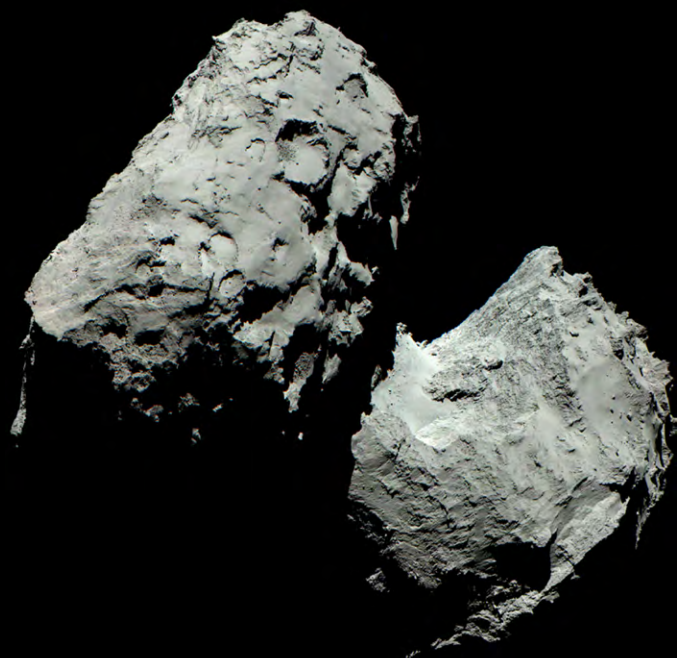


# The Top Tourist Sights of the Solar System (An Activity)

By Andrew Fraknoi, Fromm Institute, University of San Francisco



**Rosetta's OSIRIS** team have produced a colour image of Comet 67P/Churyumov-Gerasimenko as it would be seen by the human eye. As anticipated, the comet turns out to be very grey indeed, with only slight, subtle colour variations seen across its surface. Photo Credit: ESA/Rosetta/MPS for OSIRIS Team MPS/UPD/LAM/IAA/SSO/INTA/UPM/DASP/IDA

For the first time in human history, we have images of the planets (and two dwarf planets) in our solar system that show them “up close and personal” – as worlds with their own geography and places of interest. While human travel to these worlds is likely to be slower and far more difficult than science fiction shows and films imagine them to be, we can nevertheless imagine a future where it might be possible for people to journey to some of them and explore. This activity encourages students to delve deeper into where they might go. It can be part of a series of lessons related to [NGSS](#) and [Earth's Place in Space](#) at the middle or high school level. As students examine the processes governing the formation, evolution, and workings of the solar system, this interdisciplinary lesson can be used as an in-class or homework activity.

Consider dividing the student into pairs or groups of 3-5. Ask them to imagine that it is the future, and space travel among the planets and moons in the solar system is now common, although still expensive. Each group is a travel agency in the future, catering to clients who want to take a tourist trip of a lifetime through the solar system. The clients have a strong interest in astronomy, and thus want to see places that are not only 1. dramatic and exciting, but also 2. scientifically significant. (The reasons that some place or feature is significant could include that it is the largest or hottest or deepest of its kind, that it is unique, or that it reveals something important about how its world works.) If time or student abilities are an issue, consider the assignment to focus on just one world, such as Mars.

Each group should plan for ten destinations, complete with images, and explain how they meet the traveler's double criteria. Students can use class, textbook, library and web resources to come up with their own lists and images. The author's list of top tourist sites is in the accompanying box, for reference. During their research, ask student to include additional information about the destinations and the trip.

- What the distance is to the site from Earth (it might be a range of distances depending on what side of the Sun each world is on)?
- Will be any weather or special environmental conditions at the site, and, if so, what it might be like?
- What other dangers travelers might be exposed to (such as active local volcanoes, strong magnetic fields, unshielded ultraviolet rays from the Sun, etc.)?
- What equipment and clothing will be required for explorers who want to land?

After making a list of their destinations (with explanations), each group must then use its knowledge of the planets—along with their writing and art skills—to produce a well-illustrated travel brochure, featuring the solar system attractions their tour would visit. This can be a hand-drawn brochure, a presentation, a poster or digital product.

Time permitting, you might also feature oral presentations by each group, advocating for their travel agency and their tour. Students are encouraged to be as creative as possible, and to recommend exciting recreational activities (sports, special vistas for photography, romantic getaways, etc.) for the client. Their task is to convince the hard-nosed representative of the client (played by the teacher) that spending all the money that their tour will require is a great investment. Alternatively, each group could be asked to present an oral paper on their choices to a meeting of the Astronomical Travel Society, and the other students can act as a skeptical audience.

## Resources for the Tourist Activity

- Encyclopedia Britannica [10 Places to Visit in the Solar System](#)
- Wenz, J. [The Seven Best Travel Spots in the Solar System](#)
- Gerbis, N. [10 Space Landmarks We'd Like to Visit](#)
- Mann, A. [Ten Interesting Places in the Solar System We'd Like to Visit](#)
- Johnson, C. [The Top 10 Space Tourism Destinations of the Future](#)

## Images of the Solar System

### [Astronomy Picture of the Day](#)

Two space scientists scour the internet and select one astronomy image to feature each day. Their archives range widely, from traditional astronomical objects to space history, and have also been organized by subject. The search function works quite well for finding something specific among 31 years' worth of daily images.

