



# Stars and Galaxies – PHYS 1303.001 (F2F)

Course Syllabus: Spring 2021

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*“Northeast Texas Community College exists to provide personal, dynamic learning experiences empowering students to succeed.”*

**Instructor: Mr. Mark Ellermann II**

**Office:** MS 117

**Phone:** 903-434-8297

**Email:** mellermann@ntcc.edu

| Office | Monday      | Tuesday                  | Wednesday   | Thursday                 | Friday |
|--------|-------------|--------------------------|-------------|--------------------------|--------|
| Hours  | 4:30 – 5:30 | 9:30 – 11<br>4:30 – 5:30 | 4:30 – 5:30 | 9:30 – 11<br>1:30 – 5:30 | N/A    |

***This syllabus serves as the documentation for all course policies and requirements, assignments, and instructor/student responsibilities.***

*Information relative to the delivery of the content contained in this syllabus is subject to change. Should that happen, the student will be notified.*

**Course Description:** This course focuses on the history, development, and modern use of astronomy. It covers solar, galactic, and universal aspects of astronomy including stellar evolution, black holes, and current cosmological concepts. Three hours college credit.

**Prerequisite(s):** TSI Complete Status

## **Student Learning Outcomes:**

1303.1 Recognize scientific and quantitative methods and the differences between these approaches and other methods of inquiry used in modern astrophysics.

1303.2 Communicate observations and interpretations clearly through written communication.

1303.3 Use basic laws of astronomy to solve assigned tasks.

1303.4 Translate, interpret, and extrapolate scientific theory governing the formation and evolution of stars.

1303.5 Translate, interpret, and extrapolate scientific theory governing the formation and evolution of galaxies and the universe.

1303.6 Use simple astronomy laboratory techniques to collect, manipulate, analyze, and draw conclusions from data representing physical phenomenon while working individually and in teams.

### **Core Curriculum Purpose and Objectives:**

Through the core curriculum, students will gain a foundation of knowledge of human cultures and the physical and natural world; develop principles of personal and social responsibility for living in a diverse world; and advance intellectual and practical skills that are essential for all learning.

Courses in the foundation area of mathematics focus on quantitative literacy in logic, patterns, and relationships. In addition, these courses involve the understanding of key mathematical concepts and the application of appropriate quantitative tools to everyday experience.

### **Program Student Learning Outcomes:**

#### Critical Thinking Skills

CT.1 Students will demonstrate the ability to 1) analyze complex issues, 2) synthesize information, and 3) evaluate the logic, validity, and relevance of data.

#### Communication Skills

CS.1 Students will effectively develop, interpret and express ideas through written communication.

#### Empirical and Quantitative Skills

EQS.1 Students will manipulate numerical data or observable facts by organizing and converting relevant information into mathematical or empirical form

EQS.2 Students will analyze numerical data or observable facts by processing information with correct calculations, explicit notations, and appropriate technology.

EQS.3 Students will draw informed conclusions from numerical data or observable facts that are accurate, complete, and relevant to the investigation.

#### Teamwork

TW.2 Students will work with others to support and accomplish a shared goal.

### **Evaluation/Grading Policy:**

Quizzes will represent 20% of your grade and class participation will count another 20%. There will be 4 tests and a Final Exam, as well as a group research paper (that will count as a test grade). The average of all tests will represent 60% of your grade. The letter grading system is:

|          |              |
|----------|--------------|
| <b>A</b> | (90% - 100%) |
| <b>B</b> | (80% - 89%)  |
| <b>C</b> | (70% - 79%)  |
| <b>D</b> | (60% - 69%)  |
| <b>F</b> | (< 60%)      |

## Tests / Exams:

TEST 1: Introduction to Astronomy and Taking Measure of the Stars

TEST 2: The Interstellar Medium and Star Formation

TEST 3: Low Mass Stars, High Mass Stars, Relativity, and Black Holes

TEST 4: Galaxies and the Milky Way

FINAL EXAM: All Previous Topics in addition to The Expanding Universe and Cosmology

## Required Instructional Materials:

Kay. Palen, and Blumenthal. *21<sup>st</sup> Century Astronomy: Stars and Galaxies*, 6<sup>th</sup> Ed. W.W. Norton & Company, New York, 2019.

