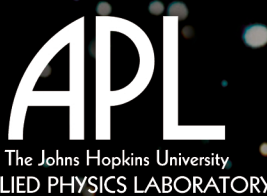


NEW HORIZONS



170 cm

Average Distance of Pluto



Hubble Space Telescope image:
Pluto and its moons

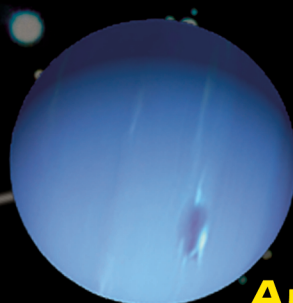
TO PLUTO AND THE KUIPER BELT JULY 14, 2015

160 cm

New Horizons-Pluto Encounter Distance

Pluto's Closest Distance from the Sun
(Pluto's Farthest Distance is 186 cm)

150 cm



August 24, 2014

140 cm

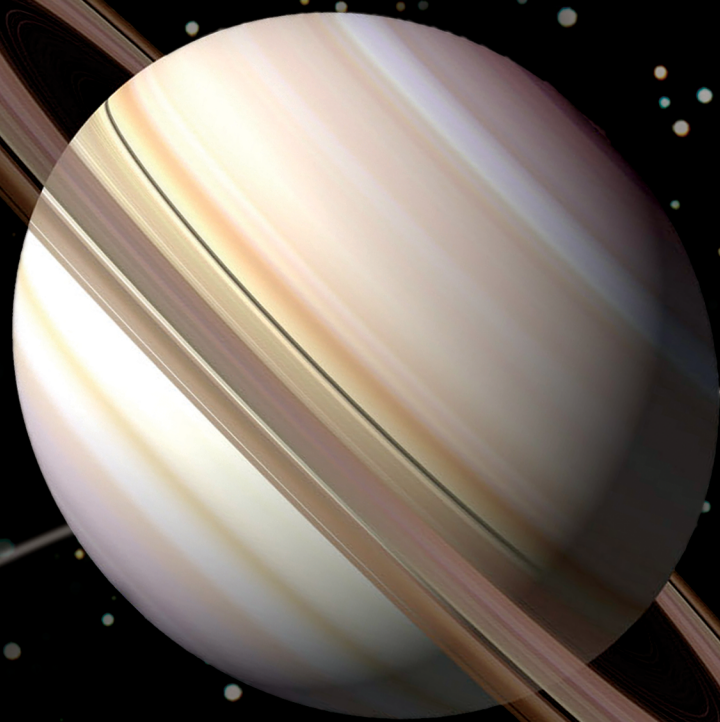
130 cm



March 18, 2011

120 cm

June 8, 2008



110 cm

100 cm

TRACK YOUR
GROWTH THROUGH
CHILDHOOD AND
NEW HORIZONS'
JOURNEY TOWARD
THE FARTHEST
REACHES OF THE
SOLAR SYSTEM

February 28, 2007



April 7, 2006

Launch: January 19, 2006

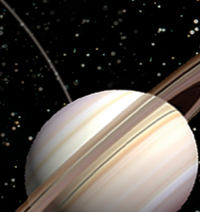
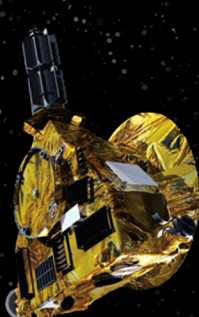


90 cm

SCALE OF ORBITS: 2 CM = 1 AU
SCALE OF PLANETS: 1 CM = 1 D_{EARTH}
1 ASTRONOMICAL UNIT (AU) IS THE MEAN
DISTANCE BETWEEN THE EARTH AND THE
SUN (93 MILLION MILES)

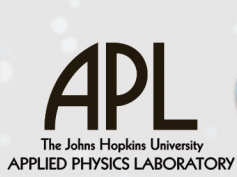
[HTTP://PLUTO.JHUAPL.EDU](http://pluto.jhuapl.edu)

TO PLUTO AND BEYOND





NEW HORIZONS TO PLUTO AND BEYOND



<http://pluto.jhuapl.edu>

Note to Educators

Thanks for using this New Horizons educational poster in your classroom! The mission team has developed six fun and educational activities (K-5) that you can use as stand-alone lessons or as a series centered on the theme Pluto.

