## The Immensity of the Universe

- Solar Systems
- Galaxies
- The Andromeda Galaxy
- Aliens
- The Drake Equation
- Alien Inquiry







#### Solar System $\rightarrow$ big

# Galaxies $\rightarrow$ Bigger

# 



#### **Play Video**

Universe Size Comparison

#### Solar System

A Solar System is made up of all the **planets**, **moons**, **comets and asteroids that orbit the star**. Example – Our Solar System



### Galaxy

A group of stars (most with their own solar system) Example our galaxy is called the Milky Way Galaxy <u>There are between 100 – 300 billion stars in the</u> <u>Milky Way Galaxy!</u>







### Nearest Galaxy

The nearest galaxy to the Milky Way is the Andromeda galaxy

It would take light traveling at 300,000 km/s about 2.7 million years to reach it!!

It would take about 155 billion years to travel there using our current technology!



#### Number of Galaxies

There are approximately 200 000 000 000 (200 billion) galaxies in the Universe

Each galaxy will have about 300 000 000 000 (300 billion) stars



#### Do the math

200 000 000 ooo galaxies x 300 000 000 000 stars / galaxy

= 60 000 000 000 000 000 000 000 (60 Sextillion) stars in the Universe each with their own planets and moons!!!!!!









With that many planets and moons, it is hard to believe that aliens don't exist













### The Drake Equation

Used to calculate the odds of intelligent alien life



#### The Drake Equation

 $N = R^* \bullet f_p \bullet n_e \bullet f_l \bullet f_i \bullet f_c \bullet L$ 

- R\* represents the number of stars in the Milky Way Galaxy
  Answer: Current estimates are 100 billion.
- **fp** is the fraction of stars that have planets around them **Answer**: Between 20-40%
- **ne** is the number of planets per star that are capable of sustaining life **Answer**: Looking at our Solar System – 33%
- f1 on what percentage of the planets that are capable of sustaining life does life actually evolve?
  Answer: Current estimates range from 100% (where life can evolve it will) down to close to 0%.
- fi is the fraction of fl where intelligent life evolves
  Answer: Estimates range from 100% (intelligence is such a survival advantage that it will certainly evolve) down to near 0%.
- **fc** is the fraction of **fi** that will communicate **Answer**: 10% to 20%
- ${f fL}$  is fraction of the planet's life during which the communicating civilizations live
  - **Answer**: This is the toughest of the questions. If we take Earth as an example, the expected lifetime of our Sun and the Earth is roughly 10 billion years. So far we've been communicating with radio waves for less than 100 years. How long will our civilization survive? Answer: If we survive for 10,000 years the answer will be 1/1,000,000th.
- N, the number of communicating civilizations in the galaxy.

#### The Drake Equation

Lets figure it out using very conservative numbers.
 N = R\* • f<sub>p</sub> • n<sub>e</sub> • f<sub>l</sub> • f<sub>i</sub> • f<sub>c</sub> • L
 N, the number of communicating civilizations in the galaxy.

 $R^* = 100,000,000,000$   $f_p = 40\%$   $n_e = 0.33$   $f_l = 10\%$   $f_i = 10\%$   $f_c = 10\%$  $f_l = 1/10,000,000$ 



Click here to calculate

N = 100,000,000,000 • 0.4 • 0.33 • 0.10 • 0.10 • 0.10 • 0.0000001 N = 1.32

#### The Drake Equation

If N = 1.32, that means that there are 1.32 civilizations capable of communicating within the Milky Way Galaxy

The number of galaxies thought to exist in the Universe is 200,000,000

Therefore the number of civilizations capable of communicating in the Universe would be approximately - 200,000,000,000 X 1.32 = 264,000,000,000 - 264 Billion!

### **Student Inquiry Activity**

What do you think they would look like and why?

Why haven't we found them yet?

) What do you think would happen if we made contact?

) Draw your alien but make sure you include reasons for their characteristics.

#### Through the Wormhole: Are We Alone?

