

AST 248: The Search for Life in the Universe

Fall 2015

TuTh 1:00 - 2:20, Harriman 137

- **Instructor:** James Lattimer [james.lattimer @ stonybrook.edu](mailto:james.lattimer@stonybrook.edu)
 - **Office:** ESS 449, 632-8227
 - **Hours:** M, Tu, W, Th 3:00 - 4:00
 - **Additional assistance** by appointment.
- **TA:** Tianqi Zhao
 - **Office:** ESS 440
 - **Hours:** TBA
- **Course URL** is <http://www.astro.sunysb.edu/lattimer/AST248/>

ANNOUNCEMENTS

Homeworks are posted on Blackboard at least one week before they are due. Completed homeworks must be submitted to Blackboard by the due date and time to be counted. Late homeworks will not be accepted so that the homework solutions can be posted promptly after the due date. This eases studying for exams.

Lecture notes are not posted on Blackboard.

Grades are posted on Blackboard.

- **Required text:** "Life in the Universe" by Bennett and Shostak. You may use earlier editions, but the syllabus is keyed to pages in the third edition. Those pages differ in the first and second editions. You are also responsible for additional material found in the third edition.
- **Supplementary (non-required) texts:** "Here Be Dragons" by Koerner and LeVay, and "The Science of Aliens" by Pickover. "Here Be Dragons" is out of print, but used copies should be available online.
- **Considerable additional material** will be presented in the lectures. Some, but not all this additional material, will be posted on this website in the class notes. In any case, you are responsible for all material presented in class, whether or not it is posted.
- **Exams:** There are three major exams, each counting 20%. Two are administered in class, 29 September and 3 November. The third will administered during the scheduled final exam period on 14 December at 5:30 PM in the regular classroom unless otherwise posted. 80 minutes will be allowed to complete each exam, including the third one. When the exam is announced "over", exams must be turned in immediately or loss of credit is possible. If you arrive late for the exam, you will not be given extra time to complete the exam. If you arrive more than 30 minutes late, without a valid excuse, you may not be permitted to take the exam. An ID is required to take an exam.

The exams will be effectively non-cumulative and they will be curved. Each exam counts 20% of the final grade. The test questions will be multiple choice or true/false and will be machine graded; scantron sheets will be provided but you should bring #2 pencils and erasers. The exams are closed-book and no notes are permitted.

Although some elementary math may be used, no electronic devices such as calculators, phones or computers are permitted to be used.

Grade Correspondence for the Major Exams

EXAM A A- B+ B B- C+ C C- D+ D F

1

2

3

To make up an exam will require a valid, documented excuse (doctor's/infirmarary note, obituary notice, police accident report, etc.). Make-up exams will be administered during Lattimer's office hours on dates to be arranged.

- **Homeworks:** There will be 11 homework assignments, one due every week by Thursday, except the first week, Thanksgiving week, and the two weeks with exams. Homeworks are posted on Blackboard about 1 week before they are due. Your homework responses must be submitted as pdf attachments to blackboard. Any supplementary algebra or math for the homeworks may be scanned and submitted as a jpg or gif file if it is legible. No late homeworks are accepted. In highly special circumstances, with valid excuses, I will prepare alternate homeworks. Homeworks also serve as study aids. Some of the homework questions will appear on the exams. These policies are not inflexible, and lengthy absences for athletic, health or other documentable reasons will be accommodated.

The total of your 9 highest homeworks will count for 20% of your final grade. The lowest homework grade will be dropped.

- **Term Report:** A term report will count 20% of the total grade. The due date for the report is October 16 and must be submitted as a pdf file to blackboard. Papers submitted after October 16 will be assessed the equivalent of 1 letter grade penalty until October 30, 2 letter grades until November 13, and 3 letter grades up to December 14. No papers will be accepted after December 14. You should check Blackboard for the status and grade of your paper.

