Introductory Astronomy

A College Level Science Course for High School Students
(and Advanced Middle Schoolers)

Astro 101 / 102 / 103: Course Information

This is a fun, inspiring, and academically challenging astronomy course created especially for advanced homeschoolers who are ready for something beyond the usual science class. It's based on the kind of course you'd find in college— redesigned by astronomers and scientists to be exciting, hands-on, and accessible for teens.

Students will explore planets, stars, black holes, galaxies, and more through interactive labs, stargazing, real science projects, and weekly assignments that spark curiosity and build confidence. Whether your student dreams of becoming a scientist or just loves looking at the night sky, this course is designed to ignite their passion for space and help them think like a real astronomer.

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Want to sign up or learn more?

← Scan to Enroll in the Course!

Instructor Information

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Aurora Lipper is an astronomer, mechanical engineer, and science educator with over 25 years of teaching experience. She holds a Master's degree in Mechanical Engineering with a focus on gas dynamics and complex fluid flow for high performance jet engines. Aurora has taught engineering courses at the university level and currently serves as a guest lecturer for local high schools and Cal Poly.

She is the founder of *Supercharged Science*, an award-winning STEM curriculum used by thousands of homeschool families and charter schools. Aurora is also the president of the Central Coast Astronomy Society, where she leads public star parties, telescope demonstrations, and community science outreach. In 2025, she was appointed a NASA/JPL Solar System Ambassador in recognition of her efforts to bring astronomy to wider audiences.

Aurora is the author of *Astronomy Activities for Kids* (Penguin Random House, 2021), a bestselling book with over 1,000 five-star reviews. She brings her passion for space, teaching, and hands-on learning into every lesson to spark curiosity and confidence in her students.

Prerequisites

This is a college-level introductory astronomy course adapted for high school (and advanced middle school) homeschoolers. Students are not expected to have prior experience in astronomy, but they should meet the following prerequisites to ensure success:

- **Math Proficiency:** Students should be comfortable with solving basic equations ($3x + 1 = 10$), working with scientific notation ($17{,}500 = 17.5 \times 10^3$), ratios (like miles per hour), operations on powers of ten, and it's helpful to be familiar with simple graphs. Full details on page 7.
- **Reading & Comprehension Skills:** Students should be able to read and understand nonfiction texts at a high school or college level, as the course includes physics concepts presented through detailed readings, diagrams, and data visualizations. Textbook reading is essential for this course.
- **Independent Study Habits:** Since this course meets only once per week, students are expected to manage weekly reading assignments, complete labs and projects independently, and engage in self-directed learning between class sessions. We'll help you learn how to do this!
- **Curiosity and Commitment:** A love of science and a willingness to ask big questions is essential! Students will explore not just facts, but the *process* of science, including how we know what we know about the universe.

And don't worry—if math isn't your favorite subject or you don't feel confident with it, you're still absolutely welcome! We'll walk through the math step-by-step together, and there's plenty of room for asking questions, building confidence, and learning by doing. All students with an interest in space or the natural sciences will find themselves right at home.

Course Format

This course meets once per week and blends college-level content with an engaging, hands-on learning experience designed specifically for high school (and advanced middle school) homeschoolers.

Each week includes:

- **Live Class Session (1x/week):** Students participate in an interactive in-person class that includes group discussions, guided instruction, mini-lectures, demonstrations, and lab activities. Students are expected to come prepared, having read the assigned material before class. (p. 11)
- **Weekly Assignments:** Between class sessions, students will complete reading assignments, short-answer homework questions, and weekly review quizzes to reinforce key concepts. Most homework is focused on understanding and applying big ideas, not busywork. (p. 11)
- **Lab Activities & Projects:** Labs are designed to be fun, hands-on, and inquiry-based. Some labs are completed during class, while others are started in class and finished at home. Projects include long-term investigations, creative presentations, and real astronomical observations.
- **Podcast Passport Journals:** Each week, students will listen to a space-related podcast of their choice and write a short reflection. This encourages students to explore current science topics and make personal connections with the material. (p. 19)
- **Astronomer Spotlight Presentations:** Students will research and present a short report on an influential astronomer, helping them learn to communicate science and appreciate the human side of discovery. (p. 21)
- **Optional Stargazing Events:** Students are invited to attend monthly stargazing nights hosted by their local astronomical astronomy club, or participate in the online stargazing sessions hosted by the Central Coast Astronomy Society. These events offer telescope access, sky tours, and real-world application of course content. (p. 15)

This flexible yet structured format is designed to build deep understanding while allowing room for creativity, curiosity, and student-led exploration.

Materials Required

To get the most out of this course, students will need the following materials. Most items are low-cost or free, and we've selected tools that are easy to use at home or during stargazing events.

📚 Required Textbook

- *The Cosmic Perspective*, 10th Edition by Bennett et al. This college-level textbook is filled with clear explanations, visuals, and real-world examples. It will be used weekly for reading assignments, discussions, and homework. You may rent or purchase it from the publisher.

🔭 Astronomy Tools

- **Binoculars (for Stargazing):** A good pair of binoculars will allow students to observe the Moon, planets, star clusters, and more. (Note – a telescope is neither recommended *nor* required.) Binocular minimum size is 7x50 (magnification x aperture), maximum is 10x50. If you need a recommendation, Celestron *Cometron 7x50* are an excellent, beginner-friendly choice.
- **Star Maps:** Free printable monthly sky charts from www.SkyMaps.com are used throughout the course for locating constellations, tracking planetary motion, and identifying deep-sky objects. Please select your hemisphere so it matches *your* night sky. New charts published monthly.
- **Planetarium Software:**
    - Stellarium (free for PC/Mac/Linux) – realistic digital night sky
    - SkySafari (mobile app for iOS/Android, free or paid) – helpful for outdoor stargazing
    - Optional: *Star Walk 2* or *Sky Guide* for quick, mobile-friendly sky exploration

🔬 **Scientific Data Tools:** Students will access and analyze real (and free) astronomical data during projects. **AAVSO** (American Association of Variable Star Observers) – used for star brightness analysis and observation-based labs. All training will be provided—no previous experience required.

