

Astronomy 230

Section 1– MWF 1400-1450

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Office Hours:

**MTF 10:30-11:30 a.m.
or by appointment**

<http://eeyore.astro.uiuc.edu/~lwl/classes/astro230/spring04/>

This Class (Lecture 1):

Introductions

Next Class:

Size Scales & Cosmology

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Outline



- Class Introductions
- Introduction of Extraterrestrial Life
- Class Goals
- Syllabus

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Welcome to Astro 230



You have chosen a great time to take this course. The search for extraterrestrial life is making larger and larger strides. In the last 10 years, we have gone from knowledge of only 9 planets around only our Sun to 100s of planets around many suns. In the near future, NASA will have missions that may find signs of life on Mars or Earth-like planets around nearby stars or life under the oceans of Europa or other exciting discoveries. In this course, you will get an understanding of arguably the biggest astronomical question of all time: *Are we alone?* We will address this question with scientific methods, but also perhaps with some philosophy and science fiction thrown in too.

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Roving on Mars



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Welcome to Astro 230



One of the neat aspects of this course is that we can address this cool subject with an open mind and scientific rigor.

Don't be scared of science. It is really just common sense and logic. Although not all scientist have those in any larger amounts than non-scientists.

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Welcome to Astro 230



In this class, we shall confront some of the ideas concerning the formation of life on this planet (origination of life), so we can apply it to extraterrestrial life. Remember, we only have a sample of one in the entire Universe!

BUT, we will not condemn anyone's beliefs (God, Gods, UFOs, etc.). So, we will examine life in the scientific sense.

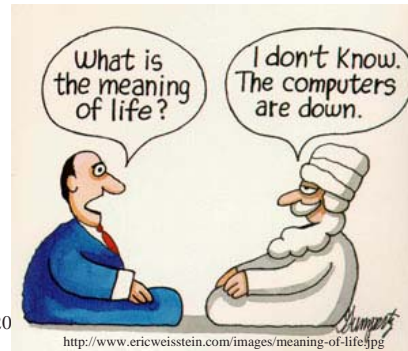
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Life



- This examination may bring us to some very depressing conclusions
- What is life?
 - Just sunlight plus geochemistry?



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Class Facts



- Today, there is no evidence for ET life.
- Earth's early geologic record (first 1/2 billion years) is GONE
 - Clues to early life formation are gone
- But, we do have evidence for very early microbial life on Earth (4 billion yrs old)
- Humans are NEW life on Earth.
- Keep in mind that faith is not science. Faith is fine, but we have to keep in mind that in this class, "I just KNOW it!" is not an acceptable answer. We are investigating big questions scientifically.



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Careful



- Sometimes people make big claims in the name of science too.
 - Ancient world thought that the Earth was the center of the Universe.
 - Percival Lowell (~1913) thought he saw canals on Mars (optical illusion).
 - Eddington (~1940) tried to make the fine structure constant a rational number.
- We need to learn from these mistakes.

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And Speculate



- The French Academy of Sciences once pronounced that meteorites were nonsense
 - EVIDENCE and REASON can produce just as many thrills as dogmatic faith-based belief (*Chladni showed them a meteorite!*)
- The professors of Astronomy in the early 1600s, were probably teaching a geocentric solar system.
 - The Catholic church only forgave Galileo about his heliocentric solar system ideas in 1992!

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Life on Earth



- A miracle?
- An accident?
- More-or-less inevitable given the laws of nature and chemistry with suitable conditions?
- Principle of Mediocrity: There's nothing terribly special about the astronomical, geological, physical and chemical circumstances on Earth; most likely nothing special about biology either

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Major Premise



- The Universe is homogenous and isotropic.
- The laws of nature are the same everywhere.
 - So we can apply the lessons learned from life on Earth to extrapolate about life in space.
 - Life probably should have repeated elsewhere, given the same circumstances

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Course Goals



- My goal for a graduate of this course is that they will understand our current scientific view of life in the universe, propose what the future may hold for the field, and hold any “discovery” of extraterrestrial life to an personal scientific standard of proof.
- This class is designed to be fun. It will endeavor to teach the student about extraterrestrial life, but it will also combine various topics together. This course will revolve around an equation (discussed in Chapter 1 of the text) called the "Drake Equation". The Drake Equation looks like an attempt to calculate how many intelligent extraterrestrial civilizations exist with whom we *might* be able to communicate. However, the equation actually helps us understand our ignorance about the subject and illuminates the various topics and issues worth thinking about when we ask the question, “*Are we alone?*”, with an open mind.

