

# Introduction to Science and Writing

Physical Sciences

Broward College

Prepared for AST 1002

Horizons in Astronomy

# Objectives

- Science and the Scientific Method
- Physical Sciences and Astronomy
- Writing in the Sciences

# What is Science?

- Science is the methodological study of systems.
- Science studies these systems on why they work, how they work, and the relationship of these systems.
- Science tries to ask questions that quantify observable values and equations relating to the systems.

# Scientific Method

- Brainstorm: Ask a Question
- Hypothesis: Testable Question
- Experiment: Testing the Question
- Theory: A Repeatable Experiment
- Law

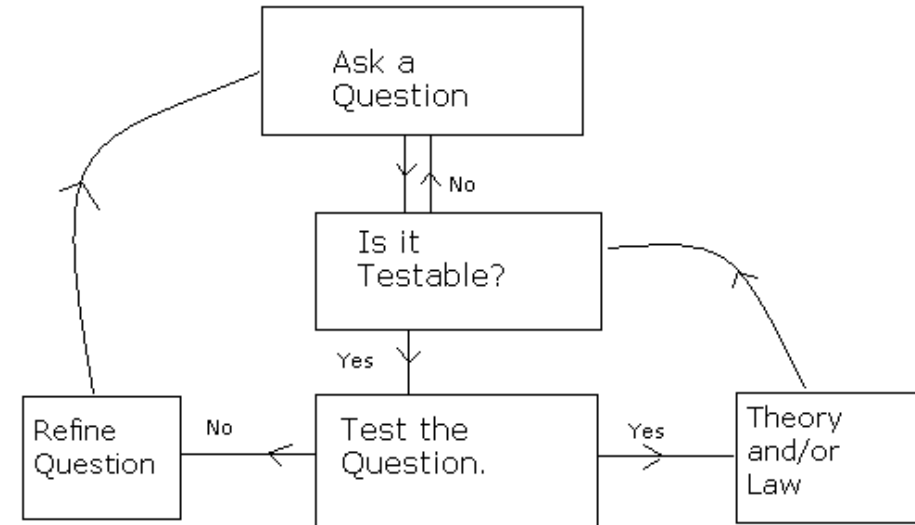



Figure 1. The Scientific Method

# Science and the Physical Sciences

- Physical Sciences 
  - Studies how physical phenomena work.
- Biological Sciences
  - Studies how biological phenomena work.
- Social Sciences
  - Studies how social systems (people) work.
- Astronomy
  - The study of how the planets, stars, galaxies, and universe work.
- Physics
  - The general study of how systems work individually and in connection.
- Chemistry
  - The study of how atoms combine and create compounds.
- Earth Sciences
  - The study of how the Earth and its atmosphere works

# What is Astronomy?

- The science of the study of physical properties of the planets, stars, galaxies, and the universe.
- The word comes from “astro” meaning star and “nomos” meaning name and/or law in Latin.
- Astronomy is different from astrology, which was the study of the motions of the celestial globe.
- Types of Astronomers
  - Observational
    - Observers at telescopes obtaining observations and modeling those observations.
  - Theoretical
    - Theoreticians at computers finding new models for the observations.

