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# ASTR 102-001: Introductory Astronomy II

3 credit hours **Fall 2021**. TTh 2-3:15 pm Caldwell 105

**Instructor:** Prof. Gerald Cecil (cecil@unc.edu, Philips Hall 268)

**Office Hour:** T 12:30-13:30 pm or by appointment

**Prerequisite & Corequisite:** To maximize course offerings this semester, pre- and co-requisites for ASTR 102 are WAIVED. You may take ASTR 101 and/or ASTR 102 together or separately in any order. There is little overlap in material.

## Course Description from Catalog

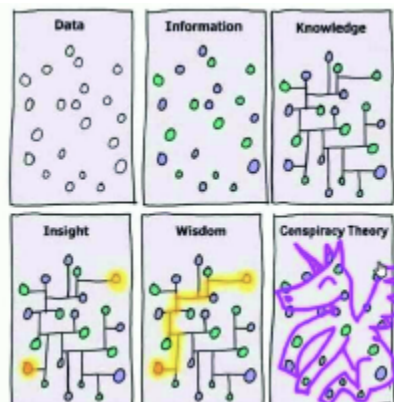
The sun, stellar observables, star birth, evolution and death, novae and supernovae, white dwarfs, neutron stars, black holes, the Milky Way galaxy, normal galaxies, active galaxies and quasars, dark matter, dark energy, cosmology, the early universe." Gen ed. PL code.

## Your Learning Outcomes

This course will not bombard you with factoids to memorize. Instead we'll develop topics to understand the limits of our knowledge and what is in store in the future. We will work together to ensure that YOU will be able to

- describe how temperature and gravity of the Sun vary from its surface atmosphere to its fusing core, explaining how we know these physical conditions throughout. Explain why gas stars seem to have a solid surface. Explain how the Sun and other stars interact with their planets by photons and particle winds. Describe the evolution of a star's interior and changes in its surface appearance as it evolves from birth to death. Explain realistic prospects and travel time for near-term interstellar travel.
- explain the origin of all elements in the Periodic Table by fusion in stable and exploding stars. Explain how fusion in stars differs from that in experimental fusion reactors. Explain the properties and methods of study of the cosmic mix of gas and dust between the stars and galaxies, and why this material contains the building blocks of life.
- explain the evidence that luminous matter comprises only a few percent of the matter in the Universe, the rest being dark, but understand what candidates are under investigation.
- explain cosmological models of the history of the Universe. Recount current observational status on our measurements of how old and big it is. What might be its ultimate fate?

These can be profound and mind-altering topics if we avoid rote memorization and instead "live" the subject. The best way to learn the material is to discuss and explain it to others, first classmates, later people beyond. We'll aim to move through this diagram but avoid the final panel! In Bloom's *Taxonomy of Education Goals and Objectives*, the hierarchy between Knowledge and Wisdom in the figure is further subdivided into insight, application, analysis, synthesis, and evaluation.



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MY role in this is to guide YOUR learning of scientific astronomy, understanding of big ideas in this field, and developing your lifetime interest in the subject. This science WILL change radically in your life and potentially some of you will work not just in space industries, but in space itself. Rather than spend classtime passively, you will be actively engaged in learning activities. If COVID doesn't push us onto Zoom again, you will be posed questions to work on in pairs to clarify important topics.

**Readings** are assigned specifically on Sakai from 8<sup>th</sup> or 9<sup>th</sup> edition of Chaisson & McMillan's *Astronomy Today*. If you took ASTR 101 and have the split vol 1 then you'll need vol 2. If you have the whole book, you are set. 8th and 9th ed are essentially the same, but you can rent the 8th ed for far less from Amazon or for more from the campus bookstore. This book is better than many but still heavy with factoids. I'll highlight the parts that you'll benefit from reading.

My lectures are pre-recorded videos that highlight and supplement the textbook material. Please read each chapter before it is covered in class and view the lecture. You are responsible for material covered the lectures and text. Classtime will be spent assessing your understanding of the material, discussing the most important parts, and working examples that will likely reappear on the "mid-terms" and final.

**WebAssign Homeworks** To register, go to <http://webassign.net>, select "Enter Class Key", and follow the instructions. Our class is 6743 5693

You have two weeks to pay for your account by credit or debit card online after you login. Cost should be under \$25. Alternatively, you can purchase an access code card at the campus bookstore for a significantly marked-up price.

At the top of each lesson's homework, you will find links to each lesson's reading assignment, and supplementary notes (including all equations used in the course). Your grades will be available on WebAssign.

### **Topic Sequence (and in-class discussion topics)**

1. astronomy/astrophysics requires a bit of knowledge of atoms and photons, normally covered in ASTR 101. So, in this odd schedule, we will cover this topic. Class discussion: how do we detect life on exoplanets?
2. powering stars and humanity by fusion. Discussion: why do we need potent power sources when we explore nearby stars?
3. Star/planet formation. Discussion: why are the most interesting regions dusty?
4. Star/planet death. Discussion: why do stars blow up?
5. Forming the elements. Discussion: what part of us is stardust?
6. Our Milky Way Galaxy. Discussion: where is everyone and what forms might they take?
7. Other galaxies, dark matter. Discussion: what might the "dark sector" look like and how can we find out?
8. The Expanding/Evolving Universe. Discussion: how did the subject develop historically? What role for technology?
9. Cosmological Models, dark energy. Discussion: what are the forefront controversies?
10. The Origin and Fate of the Universe. Discussion: how can be sure of any of this?