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Course Outline



After some introductory material to get us thinking about what we mean by life, we review some basic astronomy, which I'm hoping you will remember most of from your introductory astronomy classes. After that, we cover topics in: planetary and solar system astronomy; biology and biochemistry; geology, paleontology, and evolution; some more detailed planetary astronomy; history and the future of mankind on Earth; and finally, interstellar communication and travel, including UFO's. In addition, the class presentations will allow us to adventure wherever the interests of the class take us. Take part of the journey, and let's enjoy the ride.

<http://eevore.astro.uiuc.edu/~lwl/classes/astro230/spring04>

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Type of Course



I expect some interactivity and responses, not just my voice.

Feel free to interrupt me and ask questions, or pose new points, etc.

So....

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Class Participation



Class Participation

- You should attend lectures
- To encourage your engagement, the lectures will often be punctuated by opportunities for your feedback, in the form of asking questions, "voting" on the possible outcomes of observations or demonstrations, or brainstorming answers to open-ended questions. To reward your participation in these activities, you will occasionally be asked to write down and hand in your response.

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Extraterrestrial Life



What is extraterrestrial life?

What do people who look for extraterrestrial life search for?

Have we been visited?

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Aliens?



We have been bombarded by aliens in the media– all types.

No surprise that close to half of all Americans believe in aliens.

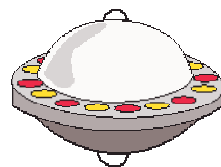
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Have we been visited by ETs?



*“Extraordinary Claims
Require Extraordinary
Evidence”*



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Questions



- How many believe that we have been visited by UFOs?
- Are our governments hiding it?

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An Example: Meteor 1972



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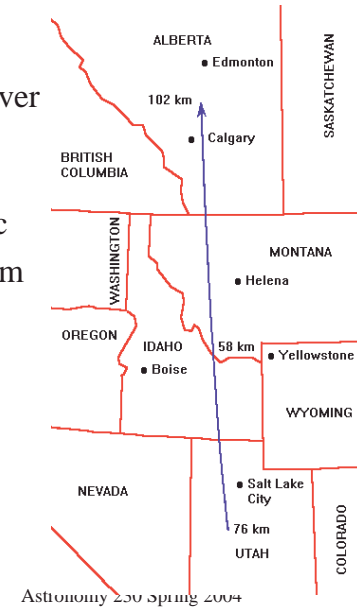
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<http://www.uwgb.edu/dutchs/>

Yikes, a Near Miss



- A bus sized object entered atmosphere over Utah and exited over Canada
- Velocity of 15 km/sec
- Missed Earth by 58 km



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But...



- Event was completely unexpected
- Crossed relatively sparsely-inhabited region
- Only visible for a *total* of 101 seconds
- Visible for no more than 30 seconds at any one spot
- Nonetheless, we have dozens of clear photographs of this event
- And still we have no comparable images of UFOs

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Oral Presentation



Experience has shown that students who take this course have ideas or particular interest about some aspect of the study of extraterrestrial life. In the first 2-3 weeks, every student will have to submit a topic on which they will give a 10 minute presentation with an additional 5 minutes allowed for questions from the audience. Students may give these talks in any way that they choose-- powerpoint, overheads, slides, etc. The grade for the presentations will be determined from audience questionnaires that will ask questions:

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Oral Presentation



1. How relevant is the topic to the search for extraterrestrial life?
2. How interesting is the topic?
3. Rate the speaker's knowledge of the topic.
4. Rate the quality of the overall presentation.
5. Rate the scientific basis of the topic.

These questions are rated 1-10 out of 10 scale.

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Presentation Examples



- Life on other bodies in our Solar System
- Faces and pyramids on Mars
- Aliens in South Park: Satire or Silly
- Supernovae: Adding Heavy Elements to the Mix
- War of the Worlds: Fact or Fiction
- Human Colonization of other Planets/Asteroids
- Terraforming Mars
- How to get to Mars

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Research Paper



You will be writing a research paper of your choice this semester on a topic of relevance to our class. Of course, writing a paper on the same topic as your oral presentation is advised (since you will have already done much of the research) but is not required. This paper must be 4 to 5 pages of single-spaced 12 point font, not including references. The paper is due on the last day of class, Wednesday May 5th, 2004.

