SYLLABUS
Origin and Evolution of the Universe and Life
HON-329-01
Schmid College of Science and Technology
Chapman University
Fall 2018

Instructor: **Dr. Amir Ahsan**
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Office Hours: Wed, Fri 12:30 – 3:00 pm

Class Information: Lectures: TTh 4:00-5:15 PM
Location: TBD

Course Website: https://blackboard.chapman.edu/

Textbooks:
Required:

- The Cosmic Perspective by Bennett, Donahue, Schneider, & Voit, 8th ed., Pearson, 2017. Modified Mastering Astronomy with Pearson eText. (ISBN-13: 978-0-13-407384-2).

- A Short History of Nearly Everything by Bill Bryson, Broadway Books, 2003 (ISBN-13: 978-0767908184).

Description
This course will cover the modern scientific understanding of the origin and evolution of the universe and life, beginning with the Big Bang and ending with the evolution of life on earth and the possibilities for life on exoplanets. We will cover the history and evolution of the universe from a fraction of a second to the present day and to its possible futures as governed by physical laws ascertained through the scientific method. We will discuss the creation of matter and the elements through Big Bang nucleosynthesis and stellar nucleosynthesis and characterize the evolution of large scale structures including planets, stars and galaxies. We will describe the evolution of our understanding of the concept of space and time, highlighting Einstein's Special and General Relativity and its implications on the fundamental nature of space-time and the recent experimental evidence. We will then proceed to build the earth, characterizing its geological evolution and the concomitant emergence of life and its evolution into the sentient beings capable of understanding the universe to the degree that it can modify its own evolution. This course is the story of our existence and the evolution of our understanding of physical reality through scientific rationalism. This course will require a qualitative and quantitative understanding utilizing basic math skills that will be reviewed during the course though a conceptual understanding will be emphasized.

Prerequisite

None

Course Structure and Grade

The format of the lectures will ideally compose of minimal formal lecture but an environment where a vibrant discussion is established where centrally, the role of the student is not passive. In order to instill a vibrant and active learning environment there is a greater responsibility of students to do the required reading and complete any pre-lecture assignments prior to coming to lecture. There will be 1 midterm exam and 1 final exam and a term paper due at the end of the semester. A tentative calendar below lists the topics that will be covered.

Your overall percentile score will be determined by a weighted combination of your score on the following:

- **Homework Assignments and Pre-lecture Questions: 20%**
- **In-class group work: 10%**
- **Midterm Exam: 25%**
- **Research Term Paper: 20%**
- **Final Exam: 25%**

Your final letter grade will be determined from the following distribution where an absolute scale is used to encourage peer-to-peer instruction with a 'curve' integrated into the distribution:

A	A-	B+	B	B-	C+	C
$\geq 90\%$	$89.9 - 85\%$	$84.9 - 80\%$	$79.9 - 75\%$	$74.9 - 70\%$	$69.9 - 65\%$	$64.9 - 55\%$

C-	D	F
$54.9 - 50\%$	$49.9 - 35\%$	$< 35\%$

Make-up Policy

There will be NO make-ups for missed exams and no late homework accepted. If you have a valid, documentable (i.e. have a written document indicating the circumstances), and verifiable (i.e. with contact information) excuse for missing the midterm exam (e.g. illness with doctor's note, or jury duty with court's notice), then your final exam percent score will be assigned to your midterm percent score.

Reading Assignments and Lectures

It is strongly recommended that you read the assigned sections of the text before they are covered in lecture. In order to facilitate this weekly pre-lecture questions will be assigned through MasteringAstronomy. This will not only familiarize you with the terminology and concepts but also optimize class time to correct misconceptions and facilitate an active-learning environment. Weekly assignments will be given, in-part, through MasteringAstronomy.

Tentative Course Calendar

Week	Tuesday	Thursday
1 (08/27 – 08/31)	**Course Introduction** **Scientific Method** • **Nature of Evidence** • **Perception, Belief and Faith** **Evolution** • **Physical and Biological**	• **Cosmology** • **Evidence for the evolution of the universe** • **Light and the Expansion of the Universe** • **Hubble's Law**
2 (09/03 – 09/07)	**Hubble's Law In-class Activity: Measure the expansion rate and age of the universe**	• **Big Bang and the formation of the simplest elements** • **Elementary particles, antimatter, dark matter and fundamental forces** • **Origin of the Universe?**
3 (09/10 – 09/14)	**The First 3 Minutes** • **Big Bang Nucleosynthesis**	• **Recombination and the cosmic microwave background (CMB)** • **Reionization**
4 (09/17 – 09/21)	**Structure Formation** • **Primordial density fluctuations: Inflation and CMB**	**Structure Formation (cont.)** • **Gravity, dark matter and radiation pressure** • **The first stars and galaxies** • **Supercomputer simulation of structure formation**
5 (09/24 – 09/28)	**Star Formation** • **Interstellar molecular clouds** • **Angular momentum and the formation of disks on all cosmic scales** • **Hierarchy of fragmentation**	**Stellar Nucleosynthesis: Creation of the Elements** • **Hydrogen burning** • **Helium burning**
6 (10/01 – 10/05)	**Stellar Nucleosynthesis** • **Filling in the Periodic Table** • **Massive stars, supernovae, neutron stars, black holes**	**Dating the Universe** • **Oldest Stars** • **Radioisotope dating** • **Nucleocosmochronology**
7 (10/08 – 10/12)	**Nature of Time** **Einstein's Theory of Special and General Relativity**	**General Relativity and the recent detection of Gravitational Waves**

