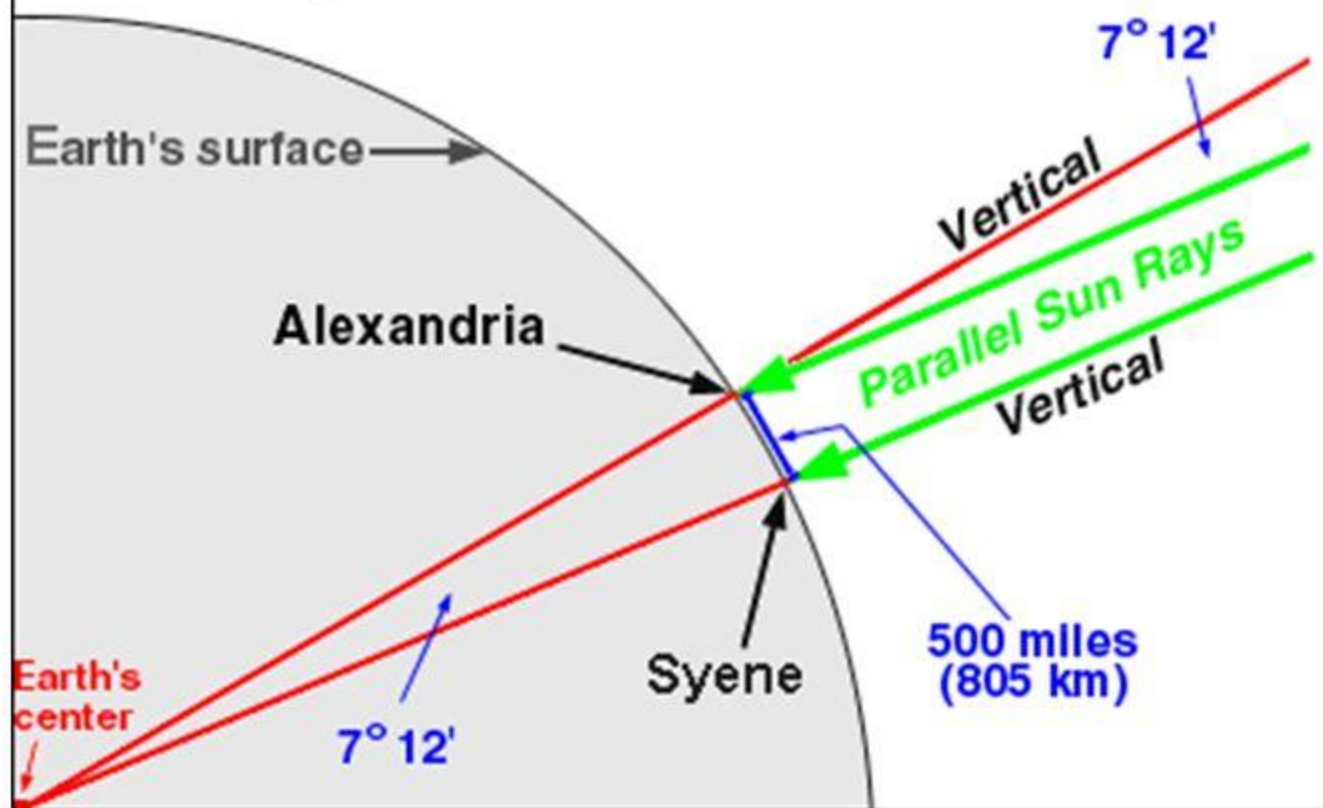


Primjena fizičke geografije u nastavi astronomije

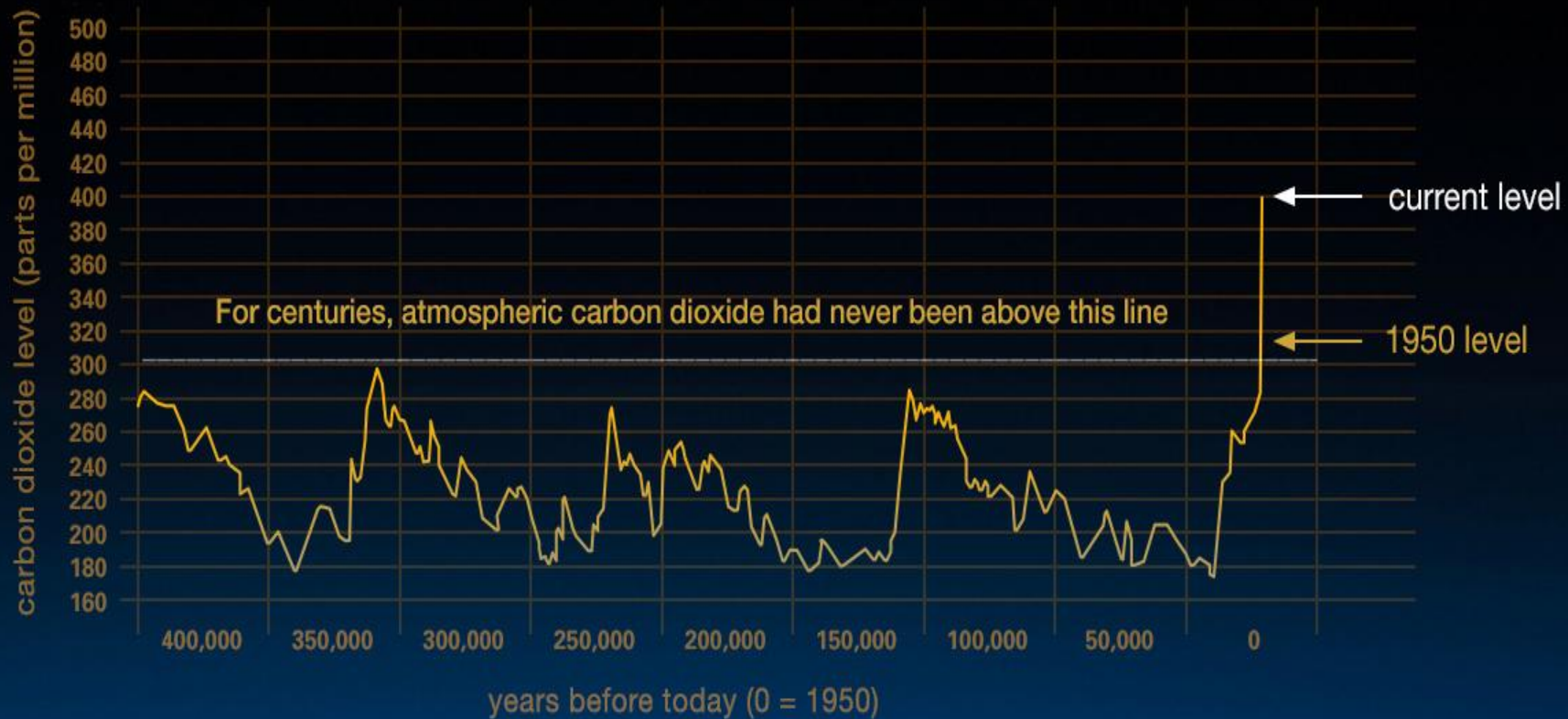


IF
 $7^{\circ} 12' = 1/50$ of a circle
THEN
 $50 \times 500 = 25,000$ miles
or
 $50 \times 805 = 40,250$ km



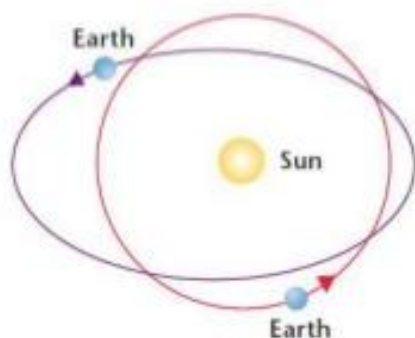
Eratosthenes (276-194 BC) calculated the radius of the Earth by measuring the arc length between (wells!) where the sun's rays are vertical and inclined to a known angle.

The actual circumference of the Earth at the equator is 40,008km

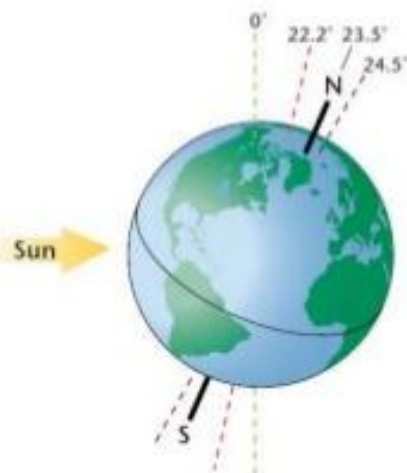


Source: climate.nasa.gov

Milankovitch Cycle



Eccentricity Earth encounters more variation in the energy that it receives from the sun when Earth's orbit is elongated than it does when Earth's orbit is more circular.



Tilt The tilt of Earth's axis varies between 22.2° and 24.5° . The greater the tilt angle is, the more solar energy the poles receive.



Precession A gradual change, or "wobble," in the orientation of Earth's axis affects the relationship between Earth's tilt and eccentricity.

Climate Change Initiatives

Connect

NASA Climate Change Curriculum

Grades 10-12

Grades 7-9

Summary for Grades 7-9 (PDF)

Unit 1

Unit 2

Unit 3

Unit 4

Grades 5-6

Grades 7-9, Unit 1

Climate Change in My Backyard Activity Descriptions

Unit 1: The Earth as a System

Unit 1 is divided into two sections that consider different Earth systems and how they interact. In 1A, students explore the Earth systems that create and affect climate including the Earth's energy balance and the greenhouse effect. They learn what the natural and human causes are of greenhouse gas emissions and explore how the sun's energy, greenhouse gases, and the Earth's surface interact to moderate global average temperature. They use a NASA data analysis tool to model different surface reflectivity and greenhouse gas scenarios. In 1B, students learn about the biosphere as a system. They explore how organisms interact with each other and their environment, how disturbances (such as climate change) can be felt throughout a food web. Finally, students learn about ecosystem services—the importance to humans of healthy, intact ecosystems.