# Observational – Ground Based

**Meyer-Womble Observatory; Mt Evans, Colorado  
(Altitude: 14,148 feet, Twin 28 inch Ritchey-Chretien  
Telescope)**



Figure 4. Meyer-Womble Observatory

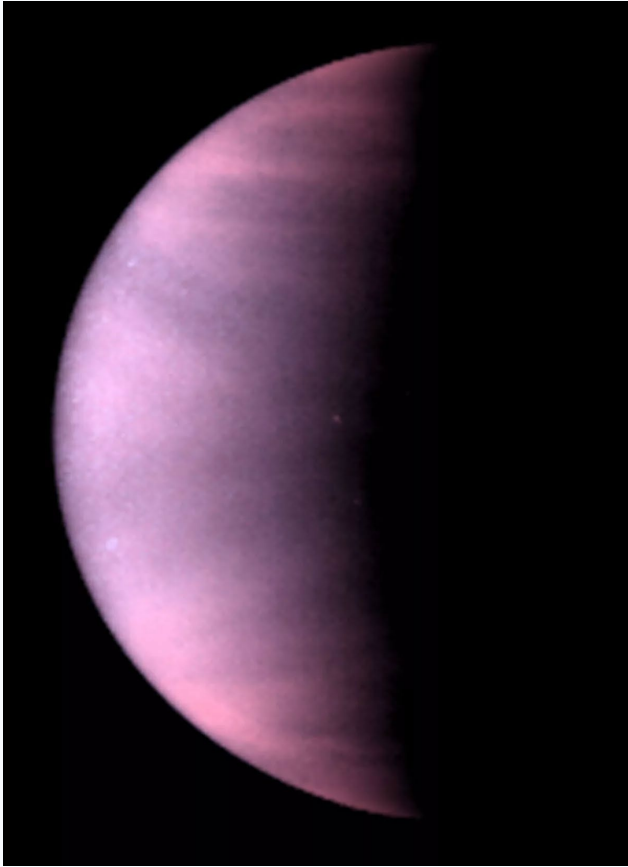
**Southeastern Association for Research in Astronomy  
(SARA) Observatory; Kitt Peak, Arizona (Altitude:  
6,800 feet, 36 inch Cassegrain Telescope)**



Figure 5. SARA Observatory



# Observational – Space Based



- Venus imaged from Hubble Space Science Telescope.

Figure 6. Venus from Hubble (Esposito, 1995)



