Emera Astronomy Center
and M. F. Jordan Planetarium

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Magic Tree House: Space Mission

Compiled and Edited by Leisa Preble

THE UNIVERSITY OF MAINE

A Member of the University of Maine System

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and M. F. Jordan Planetarium

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Mission Statement:
The mission of the Maynard F. Jordan Planetarium of the University of Maine is to provide the University and the public with educational multi-media programs and observational activities in astronomy and related subjects.

Cosmic Classroom

Looking for fun and interesting space activities? The planetarium staff has prepared a collection of materials we call the Cosmic Classroom for you to use before and/or after your visit. These materials are entirely for use at your own discretion and are not intended to be required curricula or a prerequisite to any planetarium visit. The Cosmic Classroom is one more way that the Jordan Planetarium extends its resources to help the front line teacher and support the teaching of astronomy and space science in Maine schools.

The lessons in this Cosmic Classroom have been edited and selected for the range of ages/grades that might attend a showing of this program at the Jordan Planetarium. Those activities that are not focused at your students may be adapted up or down in level. Our staff has invested the time to key these materials to the State of Maine Learning Results in order to save you time.

The State of Maine Learning Results performance indicators have been identified and listed for the program, the Cosmic Classroom as a package, and each individual activity within the package. The guide also includes related vocabulary and a list of other available resources including links to the virtual universe. We intend to support educators, so if there are additions or changes that you think would improve, PLEASE let us know.

Thank you, and may the stars light your way.

The Maynard F. Jordan Planetarium Staff

The Program – *Magic Tree House Space Mission*

Franklin, our talkative star projector, is the host for this visit to the University of Maine's sky theater. He will lead you through our solar system stopping to chat with each member from the Sun to Pluto. Visitors will learn each member's most interesting features and enjoy the colorful personality of world. The planetarium guide will help to find the constellations that are in this season's sky. Visitors are encouraged to participate in this interactive show by answering questions posed by Franklin and the planetarium staff, and by asking questions of their own after the return home.

We are very glad that you have chosen to visit our planetarium with your group. We hope that this guide either will help you prepare your group or help you review their experience at the University of Maine's sky theater.

State of Maine Learning Results Guiding Principles

The lessons in this guide, in combination with *Our Sky Family*, will help students to work towards some of the Guiding Principles set forth by the State of Maine Learning Results. By the simple act of visiting the planetarium, students of all ages open an avenue for self-directed lifelong learning. A field trip encourages students to think about learning from all environments including those beyond the schoolyard. A Jordan Planetarium visit also introduces visitors to the campus of the largest post-secondary school in Maine and encourages them to think of this as a place which holds opportunities for their future education, enjoyment and success.

Other sites on the University campus, including three museums, explore a variety of subjects, and the Visitors Center is always willing to arrange tours of the campus. A field trip can contribute to many different disciplines of the school curriculum and demonstrate that science is not separate from art, from mathematics, from history, etc. The world is not segregated into neat little boxes with labels such as social studies and science. A field trip is an opportunity for learning in an interdisciplinary setting, to bring it all together and to start the process of thinking. For a more complete discussion of field trips, please visit the Jordan Planetarium web site at http://umainesky.com.

If used in its entirety and accompanied by the Planetarium visit this guide will help students to:

Become **a clear and effective communicator** through

A. oral expression such as class discussions, and written presentations
B. listening to classmates while doing group work, cooperation, and record keeping.

Become **a self-directed and life long learner** by

A. introducing students to career and educational opportunities at the University of Maine and the Maynard F. Jordan Planetarium.
B. encouraging students to go further into the study of the subject at hand, and explore the question of "what if?"
C. giving students a chance to use a variety of resources for gathering information

Become **a creative and practical problem solver** by

A. asking students to observe phenomena and problems, and present solutions
B. urging students to ask extending questions and find answers to those questions
C. developing and applying problem solving techniques
D. encouraging alternative outcomes and solutions to presented problems

Become **a collaborative and quality worker** through

A. an understanding of the teamwork necessary to complete tasks
B. applying that understanding and working effectively in assigned groups
C. demonstrating a concern for the quality and accuracy needed to complete an activity

Become **an integrative and informed thinker** by

A. applying concepts learned in one subject area to solve problems and answer questions in another
B. participating in class discussion

State of Maine Learning Results Performance Indicators

In conjunction with the Maynard F. Jordan Planetarium show *Our Sky Family,* this guide will help you meet the following State of Maine Learning Results Performance Indicators in your classroom.