1A. The Earth's Energy Balance and the Greenhouse Effect

Activity 1.1: Understanding the Greenhouse Effect

1. [Greenhouse Effect Lab](#): Students complete a lab activity that models the greenhouse effect and then discuss the natural vs. human-induced changes in greenhouse gas concentrations.
2. [The Earth's Energy Balance](#): Students create a diagram of the Earth's energy balance, answer opinion questions, and perform a skit to understand the Earth's energy balance. Students learn that all energy on Earth originates from the sun and what happens to the energy once it reaches the Earth's atmosphere. Students are introduced to the concept of greenhouse gases.

Activity 1.2: Micro-GEEBITT (Global Equilibrium Energy Balance Interactive Tinker Toy)

Students use the NASA Micro-GEEBITT climate-modeling tool to explore how changing variables in Earth systems impact global average temperature. Students model the effects of changes in surface reflectivity and greenhouse gases in different climate and emissions scenarios.

Activity 1.3: Greenhouse Gas Emissions, Natural & Human Causes

In this activity, students dig deeper into the greenhouse effect and explore natural and human-caused greenhouse gas emissions. Students brainstorm, and then research, factors that contribute to greenhouse gas emissions. They use the energy balance diagram they completed in Activity 1.2 as the basis for a new diagram that incorporates natural and human causes of greenhouse gas emissions. Students also brainstorm how they can reduce their contributions to greenhouse gas emissions.










1B. Ecosystems and Climate


Activity 1.4: Nature Walk & Ecosystem Introduction


Students take a walk through nature and make observations of their surroundings. Students then act as different elements in an ecosystem—both biotic and abiotic—and demonstrate the interconnectedness between them. The activity provides both visual and tactile demonstrations of the interconnectedness of all components of an ecosystem, and explains that they are dependent on each other for survival.


Grades 7-9

Lesson Guide for Units 1-4

- | | | |
|--------------|---|---|
| 1.1 Activity | — | <u>Understanding the Greenhouse Effect</u>
(PDF ) |
| 1.2 Activity | — | <u>Micro-GEEBITT Climate Activity</u>
(PDF ) |
| | | <u>Micro-GEEBITT Climate Model</u>
(Excel ) |
| 1.3 Activity | — | <u>Greenhouse Gases: Natural and Human Causes</u>
(PDF ) |
| 1.4 Activity | — | <u>Nature Walk and Ecosystem Introduction</u>
(PDF ) |
| | | <u>Food Web Cards</u>
(PDF ) |
| 1.5 Activity | — | <u>Leaf Litter Lab</u>
(PDF ) |
| 1.6 Activity | — | <u>Food For Thought: Trophic Cascades</u>
(PDF ) |
| 1.7 Activity | — | <u>Ecosystem Services</u>
(PDF ) |

[Guiding Questions and Assessments](#)
(PDF )

[Unit 1 Pre-assessment](#) (PDF )

[Unit 1 Post-assessment](#) (PDF )



MARS EDUCATION

at Arizona State University

[HOME](#)[MARS RESOURCES](#)[NGSS STEM LESSONS](#)[MSIP](#)[PROFESSIONAL DEVELOPMENT](#)[NEWS](#)[ABOUT US](#)[FORUMS](#)

MSIP: Welcome to the Mars Student Imaging Project

[Back](#)[Table of Contents](#)[MSIP: How to Start](#)

The Mars Student Imaging Project (MSIP) is a nationally recognized award winning authentic **inquiry-based learning and student-centered** education project. Students learn how science works by engaging in science research using data from a NASA spacecraft orbiting Mars. Students understand how science really works by actually being a scientist.

The Mars Student Imaging Project (MSIP) is an **immersive** and **transformational** way for students in grades 5 through early college to engage in scientific process and practices through **authentic research experiences**. MSIP enhances the teaching of traditional courses, such as physical science, Earth science, chemistry, and biology. MSIP also incorporates 21st Century Skills to help students be ready for the STEM workforce.

MSIP can be done through distance learning or as an independent research project. **There is no fee to participate in the Mars Student Imaging Project.**

[Back](#)[Table of Contents](#)[MSIP: How to Start](#)

LATEST NEWS @ASUMARS!

