Astronomy 1001: Exploring the Universe

Instructor: Dr Tommy Nelson  
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tnelson@physics.umn.edu  
http://homepages.spa.umn.edu/~tnelson/Home.html

Lecture: 10:10 to 11:00, Monday, Wednesday and Friday, Tate 166

Office hours: Rm 355 Physics and Nanotechnology Building  
Thursday 1:30 to 4:00  
Or by appointment!  
Directions: Take elevator to 3rd floor, turn left out of elevator, left into corridor,  
follow signs to room 355.

Please read the entire syllabus carefully; you are responsible for all of the requirements and  
procedures described here. You are also responsible for all announcements, assignments,  
changes, etc. whether or not you are in class.

Required Texts

Texts: The Essential Cosmic Perspective, Bennett, Donahue, Schneider & Voit (Custom UMN  
Edition available at bookstore - includes online access to “Mastering Astronomy” and “Lecture-  
Tutorials”)

Lecture-Tutorials for Introductory Astronomy, Prather, Slater, Adams & Brissenden (3rd Edition)

Online: Mastering Astronomy (for homework and reading quizzes)


Exam Dates

Mid-term 1: Friday, Feb 28th, during class period, location TBD  
Mid-term 2: Friday, Apr 11th during class period, location TBD  
Final exam: Saturday, May 17th, 08:00 – 10:00, location TBD

Course Description

Welcome to AST 1001! This semester, we’ll be exploring the universe and our place within it.  
The course is designed to give you a primarily qualitative survey of astronomy, although we will  
make use of basic math and algebra in places to gain deeper insight. Don’t worry if your math is  
rusty – there will be plenty of practice throughout the semester, and math on tests will be the  
type that doesn’t need a calculator.
Although you’ll be attending lecture three times a week, do not expect to sit back and listen to me talk for 50 minutes! Instead, anticipate lots of questions from me and plenty of time for you to ask your own. We’ll also be making use of a book called “Lecture-Tutorials for Introductory Astronomy” that will give you an opportunity during class time to explore concepts in more depth. We’ll complete these worksheets in pairs or small groups during class, giving you an opportunity to ask questions and make sure you understand the material as we encounter it.

Finally, it is my goal to create a class that allows a diverse cross-section of students to do well. There are multiple opportunities to succeed in this class. Your grade is distributed fairly evenly across multiple class activities, including labs, homework, the observing project and exams, giving you numerous opportunities to pick up points. I will not be grading on a curve in this class, so it can never hurt your grade to help a classmate do well.

AST 1001 satisfies the Liberal Education Physical Science w/Lab and the Environmental Theme requirements. A key component of the course is an understanding of how science enables us to explore the physical world around us. Environmental theme topics are addressed in several of the course, in both lectures and labs.

**Student Learning Outcomes**

By taking this course, students will:

- Develop a sense of the scale of the universe and our place within it.
- Take a visual tour of our solar system.
- Learn about the physics behind the structure and formation of the sun and planets.
- Be introduced to the properties of light and explore them in a variety of astrophysical contexts.
- Know fundamental laws of nature that describe the motion of objects and light through space.
- Explore the life cycle of stars from birth to death.
- Know how extrasolar planets are discovered and characterized.
- Learn about white dwarfs, neutron stars and black holes—the weird and wonderful objects in the stellar graveyard.
- Know the basic features of galaxy morphology, and be able to connect this to their stellar content.
- Encounter Hubble’s Law and its implications for galaxy motions.
- Explore the history of the universe from the moment of the big bang to its eventual fate

Beyond the specific astronomy content, students will also develop the following general skills:

- Using equations and arithmetic to solve problems.
- Interpret information presented on a graph or chart.
- Working in small groups.
- Record experimental results and present them graphically or in a report.
Homework

We will be using Mastering Astronomy for homework. The goal of homework is to give you a chance to develop your understanding of the course material, and an opportunity to practice the types of questions that will appear on your exams. There will be two kinds of homework. There will be a short (3 questions) reading quiz due each day before lecture. Then there will a weekly homework assignment (10 questions), due Friday at 5pm. Some of the homework questions will appear on the exam. I encourage you to attend office hours on Thursday if you have any questions about your homework.

Labs

See your TA’s syllabus for specific information about the labs.