🧰 General Supplies

- **3-ring binder with 5 dividers** (1.5–2" size recommended) Students will use this binder as their main organizer for coursework and handouts. Suggested divider tabs:
    1. **Notes & Reading** – your notes on reading and key concepts from in class
    2. **Podcast Passport** – weekly podcast reflections after a podcast (p. 19)
    3. **Astronomer Spotlight** – research notes, poster, and grading rubric (p.21)
    4. **Homework & Quizzes** – weekly assignments and graded materials
    5. **Labs & Projects** – all in-class labs, take-home projects, and instructions

- College-ruled lined paper (hole-punched)
- Scientific calculator (TI-84 or a basic scientific calculator Ti-30x)
- Ruler (6–12", with both inches and centimeters)
- Compass and protractor (for orbital geometry and lab use)

📱 **Optional Material Lists for Hands-on Discovery Projects:** Students who are excited to explore astronomy firsthand through their own observations and want to make real astronomical discoveries will have opportunities throughout the year. Here is a basic list of items:

- **Smartphone with a good camera** 2020 or newer with manual control features work best. (Note – if you have access to a DSLR camera with tripod, please use that instead.)
- **Smartphone tripod or clamp** To stabilize your phone for long-exposure or time-lapse images.
- **Manual camera control app** Allows you to adjust shutter speed, ISO, and focus: *iOS:* NightCap, ProCamera; *Android:* ProCam X, Manual Camera. Be sure to get a remote release for your setup.
- **Bubble Level, Compass** and **Stopwatch** can be handheld measuring tools or apps on a phone.

Note: *Additional materials will be needed later in the course for upcoming projects. We'll let you know exactly what's needed as we get closer to those lessons, so you'll have time to prepare.*

Course Objectives & Learning Goals

This course is designed to give students a strong foundation in astronomy while building the critical thinking and scientific reasoning skills that real astronomers use every day. By the end of this course, students will be able to:

- **Understand our place in the universe** by exploring the scale, structure, and history of the cosmos—from Earth to galaxies and beyond.
- **Explain how scientists learn about space** using observation, experimentation, mathematical reasoning, and the scientific method.
- **Apply basic physics concepts** (like motion, gravity, energy, and light) to understand how celestial objects move, shine, and interact.
- **Use astronomical tools and models**, including binoculars, star charts, and planetarium software, to identify constellations, planets, and deep-sky objects in the night sky.
- **Investigate the formation and evolution of the solar system**, including the planets, moons, asteroids, and comets—and what makes Earth unique.
- **Analyze real scientific data** from professional astronomy databases (such as AAVSO) to understand star behavior and changes over time.
- **Communicate scientific ideas clearly** through projects, presentations, and written reflections that demonstrate curiosity, creativity, and personal insight.
- **Build confidence as an independent learner**, developing the study habits and inquiry skills that support success in future science, math, or engineering courses.

More than just learning facts, students will come away from this course with a deeper sense of wonder, a sharper eye for the night sky, and the tools to keep exploring long after the class is over.

Math in Astronomy

This course is all about exploring the universe—but to truly understand what's happening in space, we sometimes need to use a little math. Don't worry—this isn't a math class, and you're not expected to be a math expert. You don't even need to love math to succeed here.

Each week, we'll take a short pause for a *"Math Moment"*—a friendly, guided explanation of the math concepts used in that lesson. These are short, simple walk-throughs that show you how math helps us understand things like:

- How far away a star really is
- How fast a planet is moving
- Why light changes color depending on its energy
- How telescopes magnify the sky
- What makes one star brighter than another

These mini-lessons are designed to:

- Explain math concepts step-by-step (we won't assume you already know it)
- Focus only on what you need to understand the science
- Build your confidence using real-world numbers and tools
- Show how math is *actually useful* (and even kind of cool!)

Some of the topics we'll gently introduce include:

- Ratios and proportions (for brightness and distances)
- Graph reading (to understand star spectra, magnitudes, etc.)
- Angular measurements in degrees, radians, and arcseconds (for parallax and binary stars)
- Right angle geometry calculations (for small angle measurements)
- Kepler's Laws (for planetary motion), Rayleigh Criterion (for telescope resolution)

 Whether you're confident with math or feel a little shaky, you'll be in good company—and supported every step of the way. You can ask questions, practice at your own pace, and revisit examples whenever you need to.

Recommended Math Skills for This Astronomy Course

✅ Number Sense & Scientific Notation

- Reading and comparing large and small numbers (e.g., distances in light-years, sizes of planets)
- Converting between standard (35,000), scientific notation (35 x 10^3) and engineering (35E3)
- Performing basic operations with scientific notation (multiply/divide powers of ten) ↓

$$\frac{1.5 \times 10^8}{3.0 \times 10^5} = 5.0 \times 10^2$$

✅ Algebra Foundations

- Solving basic one- and two-step equations (5x = 30 *or* 4x – 3 = 9)
- Rearranging formulas to isolate a variable
- Understanding and using ratios and proportions
- Recognizing and interpreting simple linear relationships (*y = mx + b* form)

✅ Geometry Basics

- Understanding angles in degrees (used for position angles, sky motion, etc.)
- Familiarity with circles and triangles (for orbit shapes, parallax triangles, angular separation)
- Basic concepts of circles including radius, diameter, circumference, and π

✅ Measurement and Units

- Converting between metric units (km, m, cm, etc.)
- Comfortable with time calculations (e.g., hours → minutes; days → years)
- Recognizing and working with speed, distance, and time (v = d/t)

✅ Graphing & Data Interpretation (Optional, helpful, but not required)

- Reading and interpreting x-y graphs
- Identifying trends, peaks, and patterns
- Understanding axes, scales, and units
- Plotting simple data points on a graph (e.g., temperature vs. brightness)

If your student has completed Pre-Algebra or early Algebra 1, they'll have what they need. They don't need to master all these skills in advance—we'll guide them through the math as it comes up in each lesson. The focus is on applying math in context, not memorizing formulas, or doing abstract math drills.