The length should be approximately 8 - 12 double-spaced typed pages. Make sure your document is readable as a pdf file. Some suggested topics are listed below, but you can write about any specific topic (with a science perspective) closely related to the course. You should find at least three, and preferably more, recent (i.e., within the last 3 years) sources on which to base your report. Books, magazines or newspaper articles are acceptable, as are internet web pages if you identify your sources and conclude they are providing reliable information. (For example, NASA or ESO web pages are suitable. Wikipedia may be used in a supplementary fashion only. TV documentaries and blogs are not acceptable sources of information.) Your report should not use the lecture notes or the required text as primary references,

and neither should it use matter copied directly. Your paper must go into more depth and detail than the textbook or the class notes on your specific topic. Footnotes and detailed referencing are not required, but your paper must include a bibliography containing the sources from which material was taken. If you use a figure or table, you must cite the source at the place where the figure or table appears. Your paper will be graded on its relevance to our course, on its originality (i.e., its synthesis of different sources and contrasting or competing ideas), on its detail and on the quality of the research you performed in its writing.

Some Possible Topics for the Term Paper:

Topic

- 0 Recent Discoveries Concerning Extrasolar Planets
- 1 Recent Developments Concerning the Fermi Paradox and Its Resolution
- 2 Recent Discoveries Concerning Extremophiles
- 3 Recent Discoveries Concerning Mass Extinctions
- 4 The Controversy of Global Warming and the Practicality of Its Mitigation
- 5 Can Interstellar Travel Be Made Practical in Terms of Realistic Physical and Financial Limits?
- 6 Recent Discoveries About the Possibility of Life on Mars, Europa or Titan
- 7 Recent Discoveries About How the Brain Evolved
- 8 Recent Discoveries About the Evolution of Planets Such as Mars and the Relevance to the Origin of Life
- 9 Recent Discoveries Concerning the Origin or Evolution of Life on the Earth
- 10 Ice Cores and What They Tell Us About the History of the Earth and Life
- 11 Asteroid and Comet Impacts: What Can and Should We Do?
- 12 Oxygenation of the Earth's Atmosphere and/or Snowball Earth and Their Roles in Evolution
- 13 Catastrophic Cosmic Events that Could Destroy Life

- **Extra Credit:** A second term report may be written for extra credit. The topic can be any topic you haven't already written about. The amount of extra credit will be determined by the grade you receive: An A will raise any one exam or term paper grade (whichever gives the maximum increase in your overall course grade) by 2 letter grades. A B will raise any one exam or term paper grade by 1 letter grade, and so on. For example, an A on the extra-credit report could raise an exam grade from a C to an A; an B+- on the extra-credit report could raise an exam grade from a C to an B+; a C will not raise a grade at all. The due date for the extra-credit report, as a pdf file to blackboard, is November 19 and no late submissions will be accepted.

Plagiarism - Copying from currently or previously submitted papers or homeworks, copying directly from the WWW without attribution, or copying part of an article or book without reference will result in an "F" for the report or homework and a

complaint will be filed with the student judiciary. Since I cannot determine who copied from who in the case of plagiarism of another student's work, both students will suffer the penalty.

- **Hints on how to succeed: 1, 2.**
 - **Overall Grade: Each exam and the term paper will count 20% each, and the homework counts 20%. The only opportunity for extra credit is to do the extra-credit term report.**
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ACADEMIC INTEGRITY: Each student must pursue his or her academic goals honestly and be personally accountable for all submitted work. Representing another person's work as your own is always wrong. Any suspected instance of academic dishonesty will be reported to the Academic Judiciary. For more comprehensive information on academic integrity, including categories of academic dishonesty, please refer to the academic judiciary website.

ELECTRONIC COMMUNICATION: Email to your University email account is an important way of communicating with you for this course. For most students the email address is 'firstname.lastname@stonybrook.edu', and the account can be accessed here. It is your responsibility to read your email received at this account, which is the only account to which you will receive communications about this course.

For instructions about how to verify your University email address see this. You can set up email forwarding using instructions here. If you choose to forward your University email to another account, we are not responsible for any undeliverable messages.

RELIGIOUS OBSERVANCES: See the policy statement regarding religious holidays. Students are expected to notify the course professors by email of their intention to take time out for religious observance. This should be done as soon as possible but definitely before the end of the 'add/drop' period. They are expected to discuss with the instructor(s) how they will be able to make up the work covered. Students must submit homeworks and term papers by the due date and late penalties will apply. Late penalties can be avoided by submitting papers and assignments in advance or by obtaining advance permission from the instructor.

