

CLASSROOM ACTIVITY

SOFIA: Stars and The Space in Between

By sending an infrared telescope to altitudes of 12,000 meters (40,000 feet) and higher, NASA and the German Aerospace Center (DLR) conduct astronomical research that would be impossible using telescopes based on Earth. The Stratospheric Observatory for Infrared Astronomy-SOFIA-is the only airborne telescope in the world. Infrared imaging of stars and planets is difficult from ground-based observatories, because water vapor in Earth's lower atmosphere blocks most infrared radiation. SOFIA operates from a modified Boeing 747, soaring high above occluding vapor to capture infrared emissions from distant galaxies. Using instruments that include a high-speed imager and a sensitive far-infrared spectrometer, SOFIA will provide insights into distant star formation, the chemical composition of deep space, and the atmospheres of planets within our own solar system.

CLASS DISCUSSION

Establish Prior Knowledge

Have students work in two groups. Call on one group to research the advantages and disadvantages of land based telescopes. Have the second group research the advantages and disadvantages of space telescopes. When groups are ready, have them present their findings. *(Responses may include: Land based telescopes—disadvantages: Clouds and storms can block the land based telescope's view. Land based telescopes can detect only certain frequencies of the electromagnetic spectrum. The Earth's atmosphere bends the light from space creating another obstacle in the telescope's ability to capture clear images. Advantages: Land based telescopes are not as limited in terms of size. Larger land based telescopes are being designed using multiple mirrors which help to overcome atmospheric problems (one telescope being developed will use two 8.4 meter scopes). Space telescopes--disadvantages: Space telescopes are much smaller than telescopes on land. The Hubble telescope, for example, is 2.4 meters. The mirror size on a space telescope determines how much light it can capture. The more light, the more detailed the image. It is much harder and more expensive to install a telescope in space. Advantages: They are above the atmosphere and can more easily capture light of different wavelengths--like infrared, ultraviolet, x-ray and gamma ray--because there is no atmospheric distortion. Images taken of space are sharper.)*

Exploration

Before watching the feature have students read the synopsis. Encourage them to take notes as they watch. After viewing, use the following questions to guide a class discussion.

- What makes SOFIA unique? *(Answer: The telescope is mounted on a 747 that can fly above Earth's atmosphere.)*
- What is the primary purpose of putting an infrared telescope in an airplane? *(Answer: Water vapor in the lower atmosphere blocks most infrared radiation for land-based observatories. So the purpose is to fly high enough to where the atmosphere is cold and the water vapor has all frozen out.)*
- What are the main goals of SOFIA? *(Answer: The main goals are to study the environment where stars are forming, the chemical composition of deep space, and the atmosphere of planets within our own solar system.)*
- What instruments do SOFIA astronomers use to collect data? *(Answer: They use imagers and spectrometers. The spectrometer divides up the light, allowing astronomers to see the details of the elements that are out in space.)*
- How do astronomers use occultation to study Pluto's atmosphere? *(Answer: When Pluto passes in front of a star a faint shadow forms. The starlight is refracted by the atmosphere of the planet. By positioning SOFIA in the shadow, astronomers can study the refraction to measure the atmosphere's density.)*

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SOFIA (cont'd)

Wrap-Up

How do astronomers know that Pluto's atmosphere is becoming denser? (*Answer may include: They can look at data previously collected and compare it to data they have recently collected.*)

Extend

Students who would like to learn more about SOFIA can visit this NASA website.

http://www.nasa.gov/mission_pages/SOFIA/page2new_rd.html