NGSS Alignment

Aligned with the **Next Generation Science Standards (NGSS)** for high school Earth and Space Sciences, this course emphasizes scientific modeling, data analysis, and systems thinking while exploring astronomy through hands-on investigation and real-world data.

Earth & Space Science (HS-ESS1–ESS3)

HS-ESS1-1 Develop a model based on evidence to illustrate the life span of the Sun and the role of nuclear fusion in the Sun's core. → Covered in: Ch. 14–15 (*Our Star*, *Surveying the Stars*)

HS-ESS1-2 Construct an explanation of the Big Bang theory based on astronomical evidence of light spectra, motion of galaxies, and composition of matter. → Ch. 20–22 (*Galaxies and the Foundation of Modern Cosmology*, *The Birth of the Universe*)

HS-ESS1-3 Communicate scientific ideas about how stars produce elements over their life cycle. → Ch. 17–18 (*Star Stuff*, *Stellar Graveyard*)

HS-ESS1-4 Use mathematical or computational representations to predict the motion of orbiting objects in the solar system. → Ch. 4–9 (Kepler's Laws, launch windows, orbit tracking); real-world applications through solar rotation measurements, double-star angular separation tracking, and exoplanet orbital estimations based on archived observations

HS-ESS2-4 Use a model to describe how variations in the flow of energy into and out of Earth's systems result in changes in climate. → Ch. 10 (*Planetary Atmospheres*), with comparisons between Earth, Venus, and Mars

HS-ESS3-1 Construct an explanation based on evidence for how the availability of natural resources has influenced human activity. → Addressed during discussions on habitability, planetary science, and Ch. 24 (*Life in the Universe*)

Physical Science (HS-PS3 & HS-PS4)

HS-PS3-1 Create a computational model to calculate the change in energy of one component in a system when energy is transferred. → Gravitational and kinetic energy calculations in orbital motion labs

HS-PS4-1 Use mathematical representations to support claims about relationships among frequency, wavelength, and wave speed. → Ch. 5 (*Light and Matter*), including real measurements of spectral lines and Doppler shift interpretation

HS-PS4-3 Evaluate the claims that electromagnetic radiation can be modeled as both waves and particles. → Investigations into photon behavior, spectroscopy, and cosmic background radiation analysis

(NGSS Alignment… continued)

🧠 **Science and Engineering Practices (SEPs) — Emphasized Throughout the Course**

Your student-led investigations make this a true NGSS-aligned, three-dimensional course. Students will:

- **Develop and use models**: Star motion, parallax, orbital systems, stellar evolution
- **Plan and carry out investigations**: Including parallax labs, solar rotation tracking, exoplanet motion analysis, and double-star measurements
- **Analyze and interpret data**: Using professional data (AAVSO, archived astronomical images, binary star records)
- **Use mathematics and computational thinking**: To determine angular separation, orbital periods, brightness variation, and light curve interpretation
- **Construct explanations and design solutions**: Through research presentations and lab-based discoveries
- **Engage in argument from evidence**: Evaluate scientific models (e.g., geocentric vs. heliocentric, competing solar system formation theories)
- **Obtain, evaluate, and communicate information**: Via projects like the Astronomer Spotlight, Podcast Passport, and final presentations

🌐 **Crosscutting Concepts (CCCs) – Woven Into Every Unit**

- **Patterns**: Star classification, planetary orbits, variable star light curves
- **Scale, Proportion, and Quantity**: Cosmic distances, mass/luminosity relationships, time scales
- **Systems and System Models**: Solar systems, galaxies, telescope optics
- **Stability and Change**: Stellar life cycles, planetary climate evolution, orbital changes over time
- **Energy and Matter**: Energy transfer in stars, radiation, photosynthesis on exoplanets
- **Structure and Function**: Telescopes, star anatomy, planetary atmosphere structures
- **Cause and Effect**: Impact of gravity on orbits, light interaction with matter, planetary climate systems

🎯 **In Summary:** This Astronomy 101/102/103 course is fully aligned with NGSS high school science standards, particularly Earth and Space Sciences (HS-ESS1–3) and Physical Sciences (HS-PS3–4). The course emphasizes NGSS three-dimensional learning through authentic, student-led investigations. Activities include measuring stellar parallax, analyzing solar rotation, calculating exoplanet orbits, and conducting real double-star research. Students engage in scientific modeling, data analysis, and inquiry using current tools, techniques, and professional databases such as AAVSO. These experiences are designed to develop critical thinking, scientific literacy, and a deep appreciation for the universe.

👀 This symbol † is called a *dagger*—it's often used for footnotes or to mark something special in academic writing. A *double dagger* (‡) is used after the dagger has been used to avoid confusion when indicating a footnote or reference.