For examples on WWW reference, see the syllabus or contact me. Remember that I have access to google as much as you do. Academic honesty is vital!

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Yuck-- Exams



- There will be one midterm exam and a comprehensive final exam for this course. The exams will consist of short answer essay and multiple choice questions. Dates are as follows.
- Hour Midterm Exam: In class Friday, Feb 21st
- Final Exam: **1:30-4:30 pm Friday, May 7th**

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Grades



Requirement	Percentage of Grade		Points
Class Participation (best 5 of 7)	5 x 1% each	5%	50
Oral Presentation		15%	150
Research Paper		20%	200
Midterm		20%	200
Final Exam		40%	400
Total		100%	1000

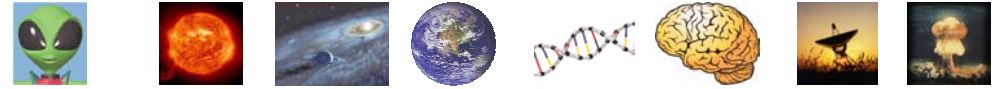
BOOK: *Extraterrestrial Life*, 5th edition, 2003 by Neal Evans

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Drake Equation

Frank Drake



$$N = R_* \times f_p \times n_e \times f_l \times f_i \times f_c \times L$$

of advanced civilizations we can contact Rate of formation of Sun-like stars Fraction of stars with planets # of Earthlike planets per system Fraction on which life arises Fraction that evolve intelligence Fraction that communicate Lifetime of advanced civilizations

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Perhaps we shouldn't look for Aliens?



- But we've been broadcasting our presence on Earth for the last 65 years now!
- At the present time, the Earth is brighter in radio than the Sun.
- Is anyone out there watching TV right now?
- Also there have been a few intentional messages...



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SETI



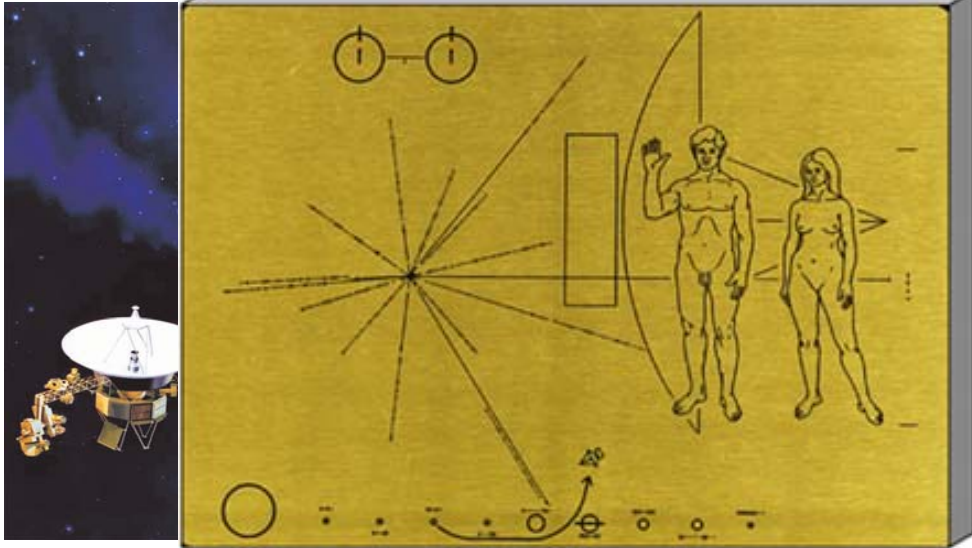
- Communications via radio signal
 - Earth has been broadcasting in RF range for most of this century
 - Earth is brighter than the Sun in radio
 - 18–21 cm wavelength range good for interstellar communication
- SETI search is ongoing
 - SETI
 - <http://www.seti.org>
- If they exist, should we contact them?



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Voyager– the message is out.



<http://voyager.jpl.nasa.gov/spacecraft/sceneearth.html>

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