On the Poster

The front side of the New Horizons poster features:

- A scale diagram of the solar system — the orbits of the planets are drawn to scale with 2 centimeters = 1 Astronomical Unit (AU).
- Scale photos of the planets — the photos of the planets are to scale with each other but NOT on the same scale as the orbits. Here 1 centimeter = 1 Earth Diameter (D_{Earth}).
- A growth chart, in centimeters, to be hung 90 centimeters above the floor.
- Dates that the New Horizons spacecraft crosses the orbits of the planets on its way to Pluto.

Why two scales? If the planets were shown on the same scale as the orbits, the planets would be tiny specs.

Conversely, the poster would need to be 6 million times longer if the orbits were drawn to the scale used for the diameters of the planets.

On this (reverse) side of the New Horizons poster you will find:

- Pluto ... A World of Extremes — student fact sheet featuring introductory material on Pluto and a crossword puzzle as a reading comprehension assessment.
- Charting the Progress of New Horizons — a ready-to-photocopy sheet of one of the six educational activities.
- Overview Map of New Horizons Educational Activities — a table that provides, at a glance, the purpose and content of each activity, the standards addressed, and the materials required.

On the Web

All of the activities, the poster, and the teacher guides are available to download and print from the New Horizons web site, <http://pluto.jhuapl.edu>. Each activity includes (1) a student activity sheet to be copied and given to students and (2) a teacher activity sheet, which contains materials lists, background information, discussion questions, and related facts. In addition, the site offers links to many more resources and web sites related to Pluto and the New Horizons mission.

About the Mission

The study of Pluto and its moons is truly part of the current frontier in planetary science. No spacecraft has ever explored the Pluto system, yet it promises to teach us much about the outskirts of our solar system. New Horizons is the first mission to Pluto and the Kuiper Belt.

New Horizons is the first mission in NASA's New Frontiers Program, which provides opportunities for the science community to propose high-priority solar system exploration initiatives. Pluto is an exciting world, with three moons, four seasons, polar caps, and even an atmosphere. Pluto is considered a dwarf planet, but at 1,460 miles (2,350 kilometers) wide, it's still a very big place! Pluto also has more rock in its interior than the entire mass of the largest asteroid, the 621-mile-wide (1,000-kilometer) Ceres.

The Johns Hopkins University Applied Physics Laboratory in Maryland manages the mission for NASA and designed, built, and operates the New Horizons spacecraft. Dr. Alan Stern, of the Southwest Research Institute, is the mission's Principal Investigator, who led the engineering, design, and integration of the spacecraft and science instruments and leads the multi-institutional science team.



Pluto ... A World of Extremes



Planet: Pluto

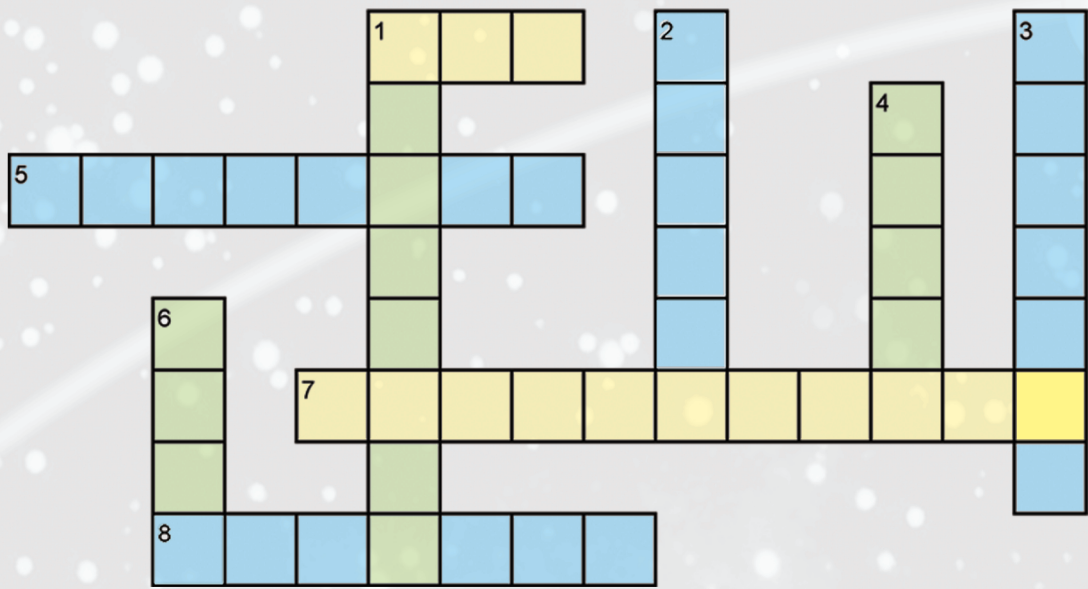
- Pluto is classified as an "ice dwarf," a small body with a solid surface made of ice and rock.
- Compared to the size of its planet, Charon is the largest moon — about half the size of Pluto.
- In 2005, members of the New Horizons team, using images from Hubble Space Telescope, discovered two previously unknown moons of Pluto. Named Nix and Hydra, they have diameters of up to 100 miles.