Major Units & Weekly Topics for Academic Year 2025-26

Live Class	Week	Part	Topic	Reading	Lab Project
Sept 10	1	Getting Started	Ch 1 Modern View of the Universe	p. 1-20	Build Scale Models
Sept 17	2	Part 1: Developing Perspective	Ch 2 Discovering the Universe *	p.24-49	Telescope Resolution
Sept 24	3		Ch 3 Science of Astronomy †	p. 53-80	Earth Size Lab
Oct 1	4		S1 Celestial Timekeeping‡	p. 84-104	Sideral & Solar Lab
Oct 8	5	Part 2: Key Astronomy Concepts	Ch 4 Making Sense of the Universe *	p.110-132	Stellar Temperature
Oct 15	6		Ch 5 Light & Matter‡	p.137-161	Spectrometer
Oct 22	7		Ch 6 Telescopes †	p.165-186	Build a Telescope
Oct 29	8	Part 3: Learning from Other Worlds	Ch 7 Our Planetary System‡	p.192-213	Mission to Mars
Nov 5	9		Ch 8 Formation of the Solar System*	p.217-233	Radiometric Dating
Nov 12	10		Ch 9 Planetary Geology‡	p.237-272	Crater Impact Lab
Nov 19	11		Ch 10 Planetary Atmospheres †	p.276-314	Atmosphere Lab
Nov 26	12		Ch 11 Jovian Planet Systems ‡	p.318-346	Jovian Moons
Jan 7	13		Ch 12 Asteroids, Comets, Dwarf Planets	p.350-378	Asteroid Analysis
Jan 14	14		Ch 13 Exoplanets †	p.381-404	Exoplanet Detection
Jan 21	15	Part 4: A Deeper Look at Nature	S2 Space & Time‡	p.410-428	Lorentz Lab
Jan 28	16		S3 Spacetime & Gravity*	p.432-451	Time Dilation Lab
Feb 4	17		S4 Building Blocks of the Universe	p.455-470	Stargazing Lab
Feb 11	18	Part 5: Stars	Ch 14 Our Star‡	p.476-494	Solar Activity Lab
Feb 18	19		Ch 15 Surveying the Stars †	p.498-518	Stellar Mass & Temp
Feb 25	20		Ch 16 Star Birth*	p.522-539	Infrared Orion
Mar 4	21		Ch 17 Star Stuff‡	p.543-562	HR Diagram Lab
Mar 11	22		Ch 18 Bizarre Stellar Graveyard	p.565-582	Gravitational Lensing
Mar 18	23	Part 6: Galaxies and Beyond	Ch 19 Our Galaxy †	p.588-610	Galaxy Structure
Apr 1	24		Ch 20 Galaxies & Modern Cosmology*	p.614-634	Variable Stars
Apr 8	25		Ch 21 Galaxy Evolution‡	p.637-654	Galaxy Color Lab
Apr 15	26		Ch 22 Birth of the Universe †	p.658-676	Redshifting Galaxies
Apr 22	27		Ch 23 Fate of the Universe	p.680-702	Astronomer Spotlight
Apr 29	28	Part 7: Life	Ch 24 Life in the Universe*	p.708-734	Exoplanet Habitability
May 6, 13	29-30	Capstone Project			

**Astronomer Spotlight Poster Due (7 total)*

† *Stargazing Week (self-paced students adjust date to new moon week)*

‡ *Optional Discovery Project*

Weekly Routine: How to Stay on Track in this Astronomy Course

To succeed in this course, it's important to build good habits. Here's your step-by-step guide so you always know what to do—and never fall behind. Don't rush and don't cram – use this plan as a guide!

Before Class (preferably 1-2 days before)

- **Read the assigned textbook pages** for in-class discussion, taking notes as you go (p. 11)
- **Listen to the weekly astronomy podcast** of your choice
- **Fill out your Podcast Passport** a quick journal reflection to record what you learned (p.19)

File these in your **Notes & Reading** and **Podcast Passport** binder sections.

During the Class Lesson

- **Come prepared** to discuss what you read, and bring your questions and insights!
- **Take notes during the main lesson.** Class time is focused on the most important ideas, challenging concepts, and math examples—not a full review of the textbook. You will need to read the assigned pages ahead of time to follow along and get the most out of the lesson.
- This course is designed to help you *think like a scientist*, not just copy facts—so active preparation is part of the learning process!

File these in your **Notes & Reading** section

Immediately Following the Class Lesson

- **Work through the assigned questions** (at the end of each textbook chapter)
- You can write your answers, talk through them with a friend, or for self-checking your understanding of the material.

File these in your **Notes & Reading** section

Next Day (after class) – Start Homework

- Go over the **math concepts** for this week's topic. Rewrite your notes so it's clear to you.
- **Begin your homework problems**. Skip any that are challenging or you're not sure how to start.

File these under **Homework & Quizzes**

Continue to work on Assignments Every Day (until finished)

- **Finish your homework assignment**. Ask for help if you're stuck—you're not alone!
- Spend time reviewing key terms, concepts, and formulas for the quiz.

File your completed work under **Homework & Quizzes**

The Day Before Class: Quiz + Assignments Due

- **Turn in your homework** before the end of the day.
- Take the assigned **short quiz** to check your understanding of the week's material.
- Work on your **Astronomer Spotlight or assigned lab projects**

File your project notes and data in **Labs & Projects**. File quizzes under **Homework & Quizzes**

Tips for Success

- Set aside **30–60 minutes a day** for astronomy outside of class time.
- Use your **binder dividers** to keep everything organized—you'll thank yourself later!

Assessment & Grading Breakdown

This course blends high school-level accessibility with college-level expectations. Students are graded on a mix of effort, participation, scientific reasoning, and mastery of concepts. Emphasis is placed on understanding the material, completing work thoughtfully, and engaging fully in the learning process—not just getting the "right" answer.

