HNRS 353-010 [Spring 2018]
Technology in the Contemporary World
Life in the Universe
with Professor Dr. Harold Geller

Subject to change and revisions throughout semester
without prior notice

Twitter @AstroBioProf :: Observatory Observing Sessions and Talks :: Planetary Habitability Laboratory
History of the Universe :: The Astrobiology Web :: Astrobiology Magazine :: Ad Astra Astrobio Special
Issue

Astronomy Picture of the Day :: Earth Picture of the Day :: Space Calendar :: NASA Image Sites
Space related news (at NASA and others): NASA Watch :: SPACEREF :: Space.com :: Universe Today
NASA Astrobiology :: Astrobiology Institute :: Center for Computational Astrobiology :: UW
Astrobiology

Mars/life/meteors :: Society of Amateur Radio Astronomers :: Bad Astronomy
Help the Analemma Society establish an observatory in Fairfax County :: Learn about The Barns at
Franklin Park in Loudoun County

Synopsis

In this course we will critically analyze emergent technologies and their impact on contemporary culture as
our species seeks to understand its place in the universe. The core concepts surrounding the technologies
and their legal, social, and ethical issues will be considered. Students will develop a significant research
project related to the search for life in the universe which, communicated through written, oral and digital
means, demonstrates a critical understanding of the technologies and their impact via multiple disciplinary
dimensions. Students will communicate their findings, both verbally and non-verbally, through ethically
and culturally aware critical thinking and scientific reasoning.

Major Topics to be Included:
* The physical and chemical basis of the universe and its origins.
* The birth, life and death of galaxies and their stars.
* The geology of solid celestial objects.
* The biochemistry of life on Earth and possibly elsewhere.
* The diversity and similarity of life on Earth and implications for the universe.
* The search for planets outside our own solar system.
* The explosion and colonization of space and its extraterrestrial planets.

TENTATIVE SCHEDULE

* Week 1
  Chapter 1 - A Universe of Life
  23 January 2018 - Introduction to Class
Introduction to Class Notes
25 January 2018 - Discuss Chapter 1
Lecture 2 notes

• Week 2
Chapter 2 - The Science of Life in the Universe
30 January 2018 - Discuss Chapter 2
Lecture 3 notes
1 February 2018
Discussion of Chapter 2 Material

• Week 3
6 February 2018 - Finish Chapter 2 and Start Chapter 3 discussion
Discussion of Chapter 3 Material
Chapter 3 - The Universal Context of Life
8 February 2018 - Finish Chapter 3 discussion
Chapter 3 Notes
Star Formation Game Comments - Was then an app called Star Seed
See an old screen capture here

• Week 4
13 February 2018 - Start Chapter 4 discussion
Chapter 4 Notes
Chapter 4 - The Habitability of Earth
15 February 2018 - Complete Chapter 4 discussion
Chapter 4 Notes
Geology of Virginia
Plate Tectonics by Adam Simon UMCP :: Mafic vs. Felsic

• Week 5
20 February 2018 - Start Chapter 5 discussion
Chapter 5 Notes
Chapter 5 and 6 - Life on Earth and its Origin and Evolution
22 February 2018 - Continue Chapter 5/6 discussion
Chapter 5 Notes

HOMEWORK DUE 1 March 2018:
On 1-Sheet of paper (single-spaced)
Top Half is 1-paragraph outline (abstract) regarding the topic of your paper
Bottom Half is a list of references (APA formatted), minimum of 3 peer-reviewed references that you will be using in your research paper

• Week 6
27 February 2018 - Chapter 6 discussion (Origins and Evolution)
Notes for Chapter 6: MP1 :: MP2 :: MP3 :: MP4 :: Creationism :: Dating the Earth :: Dendrochronology :: Geologic Time
Chapter 7 - Searching for Life in Our Solar System
1 March 2018 - Chapter 7
Notes for Chapter 7
8 March 2018 - Mid-Term EXAM on this date

2nd HOMEWORK DUE 5 April 2018:
On 1-Sheet of paper
Outline of term paper to at least 2 levels
For example:
1. Introduction
   1.1 Where in the Universe is Carmen Sandiego?
   1.2 Who is Carmen Sandiego?
   1.3 What is the universe where Carmen Sandiego can be?
2. Searching for Carmen Sandiego
   2.1 What can be used to search for Carmen Sandiego?
   2.2 Where do you search?
3. Background of Other Searches for Carmen Sandiego
   3.1 The American Search for Carmen Sandiego
   3.2 The British Search for Carmen Sandiego
   3.3 The Chinese Search for Carmen Sandiego
4. Discussion of Current Search for Carmen Sandiego
4.1 Search in the Solar System
4.2 Search in the Milky Way Galaxy
5. Conclusion
5.1 Did we find Carmen Sandiego in this Galaxy?
5.2 Did we find Carmen Sandiego in this Universe?
6. Future Research
6.1 New Technology for Searching
6.2 Future Searches for Carmen Sandiego

Chapter 9 Lecture Notes :: Titan and Dunes :: Supplemental Material on Outer Planet Satellites

