

Studying White Dwarfs at McDonald Observatory

Pre-Event Argos Lesson Plan

Pre-Event Lesson Goals:

- * Prepare students to engage via videoconference with astronomers at McDonald Observatory who are studying white dwarfs.
- * Enable students to assess their own prior knowledge about what scientists do and what an astronomer does at an observatory.

Lesson Objectives:

The student will:

Complete the activity *Astro Madness* followed by the activity *Telescope Allocation Committee* to better understand what astronomers do and how they use an observatory to do science. Students will use the *What Are Astronomers Doing?* website as a resource.

Optional: Students can participate in an activity about optics, reflection, and refraction called *Mirror, Mirror*.

Target Grade Level: IPC, Physics, and Astronomy

Science TEKS

IPC (1) Scientific processes;

(a) Demonstrate safe practices during field and laboratory investigations

IPC (2) Scientific methods;

(a) Plan and implement investigative procedures including asking questions, formulating testable hypotheses, and selecting equipment and technology

(b) Collect data and make measurements with precision

(c) Organize, analyze, evaluate, make inferences, and predict trends from data.

(d) Communicate valid conclusions.

IPC (3): Critical thinking and scientific problem solving;

(d) Describe connections between physics and chemistry, and future careers.

IPC (5): Effects of waves on everyday life;

(b) Demonstrate wave interactions including reflection and refraction

(c) Identify uses of electromagnetic waves in various technological applications such as fiber optics, optical scanners, and microwaves.

Materials and Instructional Technology:

Instructional Technology: Laptop computer and video projector, computer workstations for students, *PowerPoint* file for *Interview with a White Dwarf*.

Internet access for students to use the *What Are Astronomers Doing?* website.
 Videoconference unit for the McDonald Observatory videoconference session.
 Activity Handouts: *Astro Madness*, *Telescope Allocation Committee*,
Mirror Mirror(optional)

Astro Madness	Telescope Allocation Committee	Mirror Mirror
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Engagement:

- Fast write: What do you think astronomers do?
 Pass out a three-by-five-inch index card to each student. Ask them to write "What do you think astronomers do?" across the top of the card. Give them three minutes to write a response to the question on their index card. They may use the backside.
- Ask or select students to read their responses. On the board or overhead projector, summarize students' responses. Tally repeated responses.
- Tell students that they will soon interact with astronomers from the University of Texas at Austin McDonald Observatory. The astronomer(s) they talk to are interested in objects called white dwarfs and are searching for planets orbiting white dwarfs.

Exploration:

- ◆ **Astro Madness & Telescope Allocation Committee:** students explore the different telescopes and instruments available to astronomers at McDonald Observatory via the *What Are Astronomers Doing at McDonald Observatory?* website. They match up telescopes and instruments to specific observing tasks from pseudo-astronomers, then evaluate the scientific value of the observing proposals. This is the same process professional astronomers follow to determine which astronomer receives observing time on a telescope.

Explanation:

Think

Ask students to re-evaluate what they think astronomers do:

- What do they contribute to the body of scientific knowledge?
- How could their research be related to the science you are learning now?

They should think about this for about two minutes.

Pair

Break students up into teams of two to discuss what each thought about.

Share

For ten minutes, each team discusses their thoughts about what they think astronomers do. Select teams to share with the class their conclusions about what astronomers do. Summarize teams' responses on the board or overhead projector.

Elaboration:

Meet an Astronomer

From the *What Are Astronomers Doing at McDonald Observatory?* website, ask students to work in small groups to pick an astronomer and research topic that interests them.

They should compose a five-to-ten-frame *PowerPoint* presentation to help their group:

- Introduce their astronomer, and describe anything the group members and the astronomer may have in common (hobbies, interests, talents, etc.).
- Describe and explain the astronomer's project and the telescopes and instruments the astronomer is using.
- Identify and explain the content or concept connections they see between the astronomer's project and science content the students have studied in class.

Evaluation:

Meet an Astronomer Rubric

Criteria for maximum score	Score
Clearly and accurately communicates relevant information about the astronomer and his or her research. Group members extended their research beyond the <i>What Are Astronomers Doing at McDonald Observatory?</i> website to learn more about the astronomer's research topics.	0 2 4 6 8 10
Logical organization of information.	0 1 2 3 4 5
Creative design, easy to follow. No distracting graphics, noises, or slide transitions – these distract the audience.	0 1 2 3 4 5
Each group member clearly contributed to the research. Each group member plays a different and critical role in communicating what the group learned.	0 2 4 6 8 10
Group members describe the common science concepts in the astronomer’s research and your science curriculum.	0 2 4 6 8 10
Clearly and accurately cites information sources.	0 1 2 3 4 5
Answers questions from other students clearly and accurately.	0 1 2 3 4 5
Total Points out of 50:	

Background for Teachers:

What is a White Dwarf?

The basics:

- o <http://www.whitedwarf.org/index.html?education/&0>
- o http://imagine.gsfc.nasa.gov/docs/science/known_11/dwarfs.html

Chandra X-Ray Observatory

- o <http://chandra.harvard.edu/chronicle/0400/sirius.html>
- o http://chandra.harvard.edu/xray_sources/white_dwarfs.html

Hubble Space Telescope: Sirius B (a white dwarf)

- o <http://hubblesite.org/newscenter/newsdesk/archive/releases/2005/36/>

What Are Astronomers Doing at McDonald Observatory?

- o <http://mcdonaldobservatory.org/research/>

Research of White Dwarfs

- o <http://www.whitedwarf.org/>