📊 Grading Categories

This course is taught over 3 terms: Fall (Astro 101), Winter (Astro 102), Spring (Astro 103)

Category	Weight	What It Includes
Homework & Quizzes	20%	Weekly short-answer assignments and brief review quizzes
Labs & Investigations	25%	In-class and take-home labs, data analysis, and scientific write-ups
Projects & Presentations	20%	Includes Astronomer Spotlight, stargazing reflections, and final capstone project.
Participation & Preparation	15%	Includes discussions, engagement, assignment completion, and readiness each week
Podcast Passport	10%	Weekly reflections on science podcasts
Midterm/Final Exam	10%	Cumulative review at the end of each term

Final letter grades are based on the total weighted score, but student progress and engagement are also considered. Students who show consistent effort, curiosity, and growth are recognized and supported—even if they struggle with test-taking or technical material. Refer to last page for grading sheet.

Projects Overview

Projects Overview

Throughout the course, students will complete a variety of hands-on, creative, and research-based projects designed to deepen their understanding of astronomy and build real-world science skills. These projects encourage students to think like astronomers, communicate like scientists, and explore the cosmos with curiosity and purpose.

Projects are introduced during class (or in the self-paced version, in video/module instructions), and most are completed at home with guidance, deadlines, and rubrics provided.

Major Projects Include:

- **Astronomer Spotlight**
  Students will research and present a 5-minute talk and poster about a notable astronomer (past or present), highlighting their discoveries, impact on science, and personal journey. This project includes both a visual component (poster) and a brief presentation. (p. 21)

- **Podcast Passport Journal**
  Each week, students choose a space-related podcast episode to listen to and write a short summary in their journal. These reflections help students stay connected to current science news while developing their ability to explain scientific concepts in their own words. (p. 19)

- **Stargazing Reflections**
  Students will attend live or virtual stargazing events and record their observations—what they saw, how they identified objects, and what surprised or interested them. These entries help connect classroom learning with real sky experiences. (p. 15)

- **Scientific Investigations**
  Students will complete lab projects that use real data and observational techniques to explore astronomical phenomena. Examples include:

  - Measuring stellar parallax and tracking proper motion
  - Observing solar rotation through sunspot mapping
  - Estimating exoplanet orbits using archival images
  - Conducting double-star research (measuring angular separation and position angle)

- **Final Capstone Project / Showcase (Optional)**
  Near the end of the course, students may choose to complete a creative or technical project that showcases what they've learned—this could be a research poster, model, presentation, or portfolio entry, depending on the student's goals and interests.

All projects are graded using clear rubrics and contribute to the overall course grade. Creativity, clarity, effort, and scientific accuracy are all valued—students are encouraged to make the work their own!

Field Trips & Stargazing

Astronomy isn't just something you read about—it's something you *experience*. Throughout this course, students will have opportunities to step outside the classroom and explore the night sky firsthand.

🌌 **Stargazing Nights** Each month, students and their families are invited to attend public star parties hosted by their local astronomy clubs, or through the virtual stargazing nights hosted by the Central Coast Astronomy Society (CCAS) available both live and recorded. These events offer:

- Guided telescope tours of the night sky
- Hands-on learning with high-powered telescopes
- Opportunities to see planets, star clusters, nebulae, and more
- Q&A with local astronomers

Attendance is optional but strongly encouraged. Students are welcome to bring their own binoculars or use club telescopes provided at the event (for in-person events). Go here for pre-recorded virtual stargazing tours. Stargazing sessions are designed to be relaxed, family-friendly, and beginner-friendly.

➔ Self-paced students, select the appropriate month for your virtual stargazing tour to match the week of the new moon so you can stargaze immediately following the online class.

🔭 **Private Observing Sessions** In addition to public events, students may have the chance to attend special observing nights with access to private telescopes and research-grade equipment. These sessions will be announced as they are scheduled.

🚀 **Field Trips** As opportunities arise, we will schedule field trips to:

- Local observatories
- Planetariums or science museums
- University or amateur astronomy facilities
- Public astronomy lectures or science events

These trips are optional but provide exciting ways to connect course concepts with real-world astronomy.

📓 **Stargazing Reflections**

After each stargazing event, students may complete a short reflection or sketch in their notebook. These entries may include what they saw, how they identified it, and what they found most interesting. File these in your **Podcast Passport** section of your binder, label your page with *Stargazing Event* with date.

Academic Integrity and Expectations

This course is designed to challenge and inspire students to think critically, ask questions, and explore the universe with curiosity and confidence. As part of that journey, it's important that students approach their work with honesty, responsibility, and a commitment to doing their best.

📘 Academic Integrity

Students are expected to:

- Complete their own homework, labs, journal entries, and project work.
- Use outside sources responsibly and always put information into their own words.
- Ask for help when needed, rather than copying answers or using AI tools to complete assignments. (You completely miss the point of the assignment when you do this.)
- Accurately represent data collected from observations, labs, and scientific investigations.

This course includes opportunities to work with real data from sources like AAVSO, and students will learn how to interpret and analyze that data correctly and ethically. Practicing honesty in scientific work helps students build skills they can carry into college, research, or any future career.

🧠 Participation & Preparedness

Students are expected to:

- Come to class prepared, having completed the reading and assignments ahead of time.
- Actively participate in discussions, labs, and group activities.
- Take responsibility for managing their own learning and deadlines.
- Treat their classmates, instructor, and guest speakers with respect.

💡 Effort Over Perfection

This course values learning, growth, and persistence over getting the "right" answer every time. It's okay to make mistakes—what matters most is that students engage with the material, ask thoughtful questions, and continue improving.

Support and Resources

Astronomy is a big subject—but you're not expected to figure it all out on your own. This course is designed to support students at every step with resources that make learning clear, enjoyable, and accessible.

⭐ **Instructor Support:** If you have questions or need help:

- You can reach out directly by email at aurora@superchargedscience.com anytime
- Class questions can also be asked during live sessions or after labs.
- Feedback is provided on major assignments like projects, lab reports, and presentations.

