

Astrophysics

September 10, 2019-June 9, 2020
Tuesdays and Thursdays; 10:40 AM-12:15 PM
STEAM Room of Chance Academy
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The mission of Chance Academy is to be an educational community that serves as a center for learning, wellness, peace-building, and cultural literacy for children and adults.

Course Description

Astrophysics is a year long high school lab-based course to understand our place in the universe, how objects in the universe behave, and why they behave in that way. This class includes face-to-face class time and regular assignments (homework) as well as a science fair project. A student who meets the class requirements (see Participation, Science Fair Project, Assessments, and Expectations) is entitled to receive a formal class summary and evaluation that can be used for portfolios or transcript purposes. These formal evaluations can form the framework for letters of recommendation to other programs (college entrance, scholarships, etc). This class is offered as a part of the regular schedule at Chance Academy and *a la carte* to other students not enrolled in Chance Academy.

Astrophysics Learning Goals and Objectives

The goal of Astrophysics is to understand the formation, structure, properties, and behavior of objects in the universe and how we fit in the universe. We will learn to use mathematics, physics, and chemistry concepts to reach this goal. The class will be broken down into five main units with the following general concepts:

1. Observational astronomy
 - a. Early history of astronomy
 - b. Astronomical coordinates
 - c. Astronomical instruments
 - d. Earth, Moon, and Sun system
 - e. Orbits of the earth and moon and their impacts on each other
 - i. Day/night, seasons, lunar phases, etc.
 - f. Classification of objects in space
2. Beginning tools to measure size and distance in space
 - a. Angular Size
 - b. Parallax
 - c. Proportional reasoning
 - d. Image processing
 - e. Nearby stars
 - f. Beginning understanding of the vastness of space
3. Light as a source of information
 - a. Light gathering tools
 - b. Electromagnetic radiation and spectrum
 - c. Brightness, magnitude, and luminosity

- d. Doppler model
 - e. Classification of stars
 - f. Binary stars, eclipsing binaries, transiting planets, asteroids
4. Interaction of objects in space
- a. Motion
 - i. Constant velocity
 - ii. Acceleration of falling objects
 - iii. Projectile motion
 - iv. Orbital motion
 - b. Gravitational Attraction
 - c. Kepler's Laws of Planetary Motion
 - d. Newton's Law of Universal Gravitation
 - e. Exoplanets, black holes, galaxies
5. Cosmology
- a. Evolution of the structure of the universe
 - b. Stellar life cycle
 - c. Cepheid variables
 - d. Supernovae
 - e. Evidence for dark matter and dark energy
 - f. Understanding of the size and structure of the universe

In addition to astrophysics learning goals and objectives, the nature and practices of science will set the foundation for this class. By actively engaging in and completing the course, students will

- Understand a body of astrophysics knowledge that is transferable to physics, chemistry, and mathematics,
- Collect and analyze empirical evidence obtained through experimentation and simulations,
- Build mathematical, graphical, physical and verbal models to explain empirical evidence,
- Practice scientific discourse (argumentation) using empirical evidence to evaluate explanations and theories,
- Communicate knowledge in a variety of ways including informal and formal oral and written means.

Course Materials

All students will need a bound quad-ruled notebook and writing utensils every day.

Students will use educational websites, programs, and Google Drive that are freely available for dissemination of assignments, data collection and analysis, and presentation. Students taking the class *a la carte* may use their personal laptop or tablet for these resources *ONLY* when they are a part of the class activity and with approval by the instructor. Chance Academy has a limited supply of laptops available for enrolled students. Enrolled Chance Academy students are required to turn in phones upon entry to the building. *A la carte* students will be required to remove and store headphones, and place any electronic device used for communication (ex. phone) in airplane mode and silenced as they enter the building. All staff at Chance Academy always have phones available for emergencies.

Mid-October, students may need a trade book; TBA.

Participation: Classwork and Assignments

Most of the work to achieve the learning goals and objectives will occur in class. Assignments will be given to all students either in class or through the INTERNET (Bloomz, class website, email, etc). Assignments are designed to prepare students for the next class activity and to expand on prior class activities so that students' depth of understanding and skill increase. Occasionally, assignments will be given to an individual student as an organic process stemming from class discussions or activities.

