



SPACE
MESSENGERS

BioSTEAM Activity Guide



2

SPACE MESSENGERS' WORKSHOP Week 2 Multi Messenger Astronomy

OVERVIEW

In this lesson you will prepare your students for the second day of the workshop called Multi Messenger Astronomy. Students will meet and hear from Dr. Nicole Lloyd-Ronning an Astrophysicist at Los Alamos National Laboratory.

Subjects

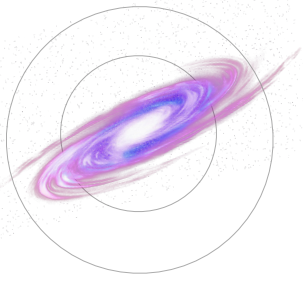
Art, science, technology, physics,

Estimated Time

Two 45 minute class period, or several class periods throughout the week.

Grade Level

7-12



INTRO

In the same way multi messenger astronomy shows us we can learn different things from the universe and see it in different ways depending on the lens through which we observe it, we too see the same objects from our own eyes, our own filters, and cultural perspectives. Exploring what it means to live sustainably on planet earth and on other worlds will need the different lenses and perspectives of all humanity, just like astronomers need to look at various different kinds of light and energy to fully understand a cosmic object. How can what we learn from space help us improve or create a more sustainable live on earth and in space?

With that in mind, imagine, how would your community on earth be different in an interplanetary future? What kind of life you'd like to live in space? What are the different ways you could imagine communities on other planets? How would people make decisions with this new understanding of our interplanetary place in the universe? How might your relationship with the environment be different? How would you conduct science and produce knowledge differently?

Dr. Nicole Lloyd-Ronning, LANL Astrophysicist

Frank Tavares, NASA Communication Specialist

SCIENCE + IMAGING ACTIVITIES

Objectives

Students will be able to:

- Understand basic concepts of spacetime, multi-messenger particles and gravity.
- Draw connections between what they learned about astrophysics and their own understanding of who we are and where we come from.
- Contemplate on how an understanding of the universe can develop empathy and humanitarianism.

Connect images to ideas / ideas to images

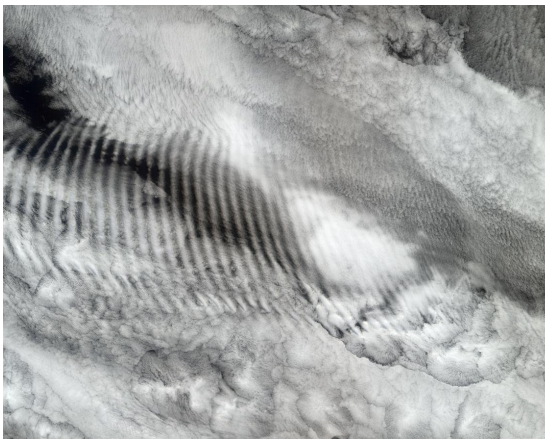
Watch Dr. Nicole Lloyd-Ronning speaker video (45 min session)

1. Watch [Nicole's video](#) on Multi-Messenger Astronomy as a class and discuss key take-aways:

- ◆ *Light and the other messages (neutrinos, gravitational waves, cosmic rays) we receive carry information about the physical processes going on in the objects in space (stars, planets, galaxies).*
- ◆ *Light (and the other space messages) look differently from different objects*
- ◆ *The color of light tells you how much energy the system has and/or how hot it is.*
- ◆ *The strength and "shape" of the signal of any of the space messages (that is, how strong the signal is and what it looks like spread across different energies and through time) tell us about what type of physical process produced it (e.g. nuclear fusion, black holes colliding, particles spinning in magnetic fields, etc)*

Students imagine and draw what they learned

2. Have students select 1-3 images from a science fact or theory that they resonated with (i.e. spacetime/gravitational waves, multi messenger particles). Ask students to imagine and draw how this science fact or theory could lead to a positive change in themselves, in their community or on the planet. It could be a tangible solution like a product, service or city design but also could be more abstract like how the knowledge transformed peoples way of thinking, attitude or behaviors. It can be abstract expressing a feeling or mood change or realistic like an engineering drawing.



•The idea can be completely fictional but should incorporate the specific science fact learned.

•The image specifications are as follows: JPG or PNG format and images should be 1000-2000px.

•Images must have a caption that includes the source link and what it is.

•*Example:* "In this natural-color image from the Multi-angle Imaging SpectroRadiometer (MISR), a fingerprint-like gravity wave feature occurs over a deck of marine stratocumulus clouds."

<https://www.jpl.nasa.gov/images/gravity-waves-ripple-over-marine-stratocumulus-clouds>

Preparation for Group Share:

In the live workshop session we will screen share student work and students will have the opportunity to explain the thinking behind it. Upload student work to the Space Board Gallery.

Dr. Nicole Lloyd-Ronning <https://vimeo.com/509215095>