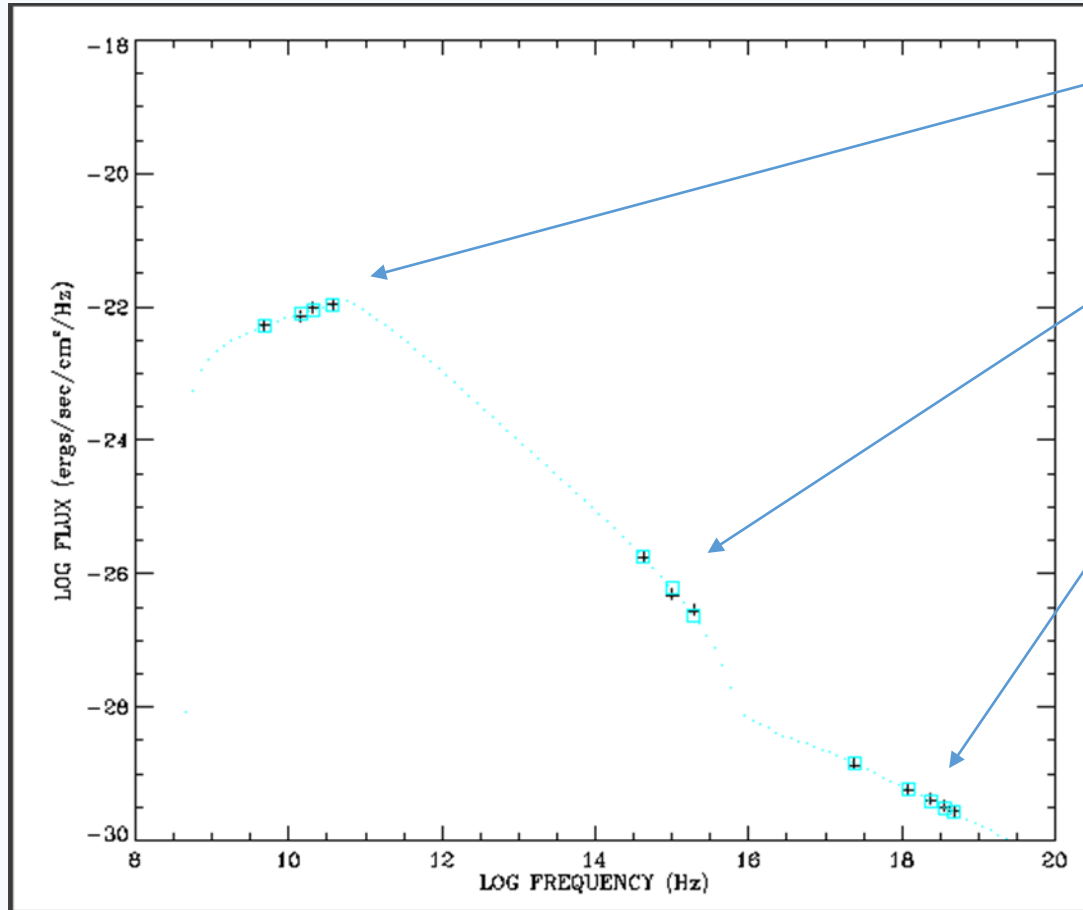
# Observational – Satellite Based



- Enceladus imaged from the Cassini Space Probe around Saturn
- Thought to have water under the icy surface

Figure 7. Enceladus from Cassini (NASA, 2016)

# Theoretical – Observations..



Dusty Torus - Radio

Accretion Disk - Visible

Relativistic Jet – X-Ray

The dimmer the region, the smaller the region is in the physical world.

Figure 8. Power Spectrum of 3C 345 (Webb et. al, 1994)