DISABILITIES: If you have a physical, psychiatric/emotional, medical or learning disability that may impact on your ability to carry out assigned course work, you should contact the staff in the Disabled Student Services office (DSS), 632-6748/9. DSS will review your concerns and determine, with you, what accommodations are necessary and appropriate. All information and documentation of disability is confidential. I am not responsible for delivering an exam to the DSS office unless I

am notified by YOU at least one day BEFORE the exam is scheduled. Do not assume the DSS office will be competent in informing me: you must do so yourself.

Students who require assistance during emergency evacuation are encouraged to discuss their needs with their professors and Disability Support Services. For procedures and information go to [this website](#).

CRITICAL INCIDENT MANAGEMENT: Stony Brook University expects students to respect the rights, privileges, and property of other people. Faculty are required to report to the University Police and the Office of University Community Standards any serious disruptive behavior that interrupts teaching, compromises the safety of the learning environment, and/or inhibits students' ability to learn.

LECTURE TOPICS (SYLLABUS)

AST 248 – The Search for Life in the Universe – Syllabus		
Date	Pages in Text	Topic
Jan 26	1–47	Historical Introduction
Jan 28	48–57	Distances, Masses, Energies
Feb 2	84–89, 370–373	Properties of Radiation
Feb 4 (1)	360–369, 386–395	Stars and Stellar Evolution
Feb 9	63–64, 342–346, 360–368, 386–395	Nuclear Reactions and Nucleosynthesis
Feb 11 (2)	50–70	The Universe and the Anthropic Principle
Feb 16	70–84, 90–100	Formation of the Solar System
Feb 18 (3)	101–122	Radioactive Dating and History of the Earth
Feb 23	123–149, 346–354	Interior of the Earth and Climate
Feb 25	Exam # 1	
Mar 2	150–162	Definition of Life and Evolution
Mar 4 (4)	162–169	Composition of Life
Mar 9	169–179	Metabolism and Heredity
Mar 11 (5)	179–191	Extreme Life
Mar 13	Term paper due	
Mar 23	192–207	Origin of Life
Mar 25 (6)	208–215, 223–236	Evolution of Life
Mar 30	216–223	Impacts and Extinctions
Apr 1 (7)	237–244	Environments for Life
Apr 6	244–244, 252–256	Inner Solar System and Spacecraft Exploration
Apr 8	120–122, 141–145, 244–247, 330–336	Tidal Forces, Moon, Mercury and Venus
Apr 13	Exam # 2	
Apr 15 (8)	244–247, 260–293	Mars
Apr 20	247–249, 294–310	Jovian Planets and Satellites
Apr 22 (9)	311–325, 338–358	Titan and Outer Solar System; the Habitable Zone
Apr 24	Optional extra-credit term paper due	
Apr 27	360–385, 391–395	Extra-Solar Planets
Apr 29 (10)	396–408	Drake Equation
May 4	408–434	SETI and UFOs
May 6 (11)	435–484	Interstellar Travel and the Fermi Paradox
May 12	Exam # 3 – 5:30 PM	

Numbers in parentheses (#) indicate homework # due on this date

LECTURE NOTES

Red = no class; Black = an exam
Red superscript = homework # due

Sun	Mon	Tue	Wed	Thu	Fri	Sat
August 2015						
23	24	<u>25</u>	26	<u>27</u>	28	29
September 2015						
30	31	<u>1</u>	2	<u>3</u>	4 ¹	5
6	7	8	9	<u>10</u>	11 ²	12
13	14	<u>15</u>	16	<u>17</u>	18 ³	19
20	21	<u>22</u>	23	<u>24</u>	25 ⁴	26
27	28	29	30	<u>1</u>	2	3
October 2015						
4	5	<u>6</u>	7	<u>8</u>	9 ⁵	10
11	12	<u>13</u>	14	<u>15</u>	16 ⁶	17
18	19	<u>20</u>	21	<u>22</u>	23 ⁷	24
25	26	<u>27</u>	28	<u>29</u>	30 ⁸	31
November 2015						
1	2	3	4	<u>5</u>	6	7
8	9	<u>10</u>	11	<u>12</u>	13 ⁹	14
15	16	<u>17</u>	18	<u>19</u>	20 ¹⁰	21
22	23	<u>24</u>	25	26	27	28
December 2015						
29	30	<u>1</u>	2	<u>3</u>	4 ¹¹	5
6	7	8	9	10	11	12
13	14	15	16	17	18	19