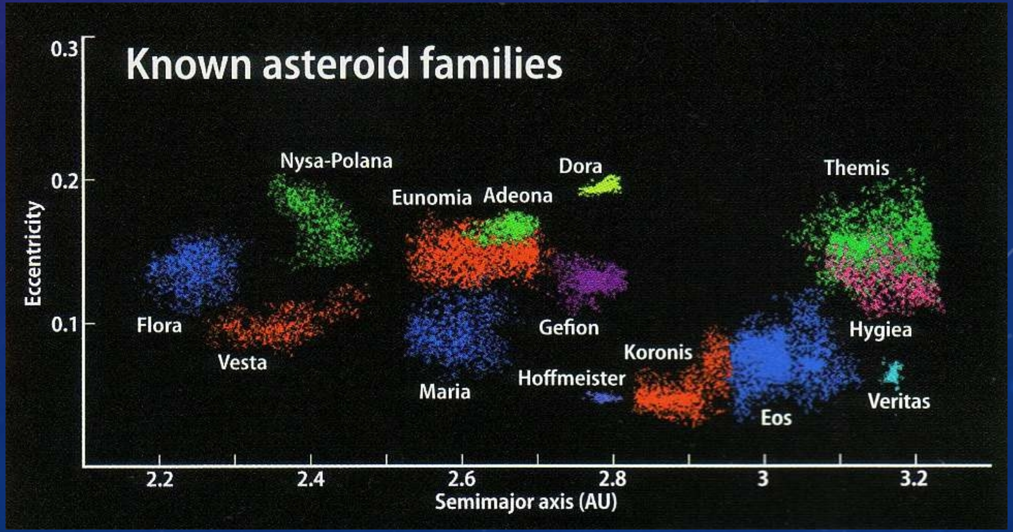
2. Asteroid Showers from Family Formation:

- When an asteroid is destroyed by a collision, it breaks up into a smaller group of objects called a family.
- If this family is created in an unstable orbit, the family could potentially be ejected into the inner solar system.
- Time between formation of families (Age of solar system)/(Number of families).

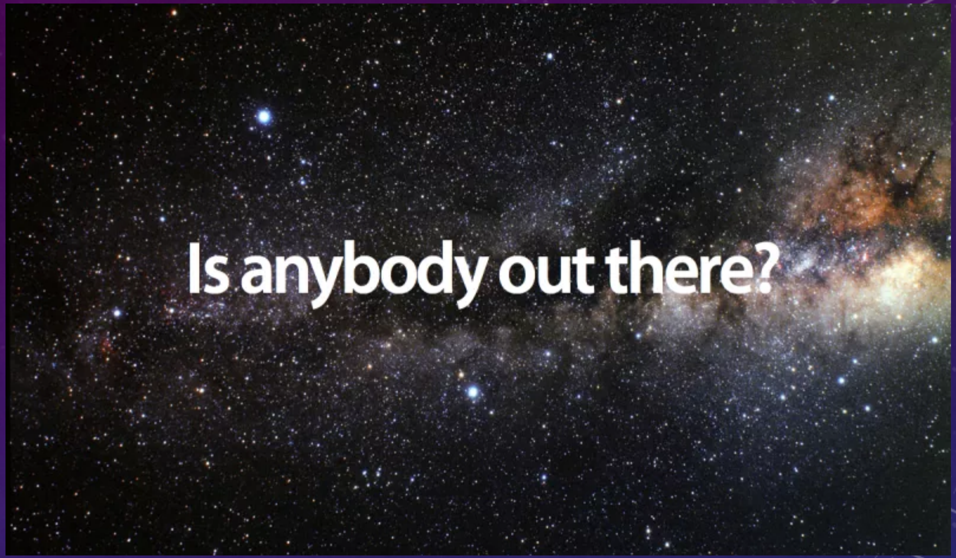




PART 3: GIANT IMPACTS: HOW LONG DO CIVILIZATIONS SURVIVE?

- We'll be looking at the destruction of a comet or asteroid impact head on!
- We will be using an online impact calculator at http://simulator.down2earth.eu/index.html
- Put in the parameters given in your lab manual and answer questions 3-5.

PART 4: DRAKE EQUATION



The Drake equation is a very rough estimate of the chances that any planet houses a technologically advanced civilization within our galaxy:

- The equation goes as $N_c = N_* \times F_P \times F_L \times F_T$
- Here, N_c is the # of civilizations, N_* is the # of stars under consideration, F_p is the fraction of stars that have Earth-like planets, F_L if the fraction of those planets that house intelligent life, and F_T is the fraction of the age of the galaxy that those civilizations can exist for.
- Through Kepler data, we have found ~950 Earth like planets, therefore $N_* \times F_P = 950$. There are 3 "Earth like planets" in our Solar System, only one of which we know to have life, therefore, $F_L \approx 1/3$
- The chance of discovering a civilization hosting planet therefore is $\frac{N_c}{150{,}000} \times 100\,\%$