8 (10/15 – 10/19)	**Planet Formation** • **Origin and structure of our solar system** • **Extrasolar Planets**	**Formation of Earth and its Moon** • **Structure of the Earth** • **Origin of the crust and hydrosphere** • **Evolution of earth's atmosphere** • **Origin of the Moon**
9 (10/22 – 10/26)	**Telescope In-class Activity** **Midterm Review**	**Midterm Exam**
10 (10/29 – 11/02)	**Plate Tectonics** • **Continents and Plates** • **Earth over time** • **Paleotectonics**	**Earth's Climate** • **Climate Variations in the history of the Earth**
11 (11/05 – 11/09)	**Universal requirements of Living Organisms** • **Definition of life** • **Carbon chemistry, Alternatives?** • **Solar System's habitable zone** • **Extrasolar scenarios for the emergence of life**	**The Anthropic Principle – Fine-tuning the universe** **The Drake Equation In-class Activity**
12 (11/12 – 11/16)	**The Evidence for Evolution**	**Natural Selection**
13 (11/19 – 11/23)	Thanksgiving Holiday	Thanksgiving Holiday
14 (11/26 – 11/30)	**Building the Tree of Life** **Origin of Animals**	**Biogeography and Evolution** **Origin of Mammals**
15 (12/03 – 12/07)	**Human Evolution**	**Review**

Course Learning Outcomes

1. Describe current scientific understanding of how the universe originated, its composition and its future.
2. Appreciate the scale of the universe in space and time and their nature.
3. Develop a broad understanding of cosmology and astronomy to appreciate modern developments.
4. Achieve a high degree of scientific literacy capable of evaluating scientific arguments using evidence-based reasoning.
5. Be able to understand arguments supported by quantitative evidence.
6. Describe current scientific understanding of the origin of the earth and its evolution to support life.
7. Describe current scientific understanding of the origin of life and the evidence for evolution.

Academic Integrity

Chapman University is a community of scholars that emphasizes the mutual responsibility of all members to seek knowledge honestly and in good faith. Students are responsible for doing their own work and academic dishonesty of any kind will be subject to sanction by the instructor/administrator and referral to the university Academic Integrity Committee, which may impose additional sanctions including expulsion. Please see the full description of Chapman University's policy on Academic Integrity at www.chapman.edu/academics/academicintegrity/index.aspx.

Accommodation for Students with Disabilities

In compliance with ADA guidelines, students who have any condition, either permanent or temporary, that might affect their ability to perform in this class are encouraged to contact the Disability Services Office. If you will need to utilize your approved accommodations in this class, please follow the proper notification procedure for informing your professor(s). This notification process must occur more than a week before any accommodation can be utilized. Please contact Disability Services at (714) 516–4520 or visit www.chapman.edu/students/student-health-services/disability-services if you have questions regarding this procedure or for information or to make an appointment to discuss and/or request potential accommodations based on documentation of your disability. Once formal approval of your need for an accommodation has been granted, you are encouraged to talk with your professor(s) about your accommodation options. The granting of any accommodation will not be retroactive and cannot jeopardize the academic standards or integrity of the course.

Equity and Diversity

Chapman University is committed to ensuring equality and valuing diversity. Students and professors are reminded to show respect at all times as outlined in Chapman's Harassment and Discrimination Policy. Please see the full description of this policy at http://www.chapman.edu/faculty-staff/human-resources/eoo.aspx. Any violations of this policy should be discussed with the professor, the dean of students and/or otherwise reported in accordance with this policy.

Student Support at Chapman University

Over the course of the semester, you may experience a range of challenges that interfere with your learning, such as problems with friend, family, and or significant other relationships; substance use; concerns about personal adequacy; feeling overwhelmed; or feeling sad or anxious without knowing why. These mental health concerns or stressful events may diminish your academic performance and/or reduce your ability to participate in daily activities. You can learn more about the resources available through Chapman University's Student Psychological Counseling Services here:
https://www.chapman.edu/students/health-and-safety/psychological-counseling/

Fostering a community of care that supports the success of students is essential to the values of Chapman University. Occasionally, you may come across a student whose personal behavior concerns or worries you, either for the student's well-being or yours. In these instances, you are encouraged to contact the Chapman University Student Concern Intervention Team who can respond to these concerns and offer assistance:
https://www.chapman.edu/students/health-and-safety/student-concern/index.aspx

While it is preferred that you include your contact information so this team can follow up with you, you can submit a report anonymously. 24-hour emergency help is also available through Public Safety at 714-997-6763.