📚 **Online & Learning Tools**

- **Mastering Astronomy** – Pearson's online companion to the textbook offers extra quizzes, visual tools, and tutorials.
- **AAVSO** – We'll be using real star observation data for some projects.
- **Stellarium** – Free planetarium software to learn the night sky and simulate telescope views.
- **SkyMaps.com** – Download your free monthly star map to use for stargazing.

🔭 **Stargazing Help:** You are invited to attend monthly star parties hosted in your local area (look up *Night Sky Network* or *Astronomical League*), and also virtually by the *Central Coast Astronomy Society*. These events are open to students and families and include telescope time, guided sky tours, and hands-on learning from local astronomers.

🎧 **Enrichment Resources**

- **Podcast Recommendations** – Weekly *Podcast Passport* reflections (p. 19) encourage students to engage with current science conversations.
- Join an astronomy forum (*Cloudy Nights*) or astronomy community if you want to dive deeper

🧠 **Study Tips**

- Create a weekly schedule that includes time for reading, labs, and journaling (p. 12)
- Use your binder to keep organized, and don't fall behind on the projects and assignments (p. 5)

Getting Started: Your First Week

Starting a new course can feel exciting—and sometimes overwhelming. Here's what to do in your very first week so you can settle in, get organized, and start strong:

✔ **Step 1: Set up your binder.**

Create your 5 divider tabs and add some lined paper to each section. Label them clearly and keep them nearby each week.

1. **Notes & Reading** – your notes on reading and key concepts from in class (p. 11)
2. **Podcast Passport** – weekly podcast reflections after a podcast (p. 19)
3. **Astronomer Spotlight** – research notes, poster, and grading rubric (p. 21)
4. **Homework & Quizzes** – weekly assignments and graded materials
5. **Labs & Projects** – all in-class labs, take-home projects, and instructions

✔ **Step 2: Install software & bookmark websites.**

1. Install Stellarium on your computer
2. Bookmark SkyMaps.com and download your star map for this month for your hemisphere
3. Try using your binoculars outside *after* sunset, even if just to spot the Moon!

✔ **Step 3: Pick a podcast.**

Choose one from the list, or ask for suggestions in class. Listen while doing something fun like drawing, daily chores, or walking the dog. After you're done listening, use the sample on the next page to write up your first journal entry.

✔ **Step 4: Read Chapter 1.**

Don't stress about memorizing a bunch of facts — just read to get the big ideas and write down things that catch your attention, along with any questions that come up as you read. Put these reading notes in the **Notes & Reading** section of your binder. Then during your first class, take more notes and add them to this section.

✔ **Step 5: Email the instructor (if you'd like).**

Send a quick hello to Aurora and share what you're most excited about learning in astronomy this year!

Podcast Passport: Format & Rubric

You will write one podcast summary each week and add it to your **Podcast Passport** section of your binder. Keep it to about 200 words total (which is about a full page if hand-written on college-ruled paper using the format below). Don't worry too much about formality of your writing style or with the technical concepts – use simple, clear ways of describing what you've learned. This is your creative sandbox for storing ideas that truly inspire you. Include both the summary and what you learned.

(If there's no episode number, include the published date with the Episode Title.)

Here are some favorite podcasts to start with:

- *Astronomy Cast*
- *Planetary Radio*
- *Awesome Astronomy*
- *Universe Today*
- *Rocket Ranch (NASA)*
- *Houston, We Have a Podcast*
- *The Supermassive Podcast*
- *R. Pogge Astronomy Lectures*

🎧 Podcast Passport Rubric

Category	✓ Score	What To Look For:
Complete Info	☐ 2 ☐ 1 ☐ 0	Includes date, podcast title, and episode number or date.
Summary	☐ 2 ☐ 1 ☐ 0	Describes main points clearly and in your own words. About 100–150 words.
What I Learned	☐ 2 ☐ 1 ☐ 0	Shares a thoughtful reflection on what you found interesting or new.
Effort & Clarity	☐ 2 ☐ 1 ☐ 0	Writing is neat and easy to follow. Shows care, not rushed or sloppy.
Length & Format	☐ 2 ☐ 1 ☐ 0	About one handwritten page (≈200 words total). Follows the suggested format.

✍️ **Total Score: ____ / 10**

Podcast Passport: Format & Sample

Today's Date: August 15, 2025

Podcast Title: Astronomy Cast

Episode: #742: Atmospheric Gravity Waves

Summary:

This episode was all about atmospheric gravity waves, which are totally different from gravitational waves (who knew?). Fraser Cain and Dr. Pamela Gay explained how these waves happen when air gets pushed up, gravity pulls it back down, and it creates a ripple effect, kind of like when you throw a rock in a pond. The coolest part? You can actually see these waves in cloud formations. And get this—they don't just happen on Earth! Scientists have spotted them on Mars, Pluto, and even Venus, which is so cool to think about. Pluto's atmosphere is super thin, but it still has these waves moving through it.

What I Learned:

Gravity waves are like ocean waves, but in the sky. They form when air moves up and down because of gravity and buoyancy, and sometimes you can see them in clouds. They happen on other planets. I had no idea waves like this could be seen on Mars and Pluto. Now I'm wondering what else is going on in those atmospheres. This episode made me look at the sky differently—now I really want to go outside and see if I can spot some of these cloud waves myself.

Astronomer Spotlight: Format & Rubric

In this project, you'll step into the role of a science storyteller. Choose an astronomer (past or present) who has made significant contributions to our understanding of the universe. Research their life, discoveries, and impact on astronomy. For inspiration, look in the *"Inclusive Astronomy"* section at the end of each chapter of your textbook.

1. **Create a 11x17" poster** highlighting key facts, images, and interesting details (400-500 words). (Hint: You can tape two printed landscape 8 ½ x 11" pages together to make a 11x17" poster.) Use 36 pt font for title, 24pt font for section headings, and 16 pt font for body text.