Orbit: Pluto

- Pluto is normally about 39 times as far from the Sun as Earth is — its distance ranges between 30 and 48 AU.
- All planets travel along an ellipse as they orbit the Sun; Pluto's orbit is elongated enough so that sometimes Pluto is closer to the Sun than Neptune is.
- Even though the orbits of Pluto and Neptune cross, the two planets will never collide.
- Although the Sun is the closest and brightest star, it looks like a bright dot in a rather dark sky and provides little light and heat.
- It takes 248 years on Earth for Pluto to travel once around the Sun (248 Earth years = 1 Pluto year).
- It takes 6½ Earth days for Pluto to rotate once on its axis (6½ Earth days = 1 Pluto day).
- Pluto shares part of its orbit in a region called the Kuiper Belt, a collection of icy, rocky bodies.

Visit: Pluto

- Pluto has not been visited by a spacecraft from Earth. This will change when NASA's New Horizons probe flies by Pluto on July 14, 2015! The spacecraft was launched on January 19, 2006, and used Jupiter's gravity to boost it toward Pluto in February 2007.



Across

- 1 Brightest star in Pluto's sky
- 5 Pluto is this type of planet
- 7 Name of first spacecraft planning to fly by Pluto
- 8 From 1979 to 1999, this planet was farther from the Sun than Pluto was

Down

- 1 Pluto is known as the ____ planet in the solar system
- 2 Compared to Earth, the temperature on Pluto is not hotter, it is ____
- 3 Shape of Pluto's orbit
- 4 Discovered in 1930 by Clyde Tombaugh
- 6 Charon is the name of Pluto's largest ____

New Horizons: NASA's Mission to Pluto and Beyond <http://pluto.jhuapl.edu>



Charting the Progress of New Horizons



Student Activity Sheet

Pluto and the mysterious region of the solar system known as the Kuiper Belt have never been visited by a spacecraft!

On January 19, 2006, NASA launched the New Horizons spacecraft to begin its journey toward Pluto. Since Pluto is so far away, it will take a long time for the New Horizons spacecraft to get there. In February 2007, the spacecraft used Jupiter's gravity to sling-shot it out to Pluto, but even with that help, it still will not fly by Pluto until 2015.

You can use this poster to track New Horizons' progress through the solar system.

Directions:

1. Carefully cut off the bottom strip of the poster along the dotted line. Save the bookmark for your favorite book and cut off the picture of the New Horizons spacecraft for this activity.
 2. The poster shows a scale drawing of the orbits of the planets, which means that if the picture were expanded with a giant copy machine, the orbits would match the orbits of the real planets in space! All scale drawings, like maps, have a scale on them that relates distances or sizes on the picture to distances or sizes in real life. Find the distance scale on the poster. Here ____ cm = ____ AU. The abbreviation "cm" is for centimeters and "AU" is for Astronomical Units. The distance from the Sun to the Earth equals 1 AU.
 3. Using the scale on the right edge of the poster, estimate the distances of the planets from the Sun to the nearest cm. Use the data chart provided by your teacher or make a table, like the one shown below but with rows for each of the planets.
- Record your estimates in column A. Write the number sentence that will change your measurement in cm to AU in column B. Write the approximate distances of the planets from the Sun in AU in column C. The information for the first planet, Mercury, has been filled in for you.