# Theoretical – Lead to Models of Active Galactic Nuclei

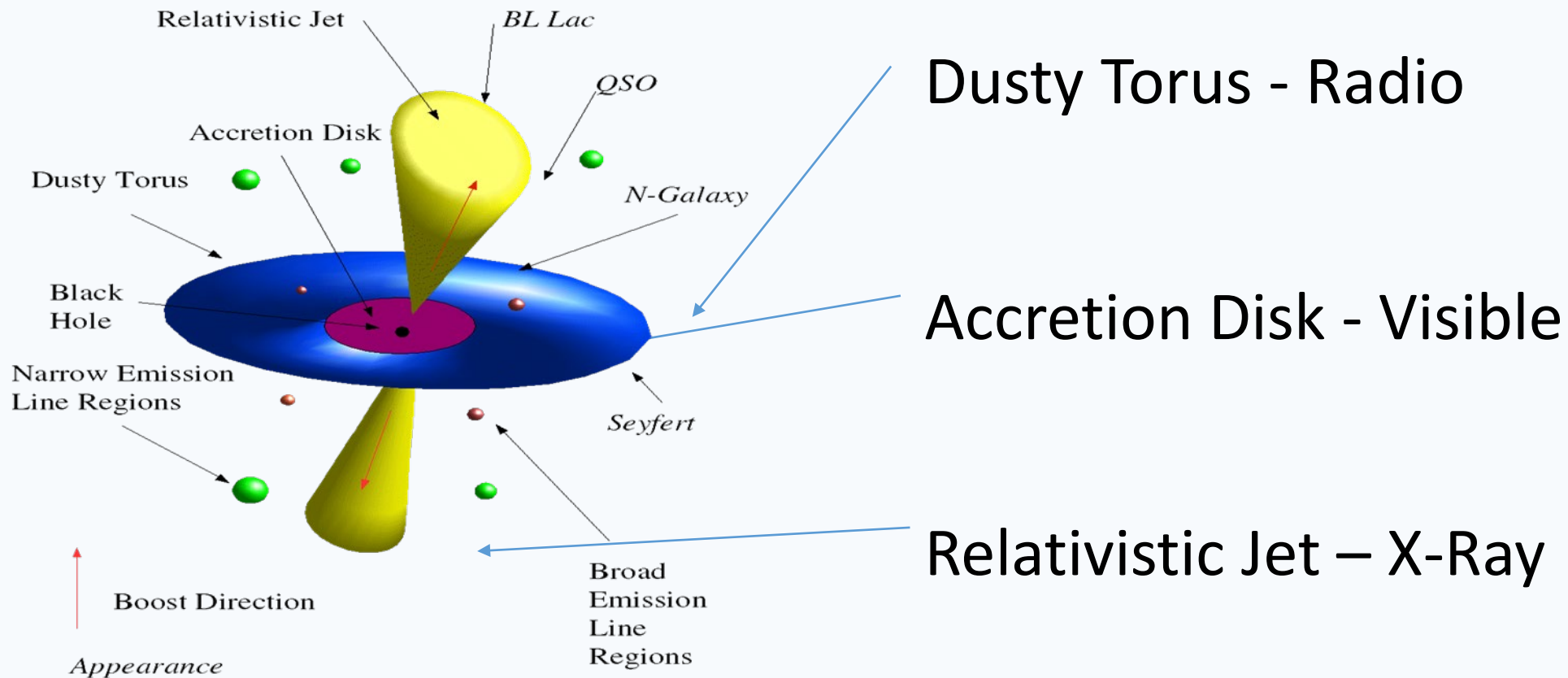


Figure 9. Active Galactic Nuclei Model

# Writing in Science

- Writing a composition for science involves explaining and analyzing a topic in science.
- Types of Scientific Writing
  - General: Writing addressing the non-science public. General science writing includes scientific concepts connecting the concepts to objects/processes in the larger world.
  - Technical: Writing reporting a specific scientific analysis or process. Technical writing reports observations/data and the analysis of these observations/data that addresses the scientific community.
  - Overview: Writing containing both general and technical compositions. An overview allows the both general public and scientific communities to see the connections between the sciences and the larger world.

# Basic Scientific Composition

- **Introduction:** The introduction introduces the scientific topic that will be explained and analyzed in the composition. Some of the background information to put the analysis in context is presented here. The last sentence in the section is context of the paper, the thesis statement. The thesis statement states what the composition is explaining and analyzing.
- **Summaries/Analysis:** The summary and analysis analyzes the summaries of the research observations and resources. The section summarizes the different literature resources. The summaries also analyze how they relate to the concept and any observations made in experiments.
- **Conclusion:** The conclusion summarizes what was learned from the literature search and observations. The conclusion includes any evaluation on possible future analysis.

# Basic Scientific Paragraph Example

Basic science paragraphs are used in science compositions to convey a main idea in the compositions. The main idea could be an observation of a system, a concept from literature, or an analysis of the observation/literature. The main idea is presented in the first sentence with supporting details presented in following sentences. First, the supporting ideas come from observations that are referenced in tables (Table 1.) or equations (Equation 1.). Second, the supporting details come from other literature resources (Howard et al., 2004). Third, the supporting details come from analysis of the main idea or the supporting details. The final sentence summarizes the main idea and supporting details while transitioning to the next main idea.

# Book/Course Image References

- Esposito, L., NASA (1995) Retrieved from: [Hubble views Venus | The Planetary Society](#)
- NASA/JPL/Space Science Institute (2016) Retrieved from: [Cassini view of Enceladus, 15 February 2016 | The Planetary Society](#)
- Webb, J.R., Schrader, C.R., Balonek, T.J., Crenshaw, D.M., Kazanas, D., Clements, S., Smith, A.G., Nair, A.D., Leacock, R.J., Gombola, P.P., Sadun, A., Miller, H.R., Robson, I., Fujimoto, R., Makino, F., Kii, T., Aller, H., Aller, M., Hughes, P., Valtoja, E., Terasranta, H., Salonnene, E., Tornikoski, M., Chism, W., (1994) *The Multifrequency Spectral Evolution of Blazar 3C 345 during the 1991 Outburst*, Astrophysical Journal, 422, 570 - 585