2. **Present a 5-minute talk** to your family & friends to share what you've learned. (Hint: you should not just be reading your poster. Make notecards if you need it!)

Be sure to explain *why* you chose this astronomer and what makes their work important. Get creative with your poster and presentation—this is your chance to bring their story to life.

Astronomer Spotlight Project Rubric (Total: 25 points)

Category	Score	Comments
Content Accuracy Facts are accurate, clear, and well-researched. Astronomer's work is explained clearly and thoughtfully.	☐ 5 ☐ 4 ☐ 3 ☐ 2 ☐ 1 ☐ 0	
Creativity & Visual Design Poster is engaging, organized, and visually appealing. Use of color, images, or style enhances presentation.	☐ 5 ☐ 4 ☐ 3 ☐ 2 ☐ 1 ☐ 0	
Depth of Insight Goes beyond basic facts. Explains *why* the astronomer is important and how their work impacts astronomy.	☐ 5 ☐ 4 ☐ 3 ☐ 2 ☐ 1 ☐ 0	
Presentation Delivery Spoken clearly, not just reading. Used note cards or cues. Maintained audience interest. Used own voice and words.	☐ 5 ☐ 4 ☐ 3 ☐ 2 ☐ 1 ☐ 0	
Completion & Word Count Includes 400–500 words, meets all assigned parts, submitted on time.	☐ 5 ☐ 4 ☐ 3 ☐ 2 ☐ 1 ☐ 0	

Grade Scale:

- 18–20: Stellar! (A)
- 15–17: Strong work! (B)
- 12–14: Meets most expectations (C)
- Below 12: Needs revision or follow-up

Astronomer Spotlight: Sample #1 (Bullet-Column Style)

Caroline Herschel

Caroline Herschel (1750–1848) was a German-born astronomer and one of the first women to receive professional recognition in the field. She was originally trained as a singer, but her life changed when she moved to England to assist her brother, William Herschel, who would later discover Uranus. Despite society expectations that limited women's roles in science, Caroline became an accomplished astronomer in her own right.

Discoveries & Contributions

- **First woman to discover a comet:** Caroline discovered eight comets, including Comet C/1786 P1, the first comet ever credited to a female astronomer.
- **Cataloged nebulae:** She worked alongside her brother to catalog over 2,500 nebulae and star clusters, laying the foundation for modern deep-space studies.
- **First woman awarded a salary for scientific work:** In 1796, King George III granted her a stipend as an assistant astronomer—making her the first woman officially paid for scientific research.
- **Published the *"Catalogue of Stars"*** (1798): A detailed listing of 561 stars missing from the British star catalog.

Challenges & Obstacles

- **Limited formal education:** As a woman in the 18th century, she was denied formal schooling and was expected to focus on household duties.
- **Social restrictions:** Women were discouraged from participating in scientific research, and Caroline often worked in the shadows of her brother's achievements.
- **Physical hardships:** As a child, she suffered from smallpox, which left her with facial scars and stunted growth (she was only 4'3" tall!).

Impact on Astronomy

- **Trailblazer for women in science:** Caroline proved that women could contribute to astronomy, inspiring future female scientists like Vera Rubin.
- **Improved star catalogs:** Her meticulous observations refined the way we study celestial objects today.
- **Recognition & Awards:** She received the Gold Medal of the Royal Astronomical Society in 1828 and became an honorary member—one of the first women ever to receive these honors.

Fun, Little-Known Facts

- She originally moved to England to be a housekeeper for her brother William, but he trained her in mathematics and telescope-making.
- She discovered her first comet on accident! She was helping William with observations when she noticed a faint, moving object in the sky.
- She lived to be 98 years old, continuing to study astronomy for a long time
- A crater on the Moon and an asteroid (281 Lucretia, her middle name) were named in her honor!

Bringing It All Together

Caroline Herschel's legacy is one of determination, resilience, and groundbreaking discoveries. Despite the challenges she faced, her contributions to astronomy remain essential to the field today. Her work reminds us that curiosity and dedication can break barriers and lead to incredible discoveries!

Astronomer Spotlight: Sample #2 (Paragraph Style)

Caroline Herschel

Caroline Herschel (1750–1848) was a German-born astronomer and one of the first women to receive professional recognition in the field.

Early Life & Unexpected Career Path

Originally trained as a singer, her life changed when she moved to England to assist her brother, William Herschel, who would later become famous for discovering Uranus. Despite societal expectations that limited women's roles in science, Caroline became an accomplished astronomer in her own right, making significant contributions to the study of comets and star cataloging.

Pioneering Discoveries in Astronomy

One of her most notable achievements was becoming the first woman to discover a comet. Over her lifetime, she identified eight comets, including Comet C/1786 P1, which was the first comet ever credited to a female astronomer. In addition to her comet discoveries, she worked alongside her brother to catalog over 2,500 nebulae and star clusters, laying the foundation for modern deep-space studies. In 1796, King George III recognized her contributions by granting her a stipend as an assistant astronomer, making her the first woman to be officially paid for scientific research. She also published the Catalogue of Stars in 1798, which contained 561 stars missing from the British star catalog and helped improve astronomical data.

Challenges as a Woman in Science

Caroline faced many challenges throughout her life. As a woman in the 18th century, she was denied formal education and expected to focus on household duties. Scientific research was largely restricted to men, and she often worked in the shadows of her brother's achievements. Her struggles were not just social but also physical. As a child, she suffered from smallpox, which left her with facial scars, and typhus, which stunted her growth. She never grew taller than 4 feet 3 inches, but that did not stop her from reaching for the stars.