Planet	A Distance from Sun (cm)	B Change from cm to AU	C Distance from Sun (AU)
Mercury	0.8 cm	$0.8 \text{ cm} \div 2$	= 0.4 AU
Venus		$\div 2$	=

4. To find out where New Horizons is today, visit the New Horizons web site at <http://pluto.jhuapl.edu> and go to the "Where is New Horizons?" page. Write down the spacecraft's current distance from the Sun.
5. New Horizons' distance from the Sun is given in AU. To change the distance in AU to a distance in cm, multiply the value by 2.
6. Use a paper clip to fasten the picture of the New Horizons spacecraft onto the right edge of the poster at the correct distance from the Sun.
7. Notice that there is also a scale for the sizes of the planets on the poster. Give two reasons why it is useful to have a scale drawing of the planets. Do the sizes of any of the planets surprise you? Why?
8. The diameter of the Earth on the poster is 1 cm. Compared to the Earth on this scale, how big would the Sun be? Choose one: a) Half the size of Earth, b) Twice the size of Earth, c) 110 times the size of Earth.

New Horizons: NASA's Mission to Pluto and Beyond <http://pluto.jhuapl.edu>



Overview Map of New Horizons Educational Activities

<http://pluto.jhuapl.edu>



Activity	Overview of Activity	Learning Goals	Materials	Standards	Grade Level
Charting the Progress of New Horizons	Students will learn that the New Horizons poster depicts a scale drawing of the solar system. They will use the poster to track the true progress of the spacecraft.	S—Understanding the long distances and timescales involved in space travel. M—Using fractions and multiplication to change scales/units.	<ul style="list-style-type: none">• Poster• Student activity sheet• Student data chart (optional)• Pencil• Ruler (cm)	S—D: Objects in the Sky; E: Abilities of Technological Design M—Measurement; Number and Operations; Problem Solving	Grades 2-5
Where Are We Going?	Students take imaginary trips through the solar system on a spacebus and use math skills to find out the next spacebus stop.	S—Understanding the order and distances of the planets from the Sun. M—Problem solving using multiplication, rounding, and fractions.	<ul style="list-style-type: none">• Student activity sheet• Pencil	S—D: Objects in the Sky M—Number and Operations; Problem Solving	Grades 2-5
Modeling the Orbits of the Planets	Students will make a scale model of the orbits of the outer planets and explore the peculiarities of Pluto's orbit.	S—Understanding the scale of the solar system. Learning about Pluto's elliptical and inclined orbit.	<ul style="list-style-type: none">• Student activity sheet (copied onto card stock if possible)• Pencils, markers• Scissors• Paper clips• Glue/glue stick/tape	S—A: Abilities Necessary to Do Scientific Inquiry; D: Objects in the Sky	Grades K-5
Growing Up with a Mission	Students will measure their height, analyze the heights of classmates, and predict their height at the time New Horizons is scheduled to fly by Pluto by using a growth chart.	S—Using a model and measurements to make predictions. M—Collecting data and finding the mean, mode, and median. Graphing points on a Cartesian coordinate system.	<ul style="list-style-type: none">• Student activity sheet• Pencil	M—Measurement; Data Analysis and Probability	Grades 2-5
Looking to the Future	Students will examine aspects of their life now and predict what it will be like when New Horizons flies by Pluto.	S—Understanding the long timescales of space travel. Predicting and proposing technological solutions that could be used in the future.	<ul style="list-style-type: none">• Student activity sheet• Pencil and markers• Scissors• Paper towel tube• Wrapping paper• String or ribbon	S—E: Abilities of Technological Design E—5: Use the writing process to communicate; 8: Use technological resources to gather and synthesize information	Grades 2-5
Last Year on Pluto	Students will determine the length of one year on the planets and match historical events that occurred on Earth one year ago on these planets.	S—Learning the astronomical meaning of a year and the timescales associated with planets with large orbits.	<ul style="list-style-type: none">• Student activity sheet• Pencil	S—A: Abilities Necessary to Do Scientific Inquiry	Grades 2-5

M—National Council of Teachers of Mathematics Standards, S—National Science Education Standards, E—National Council of Teachers of English Standards

Travel time to Pluto...

Bike:
47,600 years



Car:
6,660 years



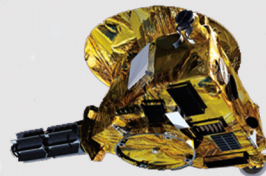
Jet Airplane:
700 years



Space Shuttle:
25 years



New Horizons: 9.5 years



Launched: January 19, 2006

Pluto flyby: July 14, 2015

Almost 10 years and over 3 billion miles

New Horizons: NASA's Mission to Pluto and Beyond <http://pluto.jhuapl.edu>

