

## Term Projects' Topics

You could choose one of topics introduced below or the topic that is not on the list but still looks very interesting!

### **Cosmology:**

#### **Assignment 1: Dark Matter**

I want you to find the reason why people think dark matter exists/ does not exist. Please include observational evidence for dark matter. What do you think it might be? Here are some websites that might help you get started:

<http://www.eclipse.net/~cmmiller/DM/>

[http://chandra.harvard.edu/xray\\_astro/dark\\_matter/index.html](http://chandra.harvard.edu/xray_astro/dark_matter/index.html)

#### **Assignment 2: Black Holes**

What are the characteristics of a black hole? What are some of the remaining mysteries about them? What are the different types of black holes? Some guided math may be required in order to help understand more about black holes. Here is a website to help you get started:

<http://www.nasa.gov/audience/forstudents/k-4/stories/what-is-a-black-hole-k4.html>

#### **Assignment 3: Will Blackholes destroy the Earth?**

Will the Large Hadron Collider (LHC) create a black hole which will destroy the Earth? (Hint: it has not done so since turning on.) Why do people think that this is possible? Are we at risk from any other black holes?

#### **Assignment 4: Gravitational Waves**

What are Gravitational Waves? What sort of catastrophic events cause them? How do we hope to detect them using such instruments as LIGO and LISA? Here is a useful website to help you get started:

<http://imagine.gsfc.nasa.gov/docs/features/topics/gwaves/gwaves.html>

#### **Assignment 5: Evidence for the Big Bang**

What are some of the observational evidences for the Big Bang? And what are the scientific critiques for what we have observed? Feel free to briefly discuss how theories such as a multi-verse system might fit into what we know about the universe or how you think the Big Bang may have been kick started. Be sure to rely on the scientific evidence that has been collected in your discussion.

### **Extraterrestrial Life:**

#### **Assignment 6: The History of ET's**

Assess the history of the search for extraterrestrial life and the possibility for it, including evidence on Earth and in the laboratory for non-carbon based organisms. Be sure to include

any notable attempts to communicate with extraterrestrials, the SETI project, and the Drake Equation.

### **Assignment 7: Where to Find Life**

Where are some other potential locations for life within our Solar System (besides Earth)? Where would that life survive and how might it be different from what we are used to?

### **Planets:**

#### **Assignment 8: Exoplanets**

What methods do we use today to find exoplanets? Carefully explain how the methods work. What have we found so far, and how do these newly discovered planets compare to those in our solar system? Is there a reason why we detect the planets that we're finding? Why not more Earth-like planets?

#### **Assignment 9: Defining a Planet**

Make your own working definition for a planet, star, moon, asteroid and comet. Then, decide which category the major objects in the Solar System belong to. Feel Free to create new classes of celestial bodies if you need to. Think about all possibilities, such as two Earth sized objects orbiting together, a 5 Jupiter mass object floating by itself without a star, a dead comet that has lost its ice and gas, etc. Your definitions should be robust enough to classify any new objects that might be discovered.

#### **Assignment 10: Planets' Missions**

<http://science.nasa.gov/planetary-science/missions/development/>

Compare two of the projected planetary space missions as if you are a legislative assistant. Discuss the pros and cons of each one then explain which one you feel deserves funding and why. Consider cost, time, broader impacts, etc.

### **Sun / Stars:**

#### **Assignment 11: Create a Children's Story Book on the Sun**

Consider discussing the formation of the Sun, its structure and appearance, and the processes that produce sunlight. It should contain good, factual information and must be at least 10 pages long. Be sure to state ahead of time the age group you plan to write for. It needs to be high quality, both in binding and pages. See Lab 32.

#### **Assignment 12: Create a Children's Story Book on the Solar System**

Consider discussing the types of objects within the solar system, their formation, and properties of the planets. It should contain good, factual information and must be at least 10 pages long. Be sure to state ahead of time the age group you plan to write for. It needs to be high quality, both in binding and pages. See Lab 32.

**Assignment 13: Create a Children's Story Book on the Stars**

Consider discussing our view of stars from Earth, the different types, how we observe and characterize their properties, and the different stages of their lives. It should contain good, factual information and must be at least 10 pages long. Be sure to state ahead of time the age group you plan to write for. It needs to be high quality, both in binding and pages. See Lab 32.

**Assignment 14: Build a Sun Dial to Keep Track of Time**

<http://www.sundials.co.uk/projects.htm>

What are the different types of sundials and how do they work? Explain their historical significance. Build a quality sundial and keep track of the time. It should work in Atlanta!

\*You must keep a log demonstrating the accuracy of your sundial.

**Assignment 15: Supernovae**

What are supernovae relative to the evolution of a star? Why do Astronomers believe Betelgeuse will go supernova? How soon might this happen? What are some other possible futures for Betelgeuse? How might this event impact us on Earth?

**Assignment 16: Constellations in perspective**

Choose any 2 constellations and show how they would look from another perspective. The easiest way to do this is by making a 3D model. First, find the distance to all of the main stars of a constellation. Then, using some scale distance that seems appropriate cut sticks representing the relative distance between the stars of the constellation. Finally, mount these to a hard backing at the proper coordinates on the celestial grid to create a 3D model of the constellation. Use correct colors for the stars and include information about them.

**Assignment 17: Evolution of Different Mass Stars**

What are the different possible evolutionary routes for different mass stars (low, solar, and high) from the Main Sequence onward? Discuss in detail the different possibilities for each mass range as well as the properties of the different evolutionary outcomes (white dwarf, neutron star, black hole, etc.).