NOTE: This text is part of the Inclusive Access program and is available to you through Blackboard. If you wish to opt out of Inclusive Access, you will need to do so through the link in Blackboard. Also, if you are taking the lab course PHYS 1103, you will need to order the text for that course separately.

**Publisher:** W.W. Norton & Company

**ISBN Number:** 978-0-393-67552-8

**Optional Instructional Materials:** None

**Minimum Technology Requirements:** Access to a computer (for research paper), online access, and a scientific calculator.

**Required Computer Literacy Skills:** You will need access to Blackboard online. You will also need access to a word processor to write your research paper.

## Course Structure and Overview:

You will be expected to check Blackboard each week to see what information to know before coming to class. This will largely be basic information that is found in the textbook. Lecture will focus on test content and an activity to build scientific comprehension and thinking.

## Communications:

Email will be responded to within 24 hours IF SENT SUNDAY-THURSDAY. Due to the lack of internet availability at my home, I cannot guarantee responses over the weekend, though I will do my best. You can also call my office during office hours if you need to speak with me but can't make it to campus. However, I prefer face-to-face discussions, especially if you have a question about a homework problem. Any information that I send out will be done in class, via Blackboard, or via NTCC email. I will NOT email sensitive information to address that don't end with "@ntcc.edu"

## Institutional/Course Policy:

Late work will not be accepted without prior approval by the instructor. Students and instructor are expected to treat each other with respect in and out of the classroom. Prompt attendance is expected for all class meetings. Missing lecture means missing discussion and important notes. During lecture, students are expected to be attentive to the topic discussed. Students found being consistently inattentive will be asked to leave.

## **Alternate Operations During Campus Closure and/or Alternate Course Delivery Requirements**

In the event of an emergency or announced campus closure due to a natural disaster or pandemic, it may be necessary for Northeast Texas Community College to move to altered operations. During this time, Northeast Texas Community College may opt to continue delivery of instruction through methods that include, but are not limited to, online through the Blackboard Learning Management System, online conferencing, email messaging, and/or an alternate schedule. It is the responsibility of the student to monitor NTCC's website (<http://www.ntcc.edu/>) for instructions about continuing courses remotely, Blackboard for each class for course-specific communication, and NTCC email for important general information.

Additionally, there may be instances where a course may not be able to be continued in the same delivery format as it originates (face-to-face, fully online, live remote, or hybrid). Should this be the case, every effort will be made to continue instruction in an alternative delivery format. Students will be informed of any changes of this nature through email messaging and/or the Blackboard course site.

### **NTCC Academic Honesty/Ethics Statement:**

NTCC upholds the highest standards of academic integrity. The college expects all students to engage in their academic pursuits in an honest manner that is beyond reproach using their intellect and resources designated as allowable by the course instructor. Students are responsible for addressing questions about allowable resources with the course instructor. Academic dishonesty such as cheating, plagiarism, and collusion is unacceptable and may result in disciplinary action. This course will follow the NTCC Academic Honesty and Academic Ethics policies stated in the Student Handbook. Refer to the student handbook for more information on these subjects.

### **ADA Statement:**

It is the policy of NTCC to provide reasonable accommodations for qualified individuals who are students with disabilities. This College will adhere to all applicable federal, state, and local laws, regulations, and guidelines with respect to providing reasonable accommodations as required to afford equal educational opportunity. It is the student's responsibility to request accommodations. An appointment can be made with the Academic Advisor/Coordinator of Special Populations located in Student Services and can be reached at 903-434-8264. For more information and to obtain a copy of the Request for Accommodations, please refer to the special populations page on the NTCC website.

### **Family Educational Rights and Privacy Act (FERPA):**

The Family Educational Rights and Privacy Act (FERPA) is a federal law that protects the privacy of student education records. The law applies to all schools that receive funds under an applicable program of the U.S. Department of Education. FERPA gives parents certain rights with respect to their children's educational records. These rights transfer to the student when he or she attends a school beyond the high school level. Students to whom the rights have transferred are considered "eligible students." In essence, a parent has no legal right to obtain information concerning the child's college records without the written consent of the student. In compliance with FERPA, information classified as "directory information" may be released to the general public without the written consent of the student unless the student makes a request in writing. Directory information is defined as: the student's name, permanent address and/or local address, telephone listing, dates of attendance, most recent previous education institution attended, other information including major, field of study, degrees, awards received, and participation in officially recognized activities/sports.