- RT [@RQChallenge](#) ✨ Check out the start of our Mars Student Imaging Project with [@ASUMARS](#) ✨, using images from [@NASA THEMIS](#). [#JourneyToMars](#) ✨ h...
9 months 6 days ago
- Amazing NASA Field Trip and Symposium for Educators now posted @ <https://t.co/7jCk18st8o> ✨
1 year 1 month ago

[MARS STUDENT IMAGING PROJECT \(MSIP\)](#)[TEACHER SPOTLIGHT](#)[ROCK AROUND THE WORLD](#)

Mars Odyssey THEMIS

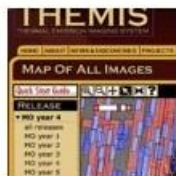
thermal emission imaging system



[About Mars Odyssey & THEMIS](#) | [Image Galleries](#) | [News](#) | [Discoveries](#) | [Education](#) | [Projects](#) | [Research](#) | [Software](#) |

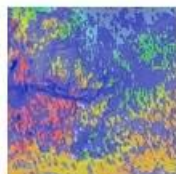
[Home](#) > [News](#) >

Image Galleries



[Webmap of All THEMIS Images \(2002-Present\)](#)

Image footprints for all released images taken by the Thermal Emission Imaging System (THEMIS) on the Mars Odyssey orbiter.



[Maps of all Mars images](#)

Find images taken by Mars-orbiting spacecraft from Viking (1976) to the present day.



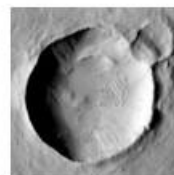
[THEMIS Feature Articles](#)

Feature articles combine striking THEMIS images and mosaics with recent research about Mars.



[Mars Global Movies](#)

Wrapping spacecraft data around a Mars globe presents new ways of seeing the Red Planet.



[THEMIS Image of the Day](#)

Daily images from the THEMIS camera analyzed by our staff scientists.



[Vistas](#)

What would you see if you could fly over Mars?



["Live" Images from Mars](#)

Every week, THEMIS takes several hundred images of the surface of Mars. See them here as they are received by mission scientists.



[THEMIS Images By Topic](#)

A continually augmented selection of THEMIS images organized by geologic theme.



Mystery Planet

2nd - 5th Grade NGSS, Common Core, and 21st Century Skills Alignment Document



WHAT STUDENTS DO: Explore a Model Planet to Discover New Features

In this activity, students step into the shoes of real planetary scientists and explore crustal samples from a “Mystery” planet. Using sorting/classification, students will interpret the geologic history of a region from which a sample has been collected and make inferences about past life or the potential for life on the “Mystery” planet.

NGSS CORE & COMPONENT QUESTIONS

HOW CAN ONE EXPLAIN THE STRUCTURE, PROPERTIES, AND INTERACTIONS OF MATTER?

NGSS Core Question: PS1: Matter and Its Interactions

HOW AND WHY IS EARTH CONSTANTLY CHANGING?

NGSS Core Question: ESS2: Earth's Systems

HOW CAN THERE BE SO MANY SIMILARITIES AMONG ORGANISMS YET SO MANY DIFFERENT KINDS OF PLANTS, ANIMALS, AND MICROORGANISMS?

NGSS Core Question: LS4: Biological Evolution: Unity and Diversity

INSTRUCTIONAL OBJECTIVES

Students will be able

IO1: to model

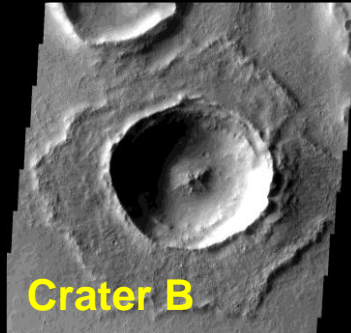
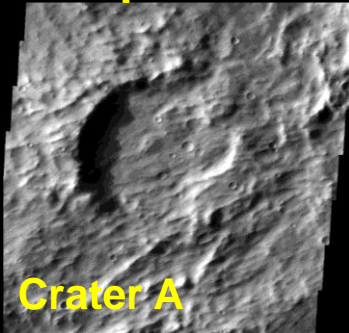
scientific
classification
schemes through
identifying criteria
necessary to sort
and classify
materials and
relate them to the
geologic history of
a region

Relative Ages of Features

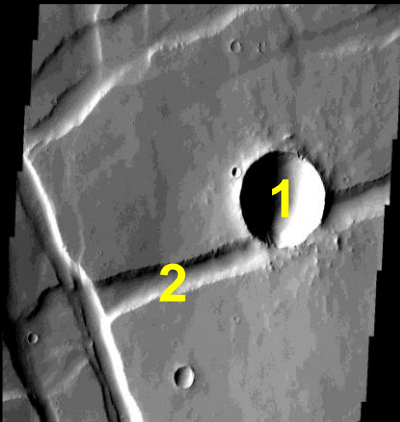
Accessing Prior Knowledge

Discuss the examples below within your group. Be sure you can justify your answers.

Example 1: Which crater is older?