Lasting Legacy & Recognition

Her impact on astronomy was profound. She paved the way for future women in science, proving that female astronomers could contribute meaningfully to the field. Her meticulous observations helped improve star catalogs, and in recognition of her work, she was awarded the Gold Medal of the Royal Astronomical Society in 1828, becoming one of the first women to receive such an honor. Today, her legacy lives on through the many celestial objects named after her, including a crater on the Moon and the asteroid 281 Lucretia, named after her middle name.

A Life of Perseverance and Curiosity

Caroline Herschel's life was filled with remarkable achievements, despite the many obstacles she faced. She originally moved to England to be a housekeeper for her brother, but he trained her in mathematics and telescope-making, leading her to a career in astronomy. She even discovered her first comet by accident while assisting her brother with observations. Living to the impressive age of 98, she continued to study astronomy well into her later years. Her story is a testament to perseverance, curiosity, and the pursuit of knowledge, reminding us that great discoveries can come from unexpected places!

Frequently Asked Questions (FAQ)

We know that starting a new course can come with a lot of questions—especially when it's something as exciting (and big!) as astronomy. Whether you're learning in a live class or working at your own pace, this section is here to help. Below are some of the most common questions students and parents ask. If you don't see your question here, just reach out—we're happy to help!

🔭 **What if I miss a class?**

No problem! You can catch up by completing the reading, homework, and podcast reflection for that week. Many lessons include video demos or summaries to help review key concepts. You can also email the instructor if you need help with what you missed.

🪐 **Can I do this course fully self-paced?**

Yes! While this course is designed for weekly live classes, everything can also be completed independently. You'll follow the same reading schedule, projects, and assignments—at your own pace. Refer to the course outline.

🔭 **Do I need a telescope to take this class?**

Nope! Binoculars (7x50 or 10x50) are more than enough for everything we do. We use published star data, star maps, software like *Stellarium*, and live stargazing events to help you explore the night sky.

🧮 **What if I'm not great at math?**

That's okay! This isn't a math class. You only need basic skills like solving simple equations or working with powers of ten. Each week we'll walk through any math together in a "Math Moment," so you never feel lost. You're supported every step of the way.

🚀 **Can I take just one term instead of all three?**

Yes, but just the first term, as the second and third terms build on the content covered in the first. Here's the breakdown of the full-year course:

- **Fall:** Astro 101 – Introduction & the Solar System
- **Winter:** Astro 102 – Stars & Stellar Life Cycles
- **Spring:** Astro 103 – Galaxies, Cosmology & Life in the Universe

Your enrollment in the course is for a 12-month cycle, and this course is designed for 30 weeks, so you will have plenty of time if you're working through it at your own pace.

End of Year Checklist

Use this checklist to make sure you've completed all major components of the astronomy course. Check each box as you finish!

🔭 Coursework & Class Participation

☐ Read all 28 chapters in the textbook
☐ Attended (or watched recordings of) all live class sessions
☐ Filed all reading notes and *Math Moments* in your **Notes & Reading** section

📘 Assignments & Homework

☐ Completed all weekly homework assignment questions (28 assignments total)
☐ Completed all short weekly review quizzes (28 total)
☐ Submitted final exams (3 total)
☐ Filed all homework, quizzes, and exams in **Homework & Quizzes**

🧪 Labs & Projects

☐ Completed projects, labs, and data investigations (28 total)
☐ Filed all lab worksheets and data logs in your binder under **Labs & Projects**

🪨 Stargazing & Observational Work

☐ Attended at least one stargazing event (in-person or virtual)
☐ Submitted at least one Stargazing Reflection (filed in *Podcast Passport)*

🎧 Enrichment Activities

☐ Completed *Podcast Passport* reflections (28 total)
☐ Researched and presented your *Astronomer Spotlight* projects (7 total)

🖊️ Capstone (optional)

☐ Completed final Capstone Project (poster, research, presentation)
☐ Filed project in **Labs & Projects** binder section
☐ Shared or presented project (in class or to family/friends)

📂 Binder & Organization

☐ Binder has all 5 dividers and is organized with class notes, labs, quizzes, and projects
☐ Binder is complete and ready to be submitted, reviewed, or kept for your portfolio
☐ Final Grade is calculated (see next page)

Calculating Your Total Grade in this Course

Add up numbers in right column to find your percent for the entire course:_____

Category	Weight	Score
Homework & Quizzes 10 points each, 56 total	20%	Add up all points for every assignment. Divide by 560 and multiply by 0.2 and write this number here_____
Labs & Investigations 10 points each, 28 total	25%	Add up all points for weekly lab projects. Divide by 280 and multiply by 0.25 and write number here_____
Projects & Presentations Astro Spot = 10 pts each, Capstone = 20 pts	20%	Add up all Astronomer Spotlight points; add Stargazing reflection (10 points); add Capstone project points. Now multiply number by 0.2 and write it here_____
Participation & Preparation*	15%	See below for grading rubric. Write score here_____
Podcast Passport 28 total, 10 points each	10%	Add up all points for each entry. Divide by 280 and multiply by 0.1 and write this number here_____
Midterm/Final Exam 100 points each, 3 total	10%	Add up all points for each exam. Divide by 300 and multiply by 0.1 and write this number here_____

*Participating & Preparation Rubric

Score	Description
13–15 pts	Fully engaged. Always prepared for class. Brings questions or insights. Completes assignments on time. Actively participates in discussions and labs.
10–12 pts	Generally engaged and prepared. Completes most assignments on time. Participates regularly, though may be quiet or need reminders.
7–9 pts	Sometimes unprepared or missing assignments. Minimal participation. May miss key parts of class/lab without follow-up.
4–6 pts	Often disengaged or missing work. Rarely contributes in discussions. Prep work is incomplete or missing.
0–3 pts	Rarely participates. Frequently unprepared. Missing most assignments or class sessions.