**Tentative Course Timeline (\*note\* instructor reserves the right to make adjustments to this timeline at any point in the term):**

| Timing | Topic  | Individual Learning  | Group Learning (F2F Class)   |
|--------|--|--|--|
| Week 1 | Introduction Notes:<br>Introduction to Astronomy | Chapter 1 (entire chapter), Key Words: <b>light-year, hypothesis, theory, falsified, cosmological principle, Occam's razor</b>   | Scale of the Solar System (outside), Identify the Science, Extra: <i>Voices from a Distance Star</i> |
| Week 2 | Taking Measure of the Stars                      | Section 5.2-5.3, Section 13.2, 13.4, Key Words: <b>emission lines, absorption lines, redshift, blueshift, H-R diagram, mass-luminosity relationship</b>  | Determine distance with Parallax, Analyzing Gases by Light Emissions                                 |
| Week 3 | <b>Exam 1: Group Test and Individual Test</b>    |  |  |
| Week 4 | The Interstellar Medium and Star Formation       | Chapter 15 (entire chapter), Key Words: <b>interstellar medium, interstellar dust, interstellar extinction, reddening, interstellar clouds, intercloud gas, molecular clouds, molecular-cloud cores, protostar, main sequence star, brown dwarf, Hayashi track, Herbig-Haro object</b>           | Analyze Formation of Stars by Photograph   |
| Week 5 | The Sun  | Chapter 14 (entire chapter), Key Words: <b>hydrostatic equilibrium, proton-proton chain, core, radiative zone, conductive zone, photosphere, chromosphere, corona, helioseismology, sunspot, solar wind, sunspot cycle, prominence, solar flare, coronal mass ejection, Carrington-class CME</b> | Discuss validity of pp-chain, Sun phenomena – are we really in danger?                               |
| Week 6 | Low Mass Stars                                   | Sections 16.2-16.4, Key Words: <b>electron-degenerate, stellar evolution process, red giant, subgiant, triple-alpha process,</b>   | Comparing Planetary Nebulae  |

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|                     |   | <b>horizontal branch, asymptotic giant branch, planetary nebula, white dwarf</b>   |   |
| Week 6              | <b>Exam 2: Group Test and Individual Test</b> |  |   |
| Week 7              | High-Mass Stars                               | Sections 17.1-17.3, 16.5, Key Words: <b>carbon-nitrogen-oxygen cycle, catalyst</b> , layers of shells in high mass evolved star, <b>Cepheid variable, RR Lyrae variable, binding energy,</b>                                       | Analyze Supernovae, Discuss Life Around Stars   |
| Week 8              | Relativity and Black Holes                    | Sections 18.2-18.4, Key Words: <b>relativistic speed, special theory of relativity, event, time dilation, spacetime, relativistic</b> , the implications of relativity, <b>general theory of relativity, equivalence principle</b> | Video: A Baffling Balloon Behavior (SmarterEveryDay), Video: Is Gravity an Illusion (PBSSpaceTime), Video: How to Understand the Black Hole Image (Veritasium), Discussion of Black Hole Picture, Discussion of Relativity Concepts |
| <b>Spring Break</b> |   |  |   |
| Week 9              | <b>Exam 3: Group Test and Individual Test</b> |  |   |
| Week 10             | Galaxies                                      | Chapter 19 (entire chapter) Key Words: <b>The Great Debate</b> , types of galaxies, <b>Hubble's law, Hubble constant, dark matter, quasar, active galactic nucleus, Seyfert galaxy, radio galaxy,</b>                              | Classifying galaxies  |
| Week 11             | The Milky Way                                 | Chapter 20 (entire chapter)  | Discussion: Life in Our Galaxy  |
| Week 12             | <b>Exam 4: Group Test and Individual Test</b> |  |   |
| Week 13             | The Expanding Universe                        | Section 21.1-21.2, 21.4  | Discussion: Intergalactic Space   |

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|---------|---|--|--------|
|         |   |  | Travel |
| Week 14 | Cosmology   | Chapter 22 (entire chapter)  | TBD    |
| Week 15 | Cosmology   | Chapter 22 (entire chapter)  | TBD    |
| Week 16 | <b>Final Exam<br/>(May 10 @ 9:30<br/>am &amp; May 12<br/>@ 9:30 am)</b> | The final exam will be two parts. The first part (group) is taken on May 10 and the second part (individual) is on May 12. |        |