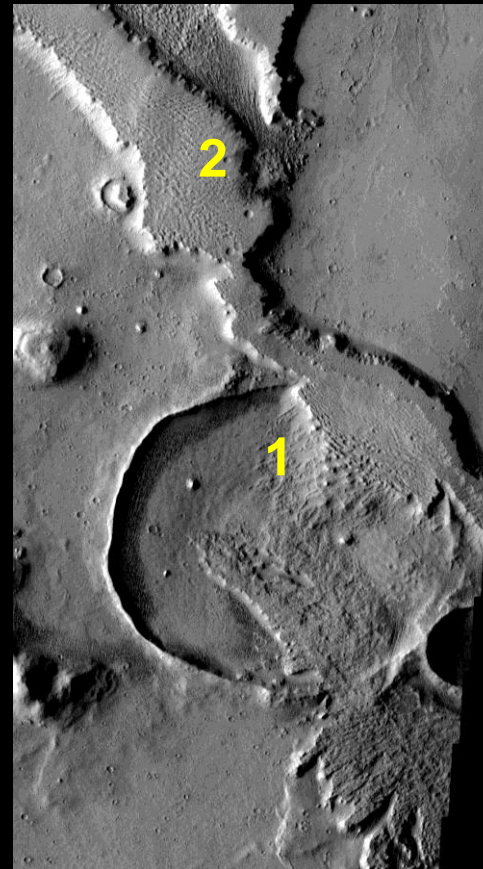


Example 2: Which feature is younger?



Feature 1 = Crater
Feature 2 = Fracture

Example 3: Which feature is younger?



Feature 1 = Crater
Feature 2 = Channel



MAMERS VALLIS

THEMIS VISUAL CAMERA
ODYSSEY SPACECRAFT

IMAGE ID: V05055010

ORBIT: 05055

VIS IMAGE NUMBER: 010

CENTER LATITUDE: 31.29 S

CENTER LONGITUDE: 19.09 E

SOLAR LONGITUDE: 132.4

INCIDENCE ANGLE (Max): 69.7

LOCAL SOLAR TIME (Max): 17.13



MOLA IMAGE

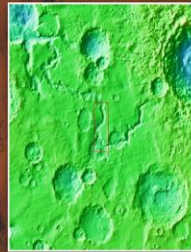


Image credit: NASA/JPL-Caltech/GSFC

CONTEXT IMAGE

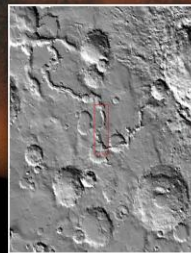


Image Credit: NASA/JPL-Caltech/Arizona State University

- What is the width of this feature?
- Where did you measure?
- How many measurements do you think are necessary?



Software

Manuals

Evaluation

Misc.


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Workshop

Staff

Contact

Project CLEA

 Radio Astronomy of Pulsars	 Astrometry of Asteroids	 The Revolution of the Moons of Jupiter	 The Rotation of Mercury by The Doppler Effect
 Photoelectric Photometry of the Pleiades	 H-R Diagrams of Star Clusters	 Spectral Classification of Stars	 The Hubble Relation
 The Large Scale Structure of the Universe	 Flow of Energy Out of the Sun	 The Quest for Object X	 Solar Rotation Using Images from the GONG Project
 Transits of Venus and Mercury Using Images from the GONG project	 Jupiter's Moons and the Speed of Light: The Classic Roemer Experiment	 Dying Stars and the Birth of the Elements	 The Height of Lunar Mountains (From an associated NON CLEA DEVELOPER)

Download [Evaluation Forms And Pre/Post Tests](#) to Administer to Classes



[CLEA Home Page](#)

Project CLEA -- CONTEMPORARY LABORATORY EXPERIENCES IN ASTRONOMY -- develops laboratory exercises that illustrate modern astronomical techniques using digital data and color images. They are suitable for high- school and college classes at all levels, but come with defaults set for use in introductory astronomy classes for non-science majors. Each CLEA laboratory exercise includes a dedicated computer program, a student manual, and a technical guide for the instructor. The technical guides describe file formats, user-settable options, and algorithms used in the programs. The most advanced CLEA labs run under the latest versions of Windows on PC's (see note above regarding Windows 7 and 8 and Vista), or under Windows emulation on Macintosh computers.