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## Grading Rubric

- 2.5 hr **final exam at noon Dec 7, 2021**, comprehensive 25%
- project 25%. On a course theme of your choice (I can make suggestions), a 12 -page double-spaced report with figures and references (guidance later). Can include work with the SkyNet telescopes (used in ASTR 101L) for which instruction will be given. Outline due by Halloween, report due just before Thanksgiving.
- Assignments every 2 wks, due the following wk on WebAssign. These are mostly multiple choice and short answer questions with answers uploaded to WebAssign. 20%
- Two 75-min in-class tests to be scheduled soon, 15% each

## Academic and Course Policies

### Community Standards in Our Course and Mask Use

This semester, while we are in the midst of a global pandemic, all enrolled students are required to wear a mask covering your mouth and nose at all times in our classroom. This requirement is to protect our educational community — your classmates and me – as we learn together. If you choose not to wear a mask, or wear it improperly, I will ask you to leave immediately, and I will submit a report to the Office of Student Conduct. At that point you will be dis-enrolled from this course for the protection of our educational community. Students who have an authorized accommodation from Accessibility Resources and Service have an exception. For additional information, see Carolina Together.

### Class Attendance Policy

No right or privilege exists that permits a student to be absent from any class meetings, except for these University Approved Absences:

- Authorized University activities Disability/religious observance/pregnancy, as required by law and approved by Accessibility Resources and Service and/or the Equal Opportunity and Compliance Office (EOC)
- Significant health condition and/or personal/family emergency as approved by the Office of the Dean of Students, Gender Violence Service Coordinators, and/or the Equal Opportunity and Compliance Office (EOC).

I will work with you to meet attendance needs that do not fall within University approved absences. For situations when an absence is not University approved (e.g., a job interview or club activity). Please communicate with me early about potential absences. Please be aware that you are bound by the Honor Code when making a request for a University approved absence.

This is a fast-paced course with in-class discussions and work assignments. I have pre-recorded most lectures so you **MUST** view them and do assigned textbook reading beforehand. Then the classes that week can discuss fascinating concepts with familiarity, and take short ungraded quizzes to confirm comprehension or guide reiteration of key points. Although my videos are often built around textbook figures, what I say will complement the textbook that I **ASSUME YOU HAVE READ BEFOREHAND**. My video recordings include YouTube and other sources embedded or linked for further elaboration with improved production values to hold your interest.

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## **Honor Code**

All students are expected to follow the guidelines of the UNC honor code. In particular, students are expected to refrain from “lying, cheating, or stealing” in the academic context. If you are unsure about which actions violate that honor code, please see me or consult [honor.unc.edu](https://honor.unc.edu). (source: Department of Asian Studies). You will work in pairs on in-class activities. All other work must be yours alone.

## **Late Submission Policy**

Unless you make prior arrangements with me or have a University excuse, you will lose 10% of assignment points each late day. This is automatic on WebAssign.

## **Syllabus Changes**

I reserve the right to change the syllabus, including WebAssign due dates when unforeseen circumstances require. These changes will be announced as early as possible so that you can adjust schedules. I will not change mid-term dates once set.

## **Academic Resources**

### **Accessibility Resources and Services**

The University of North Carolina at Chapel Hill facilitates the implementation of reasonable accommodations, including resources and services, for students with disabilities, chronic medical conditions, a temporary disability or pregnancy complications resulting in barriers to fully accessing University courses, programs and activities.

Accommodations are determined through the Office of Accessibility Resources and Service (ARS) for individuals with documented qualifying disabilities in accordance with applicable state and federal laws. See the ARS Website for contact information: <https://ars.unc.edu> or email [ars@unc.edu](mailto:ars@unc.edu).

### **Counseling and Psychological Services (CAPS)**

CAPS is strongly committed to addressing the mental health needs of a diverse student body through timely access to consultation and connection to clinically appropriate services, whether for short or long-term needs. Go to their website: <https://caps.unc.edu/> or visit their facilities on the third floor of the Campus Health Services building for a walk-in evaluation to learn more.

### **Title IX Resources**

Any student who is impacted by discrimination, harassment, interpersonal (relationship) violence, sexual violence, sexual exploitation, or stalking is encouraged to seek resources on campus or in the community. Reports can be made online to the EOC at <https://eoc.unc.edu/report-an-incident/>. Please contact the University’s Title IX Coordinator (Elizabeth Hall, interim – [titleixcoordinator@unc.edu](mailto:titleixcoordinator@unc.edu)), Report and Response Coordinators in the Equal Opportunity and Compliance Office ([reportandresponse@unc.edu](mailto:reportandresponse@unc.edu)), Counseling and Psychological Services (confidential), or the Gender Violence Services Coordinators ([gvsc@unc.edu](mailto:gvsc@unc.edu); confidential) to discuss your specific needs. Additional resources are available at [safe.unc.edu](https://safe.unc.edu).