PHYS 2107
Bennington College
Spring 2025

Stars, Planets, Life

(4 credits)

Class Times: Tuesday/Friday 10:30am – 12:20pm

Me

Hugh Crowl Office: Dickinson 104 Email: hcrowl@bennington.edu Phone: x4481

Office Hours: Tuesdays 2-3:30pm, Wednesday 1-2:30pm, *or by appointment*

Texts: The Cosmic Perspective (8th Edition), Bennett, et al.
Lecture Tutorials for Introductory Astronomy (4th Edition), Prather, Slater, et al.
Supplementary Material will be assigned as needed

Course Homepage: Course materials will be posted at: https://crowl.bennington.edu/spl/

Course Overview: In the last thirty-five years, the study of life beyond our own planet has gone from science fiction to legitimate science. The course will initially focus on how stars form and evolve, starting from the formation of the universe, and continuing to a discussion of stars as both the synthesizers of heavy elements and the central energy source for stellar systems. From there, we will discuss current planetary formation theories, planet detection techniques, and the explosive discovery of planets outside our solar system in the past fifteen years. Finally, we will examine the conditions under which we think life evolves and whether any of the glut of planets we've discovered recently may support life.

Course Goals: After taking this course, you should have an understanding of the way that astronomers search for life beyond our solar system. You should also have an understanding of how physical processes in the universe inform our picture of the formation and evolution of life.

Problem Sets: You will be assigned a problem sets regularly throughout the term. These problem sets will take different forms, but will usually contain a mix of qualitative short answer questions, quantitative problems, and longer-form essay questions. On the quantitative problems, you are encouraged to show your work and state any assumptions you make. This will help me to understand your reasoning and, where appropriate, award partial credit. In general, I do not accept late problem sets. Please see me in extraordinary circumstances. They will be due on the date indicated on the set.

A note on collaboration: Collaboration on problem sets is welcome and, in fact, encouraged. One of the best ways to learn something difficult is to work through it with other students. However, you should ensure that the work you turn in is your own. Distinguishing between these two different aspects of work can be tricky. One good rule of thumb is to work together to get to the right answer, but then write up the problem set on your own, using your own words. It may take some extra time, but it's a way to minimize the chance of plagiarism and also gives you another chance to really understand the material. If you have any questions, ***please ask.***

Planet Projects: As a way to synthesize what we have learned in this class, there will be a final project that will enable you to take a deeper dive into one of the newly discovered planetary systems outside our solar system. More details to follow after Long Weekend.

Class Participation: There is a huge amount of educational research showing that lecture alone is ineffective in ensuring a deep understanding. In the last couple decades, interactive lecturing has found its way into what were traditionally more lecture-focused classes. While Bennington classes usually are more discussion-based, we will use some of the techniques to help generate discussion in the class.

Voting Cards

I will give you a card at the beginning of the term, which allows you to represent one of four choices. Most days, there will be several opportunities to vote and confer with your neighbors. These discussions and participating in class voting are an important part of your class participation grade.

Lecture Tutorials

There will be several points throughout the term where you will, in class, work through conceptual exercises designed to help you gain a fuller understanding of the material. These serve as a good "check" of your understanding and allow you to more fully engage with the material.

Please note that *class attendance is mandatory*. Missing even one class can seriously affect your class participation grade. Missing more than 3 classes during the semester may lead to you failing the class. Please see me in extraordinary circumstances.

Tests/Quizzes: There will be approximately five in-class short tests through the term. You must inform me in advance of a test if you need to miss it. Tests cannot be "made-up" if I am not notified before the time of the test. Make-ups must be done before graded tests are returned to the class (typically the next class meeting).

Resources for Help: Building a quantitative understanding of astronomical principles can prove challenging. It is likely you will need help. There are a number of options for getting help:

- *Work with a classmate*: On all the non-quiz parts of this class, I expect you will collaborate (with one another, and with me!). You are strongly encouraged to work on the problem sets together in small groups (2-4 people tends to work best) and ask questions of me and/or of the larger class group when your smaller group gets stuck.
- *Ask questions at the start of class:* The first part of each class session is generally reserved for questions/discussions about currently assigned problem sets. Please come to class with any questions you have.
- *Come to Office Hours*: If you have further questions or would just like to talk, make a plan to attend my office hours (in Dickinson 104). I have set office hours for Tuesday & Wednesday afternoons, but I am happy to meet with you at other times that work for both of us.
- *Go to the Math Tutors*: There are (free!) Math Tutors that are happy to help you with any troubles you've been having with the more mathematical side of things. While any of the tutors can help you with mathematical questions, at least some of the math tutors are also physics & astronomy students who will be particularly adept at helping with more physics-central things. Details to follow. You can contact them to set up appointments by emailing them at mathtutors@bennington.edu

Academic Accommodations: Bennington College provides reasonable accommodations to students with documented disabilities when such accommodations are requested and necessary to ensure equal access to College programs and facilities. If you believe you are entitled to an accommodation speak with Katy Evans, the Academic Services and Accommodations Advisor, about any disability-related needs. If approved, you will receive a memo detailing your specific accommodations; it is your responsibility to provide me with the memo and discuss the implementation of accommodations. Note that I will not be aware of your needs if you do not share this memo with me. Accommodations are not retroactive, so the sooner we meet to discuss your needs, the better. Also, students experiencing mental and/or physical health challenges that are significantly impacting their academic work are encouraged to speak with their faculty advisor and member of Academic Services (academicservices@bennington.edu or 440-4400) about the impact and to connect with resources through health and psychological services (440-4426 or 440-4451).

Evaluation/Grading:

Problem Sets: 35% Tests/Quizzes: 35% Class Participation: 15% Final Project 15%

Tentative Schedule (likely to change)

Week of	Topic	Reading
February 17	Foundations + The Early Universe	Chapters 20, 22-23
February 24	Light	Chapter 5
March 3	Star Formation	Chapters 15 - 16
March 10	Stellar Structure and Evolution	Chapter 17
March 17	Stellar Death	Chapter 18
March 24	Cosmic Recycling and Planet Formation	Chapter 19
March 31	Planet Formation/Our Solar System	Chapters 7 & 8
April 7	Discovery of Extrasolar Planets *(no class Tuesday)*	Chapter 13
April 14	Discovery of Extrasolar Planets	Chapter 13
April 21	The Kepler Revolution (*no class Friday*)	Chapter 13
April 28	Extrasolar Planet Demographics	Supplementary Reading
May 5	Habitability (*no class Tuesday*)	Chapter 10
May 12	Early Life on Earth	Chapter 24
May 19	The Search for Life in the Universe	Supplementary Reading
May 26	The Search for Intelligent Life	Supplementary Reading