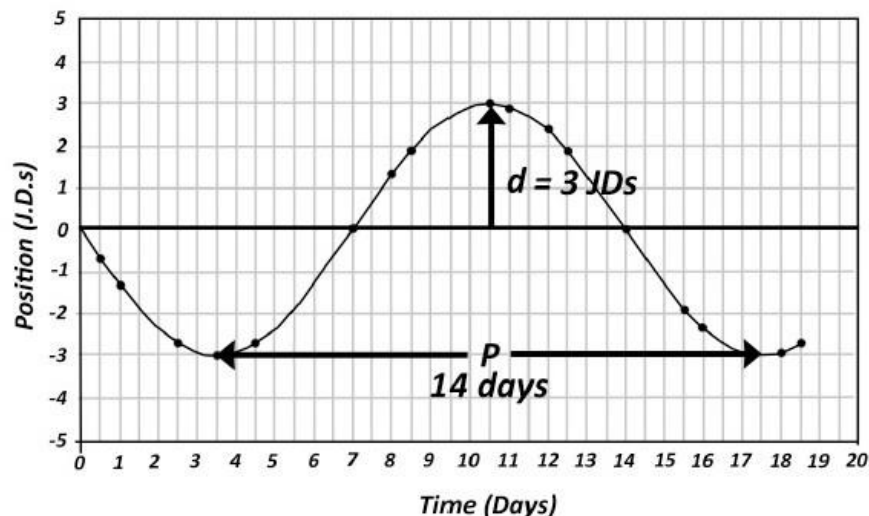
The Revolution of the Moons of Jupiter



Student Manual to Accompany the CLEA computer exercise

4. Read off the period, p , and the orbital distance, d , from your graphs in the manner shown for moon CLEA (see the example below).

These values will have units of days for p and J.D.s for d .



Period (p) = 14 days Orbital Distance (d) = 3 JDs

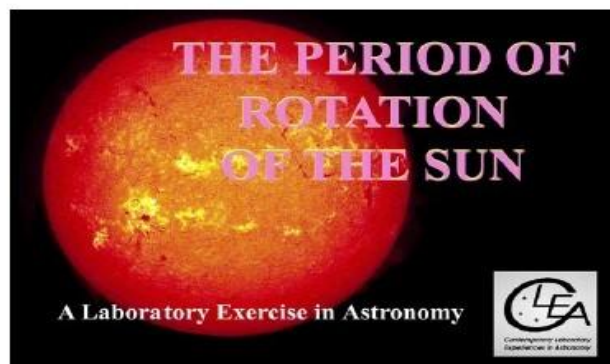
Period (p) = 0.0383 years Orbital Distance (d) = 0.00286 AUs

5. In order to use Kepler's Third Law, you need to convert the period into years by dividing by the number of days in a year (there are 365.25 days in a year), and the orbital radius by dividing by the number of Jupiter diameters in an A.U. (there are 1050 Jupiter diameters in one A.U.).

THE PERIOD OF ROTATION OF THE SUN

Student Manual

A Manual to Accompany Software for the
Introductory Astronomy Lab Exercise
Document SM 11: Circ. Version 1.0



Department of Physics
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Gettysburg, PA 17325

Telephone: (717) 337-6019
email: clea@gettysburg.edu

Database, Software, and Manuals prepared by:
Lawrence Marshall and Glenn Snyder (CLEA PROJECT, Gettysburg College)
and
Jeff Sudol (GONG Project, National Solar Observatory)



Contemporary Laboratory
Experiences in Astronomy



Measuring the Positions of Spots

The image display permits you to measure the positions of points on the Sun. To start measuring sunspot positions, choose *file..image..measure* from the menu bar at the top of the image display. A small window will appear with digits to indicate the position of the cursor in *pixels* and in *apparent heliographic coordinates*. The position of the cursor is updated whenever you click the left mouse button, or continuously if you hold the button down. You will also see a small magnification window that shows the area around the cursor. (see figure 7). Pixels are of course just the little blocks that make up the picture, and pixel 0,0 is right in the center of the image. Apparent heliographic coordinates, however, require some explanation.

Heliographic coordinates are similar to longitude and latitude on Earth. The poles of the Sun are at $+90^\circ$ (north) latitude and -90° (south) latitude. The equator of the Sun is at 0° latitude. The 0° heliographic longitude line runs right down the middle of the solar disk as you see it, with positive lines of longitude to the right, and negative ones to the left. (see figure 8).). Unlike longitude lines on the Earth, heliographic longitude lines are not fixed to the surface of the Sun and do not rotate with the Sun! The computer uses the x and y pixel values, plus a little trigonometry, to calculate the apparent heliographic latitude and longitude for the location of the cursor on the image.

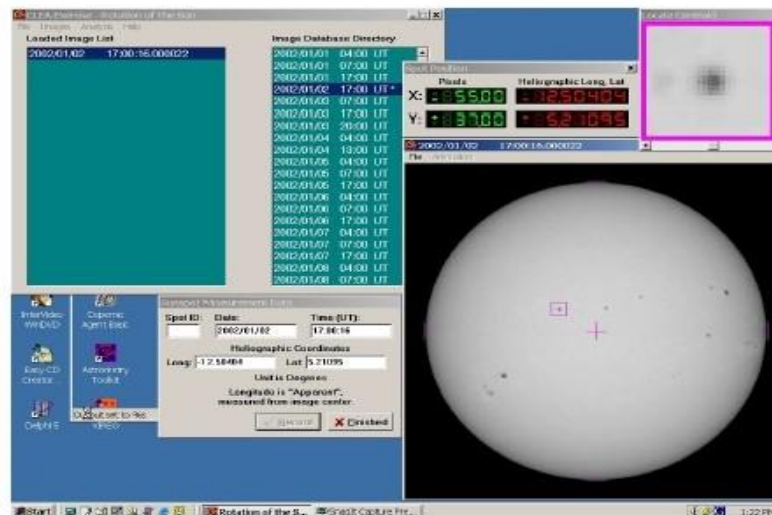


Figure 7: Measuring the positions of spots on solar images

The Hubble Redshift Distance Relation

Software Users' Guide

A Manual to Accompany Software for
the Introductory Astronomy Lab Exercise
Document SUG 3: Version 1