Grades Pre. K-2

Science and Technology –

D1. Universe

a. Describe how the sun and moon seem to move across the sky.
b. Describe the changes in the appearance of the moon from day to day.

D3. Matter and Energy

a. Describe objects in terms of what they are made of and their physical properties

Social Studies

D1. Geographic Knowledge, Concepts, Themes, and Patterns

c. Use basic maps and globes to identify local and distant places and locations, directions, and basic physical, environmental, and cultural features.

Visual and Performing Arts –

B. Creation, Performance, and Expression

B1. Media Skills – Students use basic media, tools and techniques to create original art works.

E. Visual and Performing Arts Connections

E2. The Arts and Other Disciplines – Students identify connections between and among the arts and other disciplines.

Grades 3-5

Science and Technology –

C2. Understandings About Science and Technology

a. Describe how scientists seek to answer questions and explain the natural world.

b. Describe how engineers seek solutions to problems through the design and production of products.

C3. Science, Technology and Society

c. Explain that natural resources are limited, and that reusing, recycling and reducing materials and using renewable resources is important.

D1. Universe

a. Show the locations of the sun, Earth, moon, and planets and their orbits..

c. Recognize that the sun is a star and is similar to other stars in the universe.

English Language Arts –

E1. Listening

b. Converse without interrupting.

E2. Speaking

c. Use voice level appropriate to the situation

Next Gen Science Standards

1-ESS1. Space Systems: Patterns and Cycles.

1-ESS1-1. Use observations of the sun, moon, and stars to describe patterns that can be predicted.

5-ESS1. Space Systems: Stars and the Solar System

1-ESS1-A: *The Universe and its Stars.* The sun is a star that appears larger and brighter than other stars because it is closer.

Performance Indicators Snapshot

The Show

Grades Pre. K-2

Science and Technology: A1.a; C3; D1.a, b; D3.a

Grades 3-5.

Science and Technology: C3.c; D1.a, c

English Language Arts: E1.b., E2.c.

NGSS.

Space Systems

Patterns & Cycles – 1-Ess1-1
Stars & the Solar System – 5-ESS1-A

The Guide

Grades Pre. K-2.

Science and Technology: D1.a, b; D3.a.

Social Studies – Geography: D1.c

Visual and Performing Arts: B1., E2.

Grades 3-5.

Science and Technology: D1.a, c.

NGSS.

Space Systems

Patterns and Cycles – 1-Ess1-1

Stars & the Solar System – 5-ESS1-A

The Maynard F. Jordan Planetarium - Cosmic Classroom Activity

Finding Directions

Objectives and State of Maine Learning Results Performance Indicators:

1. Learners will be able to identify the directions north, south, east, and west (Pre.K-2. Social Studies. Geography. D1.c.)

The General Idea:

Knowing the four compass directions is a starting point for observing the nighttime sky. Since the very first step in finding any star or constellation is always to face a certain direction, the following exercise is designed to help the student find and remember the directions. An obstacle course makes a good tool for teaching what directions are and why they are needed

Getting Ready:

- Make an obstacle course with chairs and tables.

What You Need:

Tables and chairs (and anything else you want) to make an obstacle course

What To Do:

1. The students will guide a classmate through the obstacle course by giving verbal directions (expect directions such as "Turn to the blackboard", or "Turn to the teacher's desk").
2. Point out that while the blackboard and teacher's desk are available as points of reference in the classroom, landmarks constantly change out of doors and over longer distances. We need references that do not change if we are to give directions over larger areas, such as cities, mountains, or the sky.
3. The easiest clue to directions that everyone is familiar with is the Sun. (***NOTE:*** Before doing any activities related to the Sun, be sure to warn the children ***never*** to look directly at the Sun.)
4. Have the students find and face toward where the Sun rises and where it sets. Mark those directions as East and West in the classroom with signs for student reference. (NOTE: the sun rises in the general direction of East and sets in the general direction of West but **very** seldom due east and due west).
5. Discuss which hand is pointing toward the north and which toward the south when the students face the sign that says East, and again when the students face West. Mark North and South with signs, too.
6. Now the students return to the obstacle course and direct each other through it using only north, south, east, and west.

What To Discuss:

1. Why is it important for us to understand and use the directions north, south, east, and west?

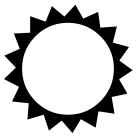
Continuations/Extension:

1. For further reinforcement, the students may figure out which direction their school building faces, which direction the jungle gym is from the school, etc.
2. As homework, they may determine in which direction their own house, their bedroom windows, and their back door face.