Observational Project

A key component of this course is to undertake an observational project – in this case of the phases of the moon over the course of the semester. You are required to complete a series of observations and to submit your results in both online and paper format.

The website for submitting your observations is http://www.physics.umn.edu/resources/moonproject/

You can find a pdf of the paper observations sheet here: http://www.astro.umn.edu/courses/1001/moon/mobssht.pdf

background information and instructions on how to complete this project can be found here: http://www.astro.umn.edu/courses/1001/moon/

You must submit your observations in three stages:

Part I: At least 3 observations entered online and paper photocopies of Observing Form placed in your TA's box (outside Phys Rm. 256) by Friday, February 21st at 5 PM (note this is the Friday before the first mid-term.)

Part II: At least 9 total observations entered online and paper photocopies of Observing Form placed in your TA's box by Friday, March 28th at 5PM

Final Report: Final observations (a total of 15) entered online and paper photocopies, and the final report due in your TA's box by Friday, April 25th at 5PM. (Note that you also have homework due this day).

START MAKING OBSERVATIONS RIGHT AWAY! Don’t miss a clear night/day! Every term there are a few students who put this off. DO NOT BE ONE!! You will need your three preliminary observations by the end of the fifth week (one day after the first mid-term). Always save the original copy of your observation log, and turn in a photocopy.
Grading

<table>
<thead>
<tr>
<th>Component</th>
<th>Total Points</th>
<th>% of grade</th>
</tr>
</thead>
<tbody>
<tr>
<td>12 labs</td>
<td>240 (20 points per lab)</td>
<td>24</td>
</tr>
<tr>
<td>Observational project</td>
<td>140</td>
<td>14</td>
</tr>
<tr>
<td>Homework</td>
<td>200</td>
<td>20</td>
</tr>
<tr>
<td>Mid-term 1</td>
<td>100</td>
<td>10</td>
</tr>
<tr>
<td>Mid-term 2</td>
<td>100</td>
<td>10</td>
</tr>
<tr>
<td>Final exam</td>
<td>220</td>
<td>22</td>
</tr>
<tr>
<td><strong>Total for the course</strong></td>
<td><strong>1000</strong></td>
<td><strong>100</strong></td>
</tr>
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Grading will be assigned approximately as follows based on past experience: A: 900 - 1000; B: 800 - 899; C: 700 - 799; D: 600 - 699; F: 0 - 599 (You must receive a 'C-' or better to receive a grade of 'S'). The course will not be graded on a curve.

Keep copies of all materials upon which you are graded (laboratory reports, observational project assignments, and examinations) until the end of the semester. After the first two or three weeks of the semester, grade summaries will be posted weekly at [http://www.astro.umn.edu/courses/1001/](http://www.astro.umn.edu/courses/1001/). Students are expected to review their grade summaries for accuracy periodically during the semester and after the final examination. Discrepancies should be reported to Terry Thibeault in the Office of the Minnesota Institute for Astrophysics (Room 356 Physics; Phone: 612-624-4811; FAX: 612-626-2029; e-mail: tt@astro.umn.edu).

**NOTE!** In order to receive a passing grade in the class you must earn at least 50% of the total available lab points (120/240) AND at least 50% of the total available Observational Moon Project points (70/140) AND complete at least 50% of the homework assignments (6/11). In addition, you must take all three exams.

Course Policies & Procedures

**Special Needs:** Any students with special learning needs must contact their professor during the first two weeks of class.

**Student Mental Health Services:** As a student you may experience a range of issues that can cause barriers to learning, such as strained relationships, increased anxiety, alcohol/drug problems, feeling down, difficulty concentrating and/or lack of motivation. These mental health concerns or stressful events may lead to diminished academic performance or reduce a your ability to participate in daily activities. University of Minnesota services are available to assist you with addressing these and other concerns you may be experiencing. You can learn more about the broad range of confidential mental health services available on campus via the Student Mental Health Website at [http://www.mentalhealth.umn.edu](http://www.mentalhealth.umn.edu).
Academic Standards: The CLA and CSE scholastic conduct and classroom procedures will be followed. You are responsible for being familiar with these. Students are welcome to work together, exchange ideas, etc. However, for the Moon Project, EACH STUDENT MUST MAKE HIS/HER OWN OBSERVATIONS/MEASUREMENTS AND OWN CALCULATIONS. Copying of someone else’s measurements or calculations is equivalent to cheating and will be handled accordingly.