Science Fair

All students will complete a science fair project that is a student designed unique experiment to address a question the student is curious about. The science fair project requires a student to plan and complete an experiment, write a science report, prepare a display board, and give an oral presentation. Students in Astrophysics will be encouraged to complete a project related to the class; but all reasonable science based projects will be acceptable. If students have completed a past science fair project and they wish to expand on that project, they may but they must first share the prior project and obtain approval.

This is a significant project that contributes to the practice and refinement of scientific practices and skills. To enable success, students will be given a schedule of due dates to meet the goals and objectives for each phase of the project; feedback for improvement, and assistance and guidance especially when their level of knowledge may not match the intricacies of their project. The science fair project is to be completed at home, but a small amount of class time will be given for activities, information, and collaboration that would benefit all students. To complete the project, oral presentations using their display boards will be given on Thursday, March 12, 2020 from 4:15 - 6:00 PM.

Assessments

Students will be formatively and summatively evaluated. Formative assessments inform the teacher and student about the level of the student's understanding so that teacher lessons and student work can be adjusted for ongoing learning and increased student achievement. Formative assessments occur during class and with pre-assessments and assignments. Summative assessments (unit tests, reports, presentations, etc) are used near or at the end of units to evaluate a student's level of understanding with respect to learning goals and objectives.

Both types of assessments will be used to write formal evaluations for students three times a year. During Student Parent Tutor Conferences (SPTCs), the evaluations will be available in addition to work samples and reflections selected, prepared and presented by the students. SPTCs will be on Nov 26, Feb 28, and Jun 4.

Philosophically, Dr Elizabeth is committed to helping students increase their level of understanding of the learning objectives and their achievement of goals rather than on the accumulation of points and grades. Students will always have the opportunity to work with other students and Dr Elizabeth to experience growth and achievement through a variety of means (ex. constructive feedback, re-study, corrections, redo work, etc) to improve evaluations, but they are given the autonomy and responsibility to do so.

Student Expectations:

- Take responsibility for learning
- Attend every class; valid excuses (illness, prior special event) from parent will be accepted
- Be on time; class starts at 10:40 AM
- Be prepared for class; come with a learning attitude, materials, and completed assignments
- Turn assignments in on time
- Make a genuine effort to complete high quality assignments
- Actively participate in class activities and discussions
- Embrace mistakes and constructive feedback as an opportunity to increase your understanding
- Take turns listening and speaking
- Keep discussions on class topics
- Collaborate with every individual
- Be open, considerate, and respectful to honor every individual's dignity
- Show respect for school property

Parent Expectations:

- Be a partner to enable your child's academic success and growth
- Communicate with Dr Elizabeth directly and quickly in person, by phone, with notes, text, email and/or Bloomz any concerns or suggestions
- Help your child maintain a time and space for homework completion
- Prepare for and attend SPTCs (see Assessment) with the goal of working collaboratively to enable your child's academic success and growth

Class Schedule

Astrophysics meets Tuesdays and Thursdays from 10:40 AM to 12:15 PM from September 10, 2019 through June 9, 2020.

Face-to-face classes will not meet on the following days: Nov 26, Nov 28, Dec 19, Dec 24, Dec 26, Dec 31, Jan 2, Feb 27, Apr 7, Apr 9, Jun 4. Please note on Feb 18 and Feb 20, Chance Academy has scheduled field trips to the Udvar-Hazy Air and Space Museum and the NASA Goddard Space Flight Center. Students taking the class *a la carte* may participate in these all day field trips.

Class Location

Chance Academy operates at 1600 Taylor St NE, Washington, DC 20017 but is separate from the church. To be let in, please use the buzzer at the northwest door for entrance after 9 AM. Astrophysics is in the STEAM Room upstairs and to the left.

Open Door Policy

Dr Elizabeth welcomes any parent or parental unit to drop in on class any time. The door is literally "open while a class is in session" even if it is closed. Open the door, come in, and prepare to be involved in the class. Knocking on the door or looking through the window while a class is in session is disruptive.

When there is no class in session and a private conversation is occurring in the STEAM room, a sign will be hung on the door alerting you to fact.