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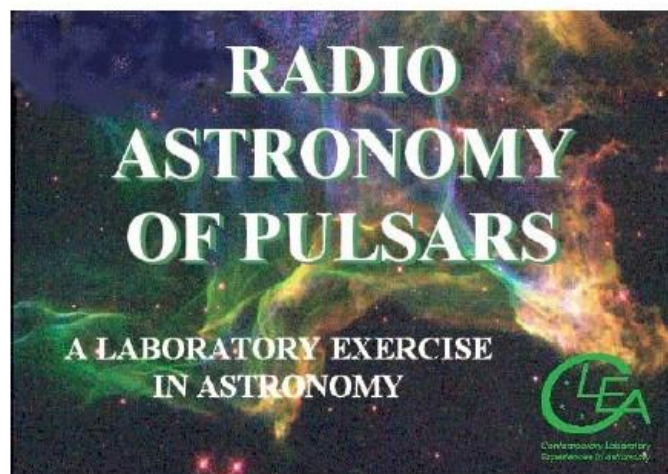


Contemporary Laboratory
Experiences in Astronomy

Radio Astronomy of Pulsars

Software Users' Guide

A Manual to Accompany Software for
the Inductory Astronomy Lab Exercise
Document UG 8: Version 1



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email: clea@gettysburg.edu



Contemporary Laboratory
Experiences in Astronomy



What is EU-HOU?



What is EU-HOU ?

The EU-HOU project is a collaboration of hundreds of teachers and scientists from 14 countries with the purpose of creating a way for students to get excited by science, primarily through the use of astronomy. Astronomy is one of the most popular subjects for students of all ages, and the chance to use real astronomical data to investigate volcanoes and craters on Mars or the moons of Jupiter, to discover a new planet outside our solar system, or to weigh a galaxy, can engage our students in the wonders of scientific discovery, and excite the natural scientist contained in all people young and old alike.

Research into how people learn has shown that active learning is the best way to create true engagement of students in a subject, and has also been shown to lead to better understanding and retention of material than traditional lecture-style instruction. The exercises developed by EU-HOU are designed to promote such active learning by giving student **real astronomical data**, and the tools to analyse it simply and easily in their own classroom. These exercises can be found [here](#).

The key to unlocking all this learning is the free software SalsaJ ([download here](#)). This software is simple to install, runs on most systems (Windows, MacOS, and most flavors of Linux), requires almost no on-site maintenance, and has been translated into many languages (English, French, Spanish, Italian, Polish, Greek, Portuguese, Swedish, Northern Sami, Arabic, Chinese).

To learn more about EU-HOU, read our [Philosophy](#) and [History](#) pages, or [contact us](#).



Education and Culture DG

Lifelong Learning Programme



Vježbe i projekti

Ovdje se nalaze vježbe (mini projekti) iz raznih područja astronomije koje učenici mogu samostalno izrađivati. Autori su navedeni uz svaku vježbu što omogućuje učenicima komunikaciju e-mailom sa znanstvenicima pri realizaciji vježbe (mini projekta). Vježbe označene s (PRO) odnose se na promatračke projekte, s (PRA) označuju praktične, kabinetske i simulirane vježbe, dok su (IZR) označene vježbe koje se odnose na praktičnu izradu astronomskih instrumenata.

Nakon što realizirate vježbu i rezultate pošaljete autoru, oni će biti vidljivi kao link uz ponuđenu vježbu.

Želite li ponuditi vašu originalnu vježbu obratite se neposredno znanstveniku specijaliziranom za odabranu tematiku.

Vježbe i mini projekti prema područjima:

1. Elementarna astronomija – položajna, sferna i efemeridna astronomija
2. Nebeska mehanika
3. Astrofizika
 - 3.1. Astrofizičke metode i instrumenti
 - 3.2. Sunce
 - 3.3. Zvezdana astronomija
 - 3.4. Galaktička astronomija i kozmologija
4. Planetologija
 - 4.1. Planeti
 - 4.2. Mala tijela Sunčeva sustava

pretraži e-školu 

Vježbe i projekti:

