PHYS 2106
Bennington College
Spring 2026

Stars and Galaxies

(4 credits)

Class Times: Monday/Thursday 10am – 11:50am

Me

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Office: Dickinson 104 Phone: x4481

Office Hours:, Wednesday 9:30-11am, Thursdays 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.

Course Homepage: Course materials will be posted at: https://crowl.bennington.edu/starsgals/ Make sure to regularly check our course page there to ensure you get all of the relevant information.

Course Overview: All but a handful of the objects you see in the night sky are stars in our Galaxy, the Milky Way. These stars are not just points of light, but large, gravitationally-bound balls of plasma governed by the laws of physics. These stars are found with dust, gas, and dark matter in larger structures called galaxies. These galaxies, in turn, are found in even larger structures called groups and clusters. As the universe has aged, stars, galaxies, and clusters of galaxies have changed and evolved. In this course, we will study the formation and evolution of stars, the formation and evolution of galaxies, and how these galaxies fit into the large-scale structure of the universe.

Course Goals: After taking this course, you should have a better understanding about the formation and evolution of stars and galaxies. Moreover, you should be able to think quantitatively about astrophysically interesting problems and have a sense of scale.

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 required 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 (usually within about a week of being assigned).

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 challenging. 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.***

Observing: A small, but important, part of this class will be to spend some time observing at Stickney Observatory. You will be guided one of the upper-level astronomy students (or me) and will be asked to sketch your observations through the telescope. More information forthcoming later in the term and will be posted at the observatory's web page at https://observatory.bennington.edu/

Class Participation: There is a large amount of educational research showing that lecture alone is ineffective in instilling a deep understanding. In the last couple decades, interactive lecturing has found its way into large lecture classrooms. We're really lucky here at Bennington that we don't need to figure out how to teach and learn in 200-person classes, but we can use what they have learned to help us here.

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 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. *These will **not** be graded, but part of your class participation grade is based on you working seriously these exercises.*

Please note that ***class attendance is mandatory***. Missing even one class can seriously affect your class participation grade. Missing more than 2 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, in class, ask questions of me and 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*: In addition to asking questions in class and working together outside of class, please plan to attend my office hours. I have set office hours for Wednesday morning and Thursday afternoon, 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. Specific tutoring hours are forthcoming, but are typically held on weeknight evenings in Dickinson. Look for signs around the building in the coming weeks or email mathtutors@bennington.edu for more information.

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, contact the Director of Student Accessibility Services (accommodations@bennington.edu) 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 a member of Academic Services (academicservices@bennington.edu or 802-440-4400) about the impact and to connect with resources through health and psychological services (440-4426 or 440-4451).

Evaluation/Grading:
30% Problem Sets 10% Observing 20% Class Participation 40% Tests/Quizzes

Tentative Schedule (likely to change)

Week of	Topic	Reading
Feb. 16	Foundations	Chapter 1
Feb. 23	Light	Chapter 5
Mar. 2	Light (cont.)	Chapter 5
Mar. 9	The Sun & Other Stars (*no class Thursday)*	Chapters 14 & 15
Mar. 16	Stellar Evolution & Star Death	Chapter 17
Mar. 23	Star Death & Cosmic Recycling	Chapters 18 & 16
Mar. 30	The Milky Way	Chapter 19
Apr. 6	The Milky Way (*no class Monday)*	Chapter 19
Apr. 13	Galaxies in the Local Universe	Chapters 20.1 & 21
Apr. 20	Environmental Effects on Galaxies	Chapter 21
Apr. 27	Groups & Clusters of Galaxies	Chapter 21
May 4	Dark Matter & Dark Energy	Chapter 23
May 11	DM/DE (cont.)	Chapters 23
May 18	Cosmology	Chapter 22
May 25	Cosmology (cont.)	Chapters 22 & 23