GEL 028: Astrobiology

Instructor: Qing-Zhu Yin (Professor of Earth and Planetary Sciences)
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Meeting Times: Lecture Tuesdays and Thursdays 1:40-3:00 PM (Zoom on Line)
Office Hour: Wednesdays 5:30-6:30 pm, zoom or by appointment TBA)

General information:
Course Description: Origin, evolution and distribution of life in our solar system and the Universe. Detecting habitable worlds, Drake equations, necessities and raw materials for life, philosophical implications of the search for life elsewhere.

- Origin of life: Chemistry and function of entities that make up a living system, habitable sites in the Universe and on Earth where life's raw materials could have been formed before life began, the mechanisms by which non-biological raw materials may have been combined into the first living organism.
- A habitable world: Is an Earth-like planet essential for life to evolve elsewhere in the Universe? Topics of discussion include: Definition of habitable zones, environments on the early Earth, Mars and the necessity of water, life in extreme environments (e.g., Europa), signs of life in planetary atmospheres.
- Detection and nature of exoplanets: Drake equation, observed and critical properties, ongoing efforts with space telescopes, characteristics of newly discovered exoplanets, probability of planet formation around stars, potential number of habitable planets per planetary system.
- Searching for extraterrestrial intelligence: SETI (Search for Extraterrestrial Intelligence), CETI (also called active SETI by sending signals out).

Grading:
Grades will be based on participation in classes (attendance and discussion 5-10%), reading assignments (if assigned), periodic quizzes (5-10%), mid term (35-40%) and final exams (40-45%), with a ±5% margin for adjustment. Letter grading.

Textbook (Required): *Life in the Universe*, by Jeffrey Bennett and Seth Shostak (4rd Edition), Addison-Wesley Pearson

Recommended Reading (In addition to Reading Assignment of Chapters):

1. Charles H. Langmuir & Wally. S. Broecker (2012) Princeton University Press. How to Build a Habitable Planet: The Story of Earth from the Big Bang to Humankind (Revised and Expanded Edition of 2).
2. Wally. S. Broecker (1987) How to build a habitable planet. Eldigio, Palisades, NY. A classic, must read (A) (Classic)
3. Iain Gilmour, Mark A. Sephton (2003) An Introduction of Astrobiology, Cambridge University Press.
4. Jonathan I. Lunine (2005) Astrobiology, A multidisciplinary Approach. Pearson Addison Wesley.

Tentative Schedule of Topics (subject to change)
One or two topics per week, two lectures each week.

Topics	**Dates**	**Topic**
Theme 1: Introducing Life in the Universe		
1.		1. A universe of life
2		2. The science of life in the Universe
3		3. The universal context of life
Theme 2: Life on Earth		
4		4. The habitability of Earth
5		5. The nature of life on Earth
6		6. The origin and evolution of life on Earth
Theme 3: Life in the Solar System		
7		7. Searching for Life in our Solar System
8		8. Mars
9		9. Life on Jovian Moons
10		10. The Nature and Evolution of Habitability
Theme 4: Life among the Stars		
11		11. Habitability Outside the Solar System
12		12. The search for Extraterrestrial Intelligence
13		13. Interstellar Travel
14		**14 Final**