- Astrofizika
 - Astrofizičke metode i instrumenti
 - Galaktička astronomija i kozmologija
 - Sunce
 - Zvezdana astronomija
- Elementarna astronomija – položajna, sferna i efemeridna astronomija
- Nebeska mehanika
 - Kepler i staza Marsa
 - Položaj Halleyeva kometa
 - Položaj planeta u stazi
 - Staze planeta
- Planetologija
 - Mala tijela Sunčeva sustava
 - Planeti



stellarium

latest version is 0.16.0



Linux
(izvor)



macOS
10.12+ i 64
bita



Windows
32 bita



Windows
64 bita



Ubuntu
latest stable
release



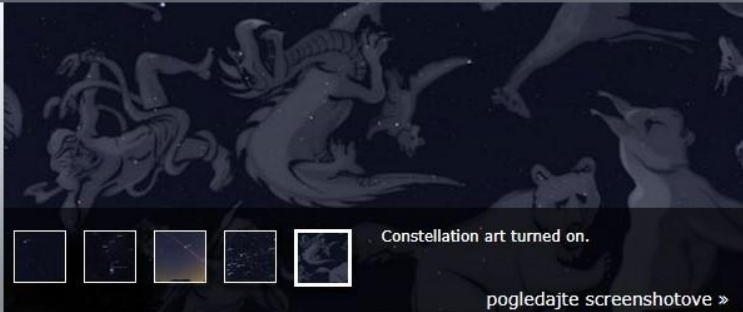
Beta
0.90.0



User Guide
0.16.0-1

Stellarium je besplatan open source planetarij za računala. Prikazuje realistično nebo u 3D-u, poput onog koje bi vidjeli golim okom, dalekozorom ili teleskopom.

Koristi se u planetarijskim projektorima. Jednostavno unesite svoje koordinate i krenite.



Constellation art turned on.

[pogledajte screenshotove »](#)

mogućnosti

nebo

- defaultni katalog sa preko 600,000 zvijezda
- extra catalogues with more than 177 million stars
- default catalogue of over 80,000 deep-sky objects
- extra catalogue with more than 1 million deep-sky objects
- asterizmi i ilustracije sazviježda
- constellations for 20+ different cultures
- slike maglica (kompletni Messier katalog)
- realistična Mliječna staza
- vrlo realistična atmosfera, izlazak i zalazak sunca
- planeti i sateliti

sučelje

- snažan zoom
- kontrola protoka vremena
- višezjezično sučelje
- ribljooka projekcija za planetarijske kupole
- sferična zrcalna projekcija za vlastitu kupolu
- grafičko sučelje i opsežna kontrola

vijesti

- Stellarium 0.16.0
- 0.16.0RC1: Call to translators
- Stellarium 0.12.9
- Stellarium 0.15.2 has been released
- Stellarium 0.12.8
- Stellarium 0.15.1
- Call to translators
- Stellarium 0.12.7 discussion

system requirements

minimal

- Linux/Unix; Windows 7 and above; OS X 10.8.5 and above
- 3D graphics card which supports OpenGL 3.0 and GLSL 1.3
- 512 MiB RAM
- 250 MiB on disk

recommended

- Linux/Unix; Windows 7 and above; OS X 10.8.5 and above
- 3D graphics card which supports OpenGL

suradnja

You can learn more about Stellarium, get support and help the project from these links:

- ➔ [sažetak](#)
- ➔ [forum](#)
- ➔ [mailing list](#)
- ➔ [vijesti](#)
- ➔ [wiki](#)
- ➔ [Često postavljana pitanja](#)
- ➔ [krajolici](#)
- ➔ [skripte](#)
- ➔ [priključci](#)
- ➔ [textures](#)
- ➔ [user's guides](#)
- ➔ [developers documentation](#)
- ➔ [scripting](#)
- ➔ [korisnička podrška](#)
- ➔ [report bugs, request new](#)

<https://solarsystem.nasa.gov/educ/>

<https://sunearthday.nasa.gov/swac/>

<http://www3.gettysburg.edu/~marschal/clea/CLEAhome.html>

<http://marsed.mars.asu.edu/sites/>

<http://pbskids.org/designsquad/parentseducators/guides/>

<https://solarsystem.nasa.gov/educ/moreeducation>

<http://nasawavelength.org/resource-search?facetSort=1&educationalLevel=Middle+school&topicsSubjects=Earth+and+space+science%3AEarth+structure>

<https://arxiv.org/abs/1009.3940>

<http://www.globalsystemsscience.org/studentbooks/acc/ch7/investigation1>

<http://www.euhou.net/index.php/exercises-mainmenu-13/astronomy-with-salsaj-mainmenu-185/269-discover-an-exoplanet-v15-269>

<http://www.euhou.net/index.php/salsaj-software-mainmenu-9/download-mainmenu-10?task=view&id=8>

<http://geology.com/teacher/astronomy-space.shtml>

<http://www.stellarium.org/hr/>

<http://eskola.zvezdarnica.hr/vjezbe-mini-projekti/>

https://www.chicagobotanic.org/nasa/Grades_7-9_Unit_1