



# Telescopes as Time Machines

## FACILITATOR GUIDE

[ncscifest.org/starparty](http://ncscifest.org/starparty)

### OBJECTIVE

Observe distant objects in the universe, and learn how long it takes their light to reach us

### SUGGESTED AGE RANGE

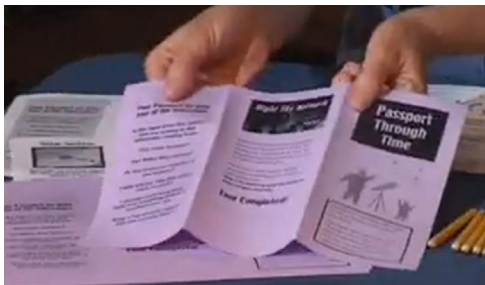
Ages 9 and up, or families

### ACTIVITY DURATION

5-10 minutes to introduce; completing the Passport can take as much time as participants wish, up to the duration of the star party

### MATERIALS

- Telescopes
- Copies of Passport Through Time handout
- Pencils
- Completion stickers



### SETTING

Indoors or outdoors for the introduction; outdoors at night for the telescope viewing

### PREPARATION

Check in with astronomers you're working with about your plans for this activity. Give them a copy of the Passport, and explain that visitors to their telescopes will be on a tour to look at objects in the three categories on the Passport. Ask them to pick whichever object(s) they wish to show and that their telescope is capable of viewing. Astronomers need to be prepared to tell visitors what they're viewing and which of three distance categories the object is in:



our solar system, or elsewhere in our Milky Way Galaxy, or outside our own galaxy. Astronomers may also wish to be prepared to relate the light-travel time of that object to historical events in human history or the history of life on Earth.

### PROCEDURE

1. Invite participants to relate telescope observing to other types of exploring, e.g., "Have any of you gone on a trip recently where you explored a new place? Has anyone ever explored (pick a favorite local attraction)?" Wait for responses.
2. Explain that tonight we'll do a different kind of exploring, by looking through telescopes. With each peek in a telescope eyepiece, you'll explore the universe, not only through space, but through time.
3. Encourage your participants to think of telescopes as time machines. Usually we think of light as traveling so fast we don't notice its travel time. Flip a light switch, and it takes no time at all for light to fill the room. But distances in space are so vast that it *does* take time for that light to reach us. The light has been traveling from within a few minutes to millions of years. Tonight you can travel from time machine to time machine, and hunt for these amazing objects whose light has been traveling for minutes, years, or even millions of years.
4. Hold up the Passport Through Time. Explain to participants that



### BACKGROUND

During telescope observing, visitors sometimes wonder, “How far can you see with your telescope?” This activity answers the question in a fun way by keeping the categories of distant objects simple and linked to the amount of time it takes that light to reach us:

- Light has been traveling for **less than a day** if it’s coming from objects in our solar system (e.g., the Moon, planets).
- Light has been traveling for **a few years to thousands of years** if it comes from stars or Messier objects that are not galaxies. These are all within the Milky Way Galaxy, the galaxy that our solar system is part of.
- Light has been traveling for **more than a million years** if it comes from most other galaxies.

Watch Night Sky Network’s activity demo (3 minutes):

<https://nightsky.jpl.nasa.gov/news/411/>

### CREDIT

Adapted with permission from  
NASA’s Night Sky Network,

<http://go.nasa.gov/nightskynetwork>

for each object they see in a telescope, they’ll determine if it is in our solar system, or elsewhere in our Milky Way Galaxy, or outside our galaxy. They should record on their Passport which objects they viewed.

5. Explain the procedure you’ve chosen to distribute the completion stickers—or other “prize.” For example: “After you’ve seen at least one object in each category, you’ll have earned a completion sticker.”
6. Explain how participants can use the Passport to guide their journey, e.g., “As you explore farther and farther away from Earth, think about how long it takes the light from each of these objects to get to us. In the case of objects you’ll see in our solar system, it is on the scale of up to a few minutes to hours.”
7. Pick a couple of solar system objects that are currently visible. For example, for the Moon and Jupiter, you might say, “The light you see from the Moon left the Moon just over one second ago. But the light from Jupiter left about 40 minutes ago. Where were you 40 minutes ago? Finishing up dinner? On your way here? For objects you see within our solar system, it takes less than a day for their light to reach us. Our solar system is a small part of the Milky Way Galaxy. For other objects in the Milky Way Galaxy, ones outside our own solar system, it takes much longer for their light to reach us. Not just days, but years, perhaps tens of thousands of years.”
8. Pick a nearby bright star—for example, Sirius, which is 9 light-years away. Ask, “Are there any 9-year-olds here? The starlight from Sirius has been traveling as long as you have been alive and is just getting here tonight. Ask the astronomers sharing their telescopes with you how long the light has been traveling from the object you’re viewing. Did it leave today (objects in our solar system), during the time modern humans have been on Earth (objects in our Milky Way galaxy), or does that light predate modern humans? Could it have started out during the reign of dinosaurs?”
9. Pass out pencils and copies of the Passport Through Time, and encourage your participants to use them as guides to their journey back in time.



The Statewide Star Party is made possible by the generous grant support of the North Carolina Space Grant.