**Assignment 18: Production of Elements**

Discuss the production of elements through astrophysical processes such as the Big Bang, P-P chain, CNO process, etc. What conditions are necessary to produce elements of different masses? Compare the percentage of abundant (>1%) elements in the universe during the time just the Big Bang to right now. Explain whether or not these values make sense given the frequency of the different astrophysical processes producing the elements.

**Galaxies:**

**Assignment 19: Galaxies Poster**

Create a poster that explains the different types of galaxies and their characteristics (elliptical, spirals and irregular dwarfs). Explain how these different types are theorized to

have formed/be related to one another. Include information on the structure of the galaxies, their size, and components. See Hubble's Tuning Fork.

### **Assignment 20: Measuring Distances in the Universe**

Make a poster illustrating how far into space different techniques in astronomy can measure. Include the range each method works for. Describe these techniques on the poster. See your text and this website for help.

<http://www.astro.ucla.edu/~wright/distance.htm>

### **Assignment 21: the Milky Way Exploration**

Make a poster or model of the Milky Way. Describe its features, where we are located, bright nearby stars, and how we know this information. Be sure to point out the location of famous objects, like the Crab Nebula, the Pleiades, etc. As well as information on the type of galaxy and its possible evolution.

### **Space Exploration:**

#### **Assignment 22: Astronauts in Space**

Explain the dangers that humans may/ are incurring from space travel, as well as how we will/can overcome them. Do the benefits outweigh the risks? What additional dangers await astronauts traveling to Mars? The outer Solar System? Beyond?

#### **Assignment 23: Interstellar travel**

Research and explain the different theoretical methods for travelling very large distances in space. What are some of the different ways that we might travel at or near the speed of light in the future as technology progresses? What types of spaceship designs would be needed to counteract the dangers of zero-gravity or radiation in space?

#### **Assignment 24: Terraforming/ Second Earth**

Realistically look into if it is possible to create a second Earth. What planets or moons in our solar system might be up for the job? How would you respond to nay sayers who feel that it is wrong to destroy these pristine planets on such a complete and total scale? What are the different processes by which this might be done and the timescales necessary?

#### **Assignment 25: Landing on the Moon**

Did humans land on the Moon? Why do some people still propose that we have not? What scientific facts contradict their accusations? Watch the Mythbusters Episode on the Moon Landing (available on YouTube and Netflix) and find other arguments to address which have been proposed by non-believers. Note that the Mythbusters episode is a good place to start but cannot be your only source.

#### **Assignment 26: Space Elevator**

Discuss the Benefits/problems associated with building a Space Elevator. What are the largest hurdles left to overcome? What is your opinion of the Space Fountain? Check out <http://science.howstuffworks.com/space-elevator.htm> for more information.

**Assignment 27: Killer asteroids**

What are the chances of an asteroid wiping out life on Earth? How large would such an asteroid have to be? What are the chances that we would see such an asteroid? What methods might we use to deflect and/or destroy it? Check out the daily asteroid counter at: [www.spaceweather.com](http://www.spaceweather.com)

**Miscellaneous:**

**Assignment 28: Global Warming (Media)**

Is it real? Find scientific evidence to support your claim. What are some of the current advances in research in this area? If it is real, what are the possible causes, and how can we prevent its escalation? What might the Earth look like in the future?

**Assignment 29: Astronomy Impact (Education)**

Given the recent budget cuts the government has been making, astronomy has been hit pretty hard, particularly in the areas of public outreach and education. Prepare a project or a letter to your local Congressperson (which you should send) which addresses the importance of astronomy and astronomy education for the general public.

**Assignment 30: Technology**

What are some modern (last 10 years) advancements in observation technology (telescopes, detectors/cameras, satellites, filters) and how do they compare to technology available 50-100 years ago? What technological developments for space travel and astronomy observations are currently being used by the general public or in other fields of research?

**Assignment 31: The Future of NASA and Privatized Space Flight**

The idea of private corporations providing civilians and researchers with access to space is becoming more mainstream. What do you think is the likelihood that the final frontier will be controlled by private corporations rather than governments? What are some possible consequences of this change? And is it a good or bad change? Support your claims with research on these developments and previously cited sources' predictions.

**Assignment 32: The Future of Science from Literature**

Choose one of the novels listed below to read and examine from a scientific standpoint. Compare the technologies predicted in the book to technological advances which have occurred up to this point in time. Also, compare the scientific theories in the book to those currently in use. Did the book predict anything correctly? If not, explain why.

Hitchhiker's Guide to the Galaxy, 2001: A Space Odyssey, Have Space Suit- Will Travel, The Mote in God's Eye, The Moon is a Harsh Mistress

**Assignment 33: Light Pollution (Photography)**

Similar to Lab 21 in the Lab Manual. Using appropriate photography equipment, photograph examples of light pollution in various locations (not limited to just Atlanta, if you happen to travel). Discuss the different types of light (Mercury, Sodium, etc.) involved in light pollution, the problems associated with light pollution, and alternatives to the bright street lights that pollute the night sky. Provide examples of technology and legislation currently in place to help minimize light pollution.

**Assignment 34: Pick an Astronomer**

Choose a less-famous astronomer from the list below. Research and give details on their life and the science on which they focused. Be sure to explain the theory behind any discoveries that were made and discuss the technology which was in use at the time.

Tycho Brahe, Annie Jump Cannon, Giovanni Schiaparelli, Cecilia Payne-Gaposchkin, Eugene Merle Shoemaker, Jocelyn Bell, Shen Kuo, Williamina Fleming

**Other Topics:**

Active Galactic Nuclei  
Neutron Stars/ Pulsars

Don't like any of these? Come up with your own topic and pass it on to your TA for approval.