Examinations: Room assignments for the exams will be announced in class and posted on the course website. Bring two pencils and a photo-ID to all exams. Exams will consist of multiple-choice questions. If you cannot make it to an exam, see the professor well in advance. If you miss an exam, see the professor immediately about scheduling a makeup exam. Makeup exams can be scheduled for anytime, and could be in the form of an ESSAY. Your midterm exams will be returned to you in your lab. If you feel there is a mistake on the multiple-choice portion of your exam, please see Terry Thibeault in Physics 356.

You are allowed to bring in one 8 1/2 x 11” page of notes covered on one side to the midterms, and on two sides for the final. You will not need a calculator for the exams, so calculators are prohibited.
## Tentative Course Schedule

<table>
<thead>
<tr>
<th>Dates</th>
<th>Topic</th>
<th>Chapter Reading (approx.)</th>
<th>Labs and Due Dates</th>
<th>Homework</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jan 22, 24</td>
<td>Our place in the universe</td>
<td>2</td>
<td>No Labs</td>
<td>No HW</td>
</tr>
<tr>
<td>Jan 27, 29, 31</td>
<td>History of Astronomy</td>
<td>1, 3</td>
<td>D</td>
<td>RQ, HW1</td>
</tr>
<tr>
<td>Feb 3, 5, 7</td>
<td>Motion, Energy and Gravity</td>
<td>4</td>
<td>A</td>
<td>RQ, HW2</td>
</tr>
<tr>
<td>Feb 10, 12, 14</td>
<td>Light and telescopes</td>
<td>5</td>
<td>B</td>
<td>RQ, HW3</td>
</tr>
<tr>
<td>Feb 17, 19, 21</td>
<td>Solar system overview;</td>
<td>6 (except 6.5), 7</td>
<td>E</td>
<td>RQ, HW4</td>
</tr>
<tr>
<td>Feb 24, 26, 28</td>
<td>Jovian Planets, MID-TERM EXAM 1</td>
<td>8</td>
<td>L</td>
<td>RQ only</td>
</tr>
<tr>
<td>Mar 3, 5, 7</td>
<td>Asteroids, Comets, Earth’s Environment</td>
<td>9</td>
<td>M</td>
<td>RQ, HW5</td>
</tr>
<tr>
<td>Mar 10, 12, 14</td>
<td>The Sun: Our nearest star</td>
<td>10</td>
<td>I</td>
<td>RQ, HW6</td>
</tr>
<tr>
<td>Mar 17, 19, 21</td>
<td>SPRING BREAK!</td>
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<tr>
<td>Mar 24, 26, 28</td>
<td>The Stars and their Properties</td>
<td>11</td>
<td>No lab</td>
<td>RQ, HW7</td>
</tr>
<tr>
<td>Mar 31, Apr 2, 4</td>
<td>Star Formation and Stellar</td>
<td>12</td>
<td>F</td>
<td>RQ, HW8</td>
</tr>
<tr>
<td>Apr 7, 9, 11</td>
<td>Exotic stars, MID-TERM EXAM 2</td>
<td>13</td>
<td>H</td>
<td>RQ only</td>
</tr>
<tr>
<td>Apr 14, 16, 18</td>
<td>The Milky Way</td>
<td>14</td>
<td>K</td>
<td>RQ, HW9</td>
</tr>
<tr>
<td>Apr 21, 23, 25</td>
<td>Galaxies and the expansion of the universe</td>
<td>15</td>
<td>J</td>
<td>RQ, HW10</td>
</tr>
<tr>
<td>Apr 28, 30, May 2</td>
<td>Cosmology and The Big Bang</td>
<td>16, 17</td>
<td>G</td>
<td>RQ, HW11</td>
</tr>
<tr>
<td>May 5, 7, 9</td>
<td>Exoplanets and life in the universe</td>
<td>6.5, 18</td>
<td>No lab</td>
<td>RQ only</td>
</tr>
<tr>
<td>May 17th</td>
<td>FINAL EXAM</td>
<td></td>
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More detailed reading assignments will be posted on Moodle each week.