The Sun Is a Star

Based on The Sun is a daytime star. by Susan Reynolds and Onondaga-Cortland-Madison Board of Cooperative Educational Services Math, Science and Technology.

Objectives and State of Maine Learning Results Performance Indicators:



1. Learners will be able to identify objects that are in the daytime and nighttime sky (Pre.K-2. Science and Technology. D1.a.)
2. Learners will be able to identify the Sun as the only star visible during the day. (3-5. Science and Technology. D1.c.)

NGSS:

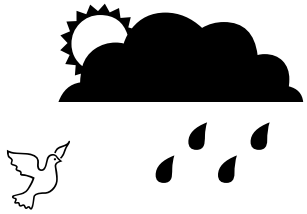
1. Learners will use observations of the sun, moon, and stars to describe patterns that can be predicted. (1.Space Systems: Patterns and Cycles. 1-ESS1-1)
2. Learners will understand that the sun is a star that appears larger and brighter than other stars because it is closer. (5.Space Systems: Stars and the Solar System. ESS1.A)

The General Idea:

When discussing astronomy we often mention the Sun, moons, stars and planets, but for many young students this may inadvertently cause them to believe that the Sun is not a star. The following activity is designed to help students remember that the Sun is a star we can see during the day.

Getting Ready:

- Ask the students to think about, and discuss, when the Sun can be seen.



What You Need:

Paper
Crayons, markers, chalk, etc.
Sunny day

What To Do:

1. Take the students outside on a Sunny day to observe the daytime sky (before going outside, emphasize to the students that they should ***never*** look directly at the Sun because it could hurt their eyes).
2. Have the students write down, or write down for your students, what they see out during the day.
3. Talk to the students about what they think the Sun is, what it's made of, etc.
4. Explain that stars are made of the same things that the Sun is made of; that the Sun is the same as many of the stars we see at night. In fact, the Sun is a star that is closer to us than all other stars and that's why it looks so much bigger.
5. Have students make a list of what they see at night and have a class discussion about the differences between this list and the list of things they see during the day.
6. Have each student fold a piece of paper in half.
7. Have students draw the daytime sky on one side of the piece of paper and the nighttime sky on the other side. Students can use these drawings to remember the differences in the daytime and nighttime sky as well as remembering that the Sun is a star.

What To Discuss:

1. What did you observe in the daytime sky?
2. What did you observe in the nighttime sky?
3. What can be seen in both the daytime and nighttime sky?

Matching Game

Written by Kim Small

Objectives and State of Maine Learning Results Performance Indicators:

1. Learners will be able to compare two objects in the universe and determine whether they are the same type of object. (Pre. K-2. Science and Technology. D3.a.)
2. Learners will be able to describe the physical properties of celestial bodies and group them based on those properties. (Pre. K-2. Science and Technology. A3.a, D3.a.)

NGSS:

1. Learners will be able to use observations of the sun, moon, and stars to describe patterns that can be predicted. (1.Space Systems: Patterns and Cycles. ESS1-1)

The General Idea:

This activity exercises recognition skills by matching objects in the sky that students may not realize are very similar. An example of this is Sun/star, Earth/planet, and different phases of the Moon. Emphasis can be placed on the idea that even though objects don't always look the same, as a whole they may not be all that different.

Getting Ready:

1. Explain to students that the Sun and stars are shaped like balls, but are often represented with points. This is a good time to show them some drawings of stars and some actual photographs of stars.
2. Explain to students that even though the shape of the Moon doesn't look round all the time, it is always shaped like a ball. A demonstration about moon phases may be helpful here for very young students.
3. Planets look different from one another and are made of different substances, but they are all planets.

What You Need:

- Pictures of the Sun, stars, Earth, planets, and Moon phases.
- Crayons, markers or colored pencils
- Scissors
- 3x5 index cards

What To Do:

1. Have students look at the different pictures and show them how they are the same.
2. Have students color their own versions of the pictures you showed them on the 3x5 cards.
3. You may organize "Match Game" for a class activity, small group, or one-on-one using the cards that the students have constructed. For young students, the pictures themselves may be used and you can do away with step 2 altogether.
4. Arrange a mixed group of cards on a table and ask student(s) to pick out which is the Sun/star, Moon or Earth/planet.