- Week 11
  Chapter 10 - The Evolution of Habitability
  3 April 2018 - Discuss Chapter 10
  Habitability Notes
  5 April 2018 - Finish Chapter 10 discussion
  Habitability Notes
- Week 12
  Chapter 11 - Distant Abodes for Life
  10 April 2018 - Discuss Chapter 11
  Section 1 Notes on Stars (very large file)
  12 April 2018 - Finish Chapter 11 discussion
  Part 1 Notes on Stars (very large file)
- Week 13
  Chapter 11 and 12 - The Search for Extraterrestrial Intelligence
  17 April 2018 - Discuss Chapter 12
  Star Formation Game Comments
  Guidelines for Determining Cluster Age
  Planetquest Link at JPL :: Chapter 11 Part 2 Notes
  19 April 2018 - Finish Chapter 12 discussion
  PowerPoint Presentation on SETI
- Week 14
  24 April 2018 - Discuss Chapter 13
  Chapter 13 - Interstellar Travel
  PowerPoint Presentation on Space Travel
  Look in "Through the eyes..." for Eagle Nebula animation
  26 April 2018 - Chapter 13 discussion
  Chapter 13 - Interstellar Travel
  PowerPoint Presentation on Space Travel
  Look in "Through the eyes..." for Eagle Nebula animation
- Week 15
  1 May 2018 - Discuss Chapter 13
  Chapter 13 - Fermi Paradox
  3 May 2018 - Complete Discussion of Chapter 13
Final Paper Presentations - Share Out Presentations
Epilogue - Implications of the Search and Discovery
  - U.N. Office for Outer Space Affairs
  - A version of SETI Guidelines

Dr. Ehrlich's Relativity Presentation
Summary of Astrobiology

TERM PAPERS AND TAKE HOME FINAL DUE 10 May 2018 4:15 PM

Regarding Term Paper:
* Turned in via e-mail attachment (save trees and cost) as a DOC file to hgeller@gmu.edu
* Structured (6000 words minimum) with numbered sections
* Abstract (1-page summary; not numbered section)
* Introduction (first numbered section)
* Body (numbered sections with in-text references in APA)
* Conclusion and Suggested Future Research (numbered section)
* References (final numbered section using APA format)
** N.B.- References from peer-reviewed journal articles

Other SPRING 2018 Semester Information
Classes begin 22 January
2018 Last day to add classes 29 January
2018 Last day to drop 23 February
2018 Spring Break 12 March to 18 March 2018 Last day of classes

Instructor:
• Professor Dr. Harold A. Geller
  - Office: Research Hall Room 216
  - Telephone: 703-993-1276
  - E-mail: hgeller@gmu.edu
Office Hours: 3:00-4:30PM Tuesday/Thursday and by appointment (on campus 5 days/week)

- **Lecture Meetings**: Tuesday/Thursday 12:00-1:15PM (T1018)
- **Textbook**: Life in the Universe (4th edition) by Jeffrey Bennett and Seth Shostak

**Grading Policy**

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<thead>
<tr>
<th>Component</th>
<th>Percentage</th>
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<tbody>
<tr>
<td>Homework assignments</td>
<td>20 %</td>
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<tr>
<td>Class Participation</td>
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<tr>
<td>Mid-Term Examination</td>
<td>15 %</td>
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<tr>
<td>Comprehensive Final</td>
<td>15 %</td>
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<tr>
<td>Term Papers</td>
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<tr>
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**Honor Code Adherence**

Students are expected to follow the George Mason University rules of student honor. As noted in the catalog:

"George Mason University shares in the tradition of an honor system that has existed in Virginia since 1842. The Honor Code is an integral part of university life. On the application for admission, students sign a statement agreeing to conform to and uphold the Honor Code. Therefore, students are responsible for understanding the provisions of the code. In the spirit of the code, a student's word is a declaration of good faith acceptable as truth in all academic matters. Therefore, cheating and attempted cheating, plagiarism, lying, and stealing of academic work and related materials constitute Honor Code violations. To maintain an academic community according to these standards, students and faculty must report all alleged violations of the Honor Code to the Honor Committee. Any student who has knowledge of, but does not report, an Honor Code violation may be accused of lying under the Honor Code."

[Source: [http://www.gmu.edu/catalog/apolicies/index.html](http://www.gmu.edu/catalog/apolicies/index.html)]

**Course Format - Socratic Discussion**

Discussions will consist of various forms of presentation material including videos, computer displays, demonstrations and transparencies. Questions are acceptable at any time during the lecture. Students should be alert during the lecture and prepared to answer queries posed as they arise.

**Entry level Competencies**

The course is a conceptual-based course using a minimal amount of algebra and geometry. Students should have English composition skills.

**Course Objectives**

1. Describe the origins of life in the universe and on Earth.
2. Explain the scientific method and the philosophy of science, as related to the study of astrobiology.
3. Describe the physical laws that govern the interaction of matter, energy, time, and space in the cosmos.
4. State how astrobiologists utilize electromagnetic radiation to gain the knowledge of the mechanics of the birth, life, and death of stars from the distant past.
5. Appreciate the magnitude of the scientific problem of the search for extraterrestrial life in the universe.
6. Exploration of biochemical properties of living systems that are essential to all life.
7. The physical, chemical and biological constraints underlying the exploration of the universe and the habitation of other planets.

**Major Topics to be Included**
1. The origins of the universe.
2. The origins of solar and planetary systems.
3. The physics of light, gravity, matter, energy, magnetism, radioactivity, nuclear energy, and relativity.
4. The geology of volcanism, plate tectonics, and erosion as applied to all planets.
5. The birth and death of stars and galaxies.
6. The H-R diagram for stars including the location of the main sequence, red giants and white dwarfs.
7. The "Big Bang" theory of universal creation, pulsars, neutron stars, and black holes.
9. Cosmology and life in the universe.
10. The biochemical principles of all living systems.
12. The physical, chemical and biological aspects of space exploration and the habitation of extraterrestrial planets.
13. Laboratory work dealing with measuring instruments of the astrobiologist, and drawing conclusions from astrobiological data.

Additional Topics Regarding Classwork
As deemed appropriate, the course may be supplemented with homework, guest speakers and discussions of new discoveries.