

## Final Review

### $f_c$ : Evolution of Worldview

- How does ancient astronomy compare with their worldview (i.e. place in the Universe)?
- Ptolemaic System
  - What is it?
  - How does it explain retrograde motions?
- Copernican Theory
  - What is it?
  - How does it explain retrograde motions?
- Kepler did what?
- Galileo did what? With what? Saw what?
- Newton did what?
- Heliocentric model
  - What is the evidence?
- Copernican revolutions
  - What do we mean?

## Key Ideas

- $f_c$ 
  - What are the important factors for estimating  $f_c$ ?
  - Cultural evolution
  - Worldview & Technology
- Worldview
  - How does it evolve?
  - Geocentric and heliocentric models
- L
  - What are the important factors for estimating L?
  - Possible ways to kill a civilization
- Search for extraterrestrial life
- Space travel
- Conclusions?

### $f_c$

- Cultural evolution
  - What is Extrasomatic storage? Give some examples.
  - What is the critical breakthrough of human cultural evolution?
  - What is technological evolution?
  - What are the major breakthroughs of technology?

## fi

- What is fi?
- What are the four cases to determine lifetime of a civilization?
- Explain energy solutions.
  - What are the possible energy sources for a civilization?
  - Which is the most likely energy source with technology today?
  - What is a Dyson Sphere?
- Possible ways to kill a civilization
  - Sun evolution
    - How many years until the Sun becomes a red giant?
    - When does the Sun's evolution affect us the most? Is it multiple times?
  - Asteroids/impacts
    - Is there any way to keep asteroids from hitting the Earth?
  - Killer supernova
    - How would a supernova kill the civilization on Earth?
  - Stars burn out
    - When will this happen?
  - End of Universe: How can cosmology kills us?
  - Black holes evaporation
  - Protons decay

## Continue.....Search for aliens

- In what range of frequency should we search for ET?  
Is radio the only option?
- What is the communicational haystack?
- What are leakage signals?
- Radio telescope
  - What factors affect the sensitivity of radio telescopes?
  - How does the size of the dish relate to the field of view?
  - Dish decision
    - In which case should we use a big dish? In which case should we use a small dish?

## Search for Extraterrestrial Life

- What are the estimations made in the Drake equation?
  - For optimist? For pessimist? On average? (not the numbers but the differences)
  - What is the Fermi paradox? What does it mean?
- How do we estimate the distance to our nearest neighbors? What is the search volume dependent upon?

## Continue....Talk to aliens?

- What is the difference between FM and AM
- Arecibo message
  - What is it?
  - Is the signal FM or AM?
  - Is it hard to decipher?
- The Wow signal
  - What is it?
- LGM
  - What is it? What did it turn out to be?
- What is the Condon report?

## Space Travel

- How does a rocket work?
- Describe the important rocket quantities qualitatively?
- What are the three big problems of interstellar flight?
- What happens when you travel close to the speed of light?
- What are the possible energy source for space travel?
  - Which one is the most likely energy source for space travel today?
  - Which one the most efficient way to generate energy?
  - Discuss the different spacecraft designs.

## Conclusion

- What is the conclusion of this class?
  - Is anybody out there?
  - Have we been visited by aliens?
  - Any scientific evidences for those UFO pictures? Videos? Crop circles? Etc...