5. Arrange a mixed group of cards/pictures and ask student(s) to pick out which is not the Sun/star, Moon or Earth/planet; OR have students make groups of one, excluding all others. (i.e. all planets or all phases of the moon)
6. Repeat as desired with as many cards/pictures as appropriate for the age of your students.

What To Discuss:

1. The Sun is a star, and like all stars, is shaped like a ball. Even though they are sometimes drawn with points, stars are not pointed.
2. The Moon doesn't always look the same, but the different shapes we see repeat again and again over time.
3. Earth is not the only planet, but each of the eight planets are different.

The Maynard F. Jordan Planetarium - Cosmic Classroom Activity

Stars Give Off Light

Based on Stars give off light. The moon and planets reflect light. by Susan Reynolds and Onondaga-Cortland-Madison Board of Cooperative Educational Services math, Science and Technology.

Objectives and State of Maine Learning Results Performance Indicators:

1. The learners will be able to demonstrate an understanding that moons and planets get their light from stars. (3-5. Science and Technology. D1.c)
2. The learners will be able to show that the Sun is a star. (3-5. Science and Technology. D1.c).
3. The learners will be able to describe the effects of the Sun's light on how we see other stars during the day. (3-5. Science and Technology. D1.c)

NGSS:

1. Learners will be able to support an argument that differences in the apparent brightness of the sun compared to other stars is due to their relative distances from earth. (5.Space Systems: Stars and the Solar System. ESS1-1)
2. Learners will be able to demonstrate that the sun is a star that appears larger and brighter than other stars because it is closer. (5.Space Systems: Stars and the Solar System. ESS1-A)

The General Idea:

To the untrained eye, the night sky is ablaze with the light of thousands of tiny dots. From here on Earth it is sometimes hard to tell the stars from the planets. This activity will help students understand that while both the stars and planets appear to shimmer in the night sky, they are very different objects indeed.

Getting Ready:

- Provide half of the students with Styrofoam balls of varying sizes and the other half with flashlights of varying brightness.

What You Need:

Styrofoam ball
Flashlights
Slide projector
Penlight

What To Do:

1. Hand out the Styrofoam balls and flashlights
2. Darken the room
3. Have the students with the flashlights (the "Stars") shine away from the Styrofoam balls (the "planets")
4. Now have the "stars" shine ON the "planets"

What To Discuss:

1. Are the “planets” easy to see?
2. Is it easier to see the “planets” with the “stars” shining on them?
3. Do moons and planets give off light of their own?

What To Do:

1. Have a students hold a penlight next to a an unlit slide projector
2. Ask the students how easy it is to see the light from the penlight (easy)
3. Turn on the slide projector (warn students NOT to look into the light from the slide projector because it could hurt their eyes)
4. Ask the students if it’s still easy to see the penlight or if they can see it at all now (no)

What To Discuss:

1. Why couldn’t we see the penlight as well when the projector was on?
2. If the slide projector is the Sun and the penlight is a star, what effect does the Sun have on our ability to see stars during the day?
3. Why can’t we see stars during the day?

Extensions/Continuations:

1. Have students create “legends” about why we cannot see stars during the day, perhaps putting them together into a class book or a book for the library.

Vocabulary List

Axis	An imaginary straight line around which an object rotates.
Cardinal Directions	Due North, due South, due East, and due West.
Comet	Frozen masses of gas and dust which have a orbit through the solar system.
Compass	A tool for finding directions that uses a magnet to find magnetic North.
Constellation	A grouping of stars, considered by humans to form a picture in the sky. Often related to mythology.
Galaxy	A cluster of stars, dust, and gas held together by gravity.
Gravity	The force of attraction between two objects which is influenced by the mass of two objects and the distance between the two objects.
Meteor	small particles of matter in the solar system that are observable only by their burning on entry into the atmosphere.
Milky Way galaxy	large spiral galaxy consisting of several billion stars, one of which is the Sun.
Moon	A natural satellite orbiting a planet.
Orbit	A specific path followed by a planet, satellite, etc.
Planet	A massive object orbiting a star.
Recycle	To take something that has been processed at least once already and process it again so that it can be used again.
Revolution	The circling of a smaller object around a larger object.
Rotation	The spinning of an object on its axis.
Solar System	The system of planets, moons, and other objects revolving around a star (in our case, the Sun).
Star	a massive, self-luminous celestial body of gas that shines by radiation derived from its internal energy sources.
Sun	Sol, the star that is closest to Earth and from which we get heat and light energy.
Universe	The vast expanse of space which contains all of the matter and energy in existence.

Some good books to use with *Magic Tree House Space Mission*

The Magic School Bus: Out Of This World
Posner, Jackie (adaptation). Illu. By Robbin Cuddy. 1996, Scholastic Inc.

Our Solar System
Simon, Seymour. 1992, Morrow Junior Books

The Planets in Our Solar System
Branley, F. 1986, Harper & Row.

Postcards from Pluto: A Tour of the Solar System
Leedy, Loreen. 1993, Holiday House.
Dr. Quasar gives a group of children a tour of the solar system

I Didn't Know The Sun is a Star
Petty, Kate. 1997, Copper Beech Books

Mercury
Vogt, Gregory. 1994, The Millbrook Press

The Planet Venus
Hunt, G. & Moore, P. 1982, Faber & Faber.
An illustrated introduction.

The Home Planet
Kelley, K. . 1988, Addison-Wesley.
A picture album.

Mars
Vogt, Gregory. 1994, The Millbrook Press

Destination: Jupiter
Simon, Seymour. 1998, Morrow Junior Books

Saturn: A Spectacular Planet
Branley, F. 1983, Crowell.

A Distant Puzzle: The Planet Uranus
Asimov, Isaac, 1994, Milwaukee : Gareth Stevens Pub.,
Revised edition of "Uranus: The Sideways Planet"

Neptune : the farthest giant
Asimov, Isaac. 1990, G. Stevens Children's Books.
Describes the characteristics and movements of the planet Neptune.

Some good web sites to use with *Magic Tree House Space Mission*

ssd.jpl.nasa.gov
A site about our solar system maintained by the Solar System Dynamics Group of the Jet Propulsion Laboratory.

seds.lpl.arizona.edu/nineplanets/nineplanets/nineplanets.html
A Multimedia Tour of the Solar System from the Students for the Exploration and Development of Space

spaceplace.jpl.nasa.gov/spacepl.htm
The Jet Propulsion Laboratory's web site for kids

Lessons From The World Wide Web

Also, a wide variety of lesson plans and activities can be found on the World Wide Web. These sites are dedicated to lesson planning in a variety of subjects.

cse.ssl.berkeley.edu
The Center for Science Education at U. C. Berkeley Space Science Laboratory home page with a link to the Science Education Gateway, Lesson Plans

btc.montana.edu/ceres
Maintained by the Burns Telecommunications Center, this page links to educational activities and classroom resources.

school.discoveryeducation.com/
This Discovery Channel education site allows teachers to search for lesson plans by grade and subjects.

Astronomy Web Sites Worth a Visit

Astro.umaine.edu
The Emera Astronomy Center and the Maynard F. Jordan Planetarium & Observatory home page.

hawastsoc.org
The Hawaiian Astronomical Society's home page

www.nss.org
The National Space Society page

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The Maynard F. Jordan Planetarium does not guarantee that the information given on the above web sites to be accurate, accessible, or appropriate for students.

Additional Activities and Information

The Family of the Sun (song sheet)

The Family of the Sun

By Melvin Zisfein and Robert Wolfe
(revised and sung to the tune of "The Farmer in the Dell)

REFRAIN The Family of the Sun.
Its planets number eight,
Plus other rocky, icy worlds
That we appreciate.

Mercury is hot,
and Mercury is small.
Mercury has no atmosphere;
It's just a rocky ball.

(Repeat refrain)

Venus has thick clouds
That hide what is below.
The air is foul, the ground is hot.
It rotates very "slow."

(Repeat refrain)

We love the Earth, our home.
Its oceans and its trees.
We eat its food. We breathe its air.
So no pollution, please.

(Repeat refrain)

Mars is very red.
It's also dry and cold.
Some day you might visit Mars
If you are really bold.

(Repeat refrain)

Great Jupiter is big.
We've studied it a lot.
We found that it has many moons
and a big red spot.

(Repeat refrain)

Saturn has great rings.
We wondered what they were.
Now we know they're rocks and ice
which we saw as a blur.

(Repeat refrain)

With atmospheres that swirl
& wispy white clouds too
Uranus and Neptune
are so cold that you'd turn blue.

(Repeat refrain)

Pluto's small and cold
It has an icy face.
We call it a dwarf planet now,
But it's still quite a place.

The family of the Sun.
Its planets number eight.
Plus other rocky, icy worlds.
Now our journey's done.