### [Planetary Photojournal](#)

Thousands of images from planetary exploration, with captions of varied length. Note that to search for specific worlds or features, you first have to click in the Filters box on the word "PHOTOJOURNAL"; then options to search by keyword come up. One limitation is that only NASA mission images are included.

### [European Space Agency Image Gallery](#)

Search for images from ESA Missions, such as Mars Express, Venus Express, Huygens, and BepiColombo. Use the search box to look for worlds or features.

### [Planetary Society Image Gallery](#)

Click on the box that says "SUBJECT" to get to pictures from each world.

## Books

Jim Bell: *The Ultimate Interplanetary Travel Guide*. 2018, Union Square & Co. Richly illustrated, this book by an astronomer imagines a future where many worlds are permanently inhabited, and includes sub-sections for each world like "Things to Do, Places to Stay."

Neil Comins: *A Traveler's Guide to Space*. 2017, Columbia U. Press. Focuses not only on destinations but also on the journey, and what it will take to get there.

William Hartmann: *A Traveler's Guide to Mars: The Mysterious Landscapes of the Red Planet*. 2003, Workman. Is set up just like any travel guide you would buy for a city or country on Earth, even to the point of including fold-out maps.

Paul Hodge: *Higher than Everest: An Adventurer's Guide to the Solar System*. 2001, Cambridge University Press. Includes detailed descriptions of what it would like to climb the largest Martian volcano, descend into the clouds of Jupiter, or land on Io, among others.

Olivia Koski & Jana Grceвич: *Vacation Guide to the Solar System*. 2017, Penguin Books. Part science, part imagination, this guide pictures a time when travel to the planets is common.

Werner Kustenmacher: *Frommer's The Moon: A Guide for First-time Visitors*. 1999, Macmillan. Part humorous, part serious traveler's guide.

Mark McCaughrean: *111 Places in Space That You Must Not Miss*. 2025, Emons Verlag. Has a two-page spread on each destination with photos (both in and out of the solar system.)

Giles Sparrow: *The Traveler's Guide to the Solar System*. 2006, HarperCollins. Has good information and some humorous vignettes as well.

## THE FRAKNOI TOURIST AGENCY

# List of Ten Great Solar System Tourist Sights

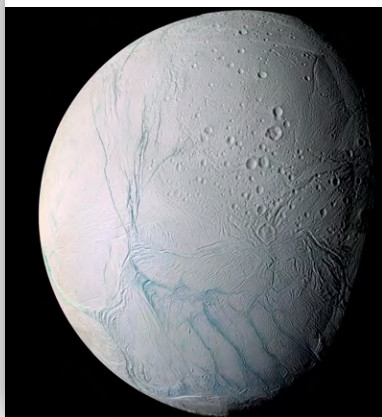
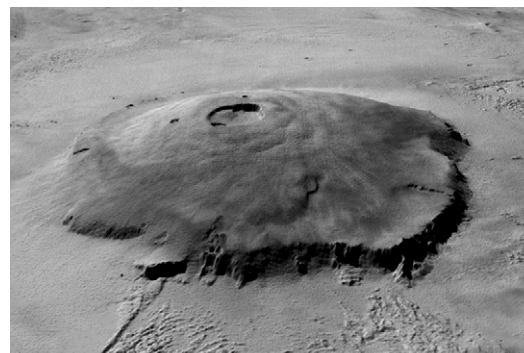
*(each briefly summarized, with some favorite images)*

Note that with images on Planetary Photojournal, if you want to see an image in full before downloading it, you need to open the image in a new tab on your browser.

**1** Olympus Mons, the huge volcanic mountain on Mars that is 3 times the height of Mt. Everest and larger than the state of Arizona at its base.

From Mars Global Surveyor: <http://photojournal.jpl.nasa.gov/catalog/PIA02806>

**Figure 1.** This 3D view of the complete volcano has been derived from US Mars Orbiter Laser Altimeter (MOLA) topographic data superimposed with the Mars Orbiter Camera (MOC) wide-angle image mosaic. Photo Credit: MOLA



**2** The "Tiger Stripes" region of fractures on Saturn's moon Enceladus, especially when there is a good water geyser eruption from them.

The region (exaggerated color): <http://photojournal.jpl.nasa.gov/catalog/PIA06254>

Eruptions (false-color): <http://photojournal.jpl.nasa.gov/catalog/PIA08386>

**Figure 2.** Zooming in on Enceladus as it swooped past the south pole of Saturn's moon Enceladus on July 14, 2005, Cassini acquired high resolution views of this puzzling ice world. From afar, Enceladus exhibits a bizarre mixture of softened craters and complex, fractured terrains.

Photo Credit: NASA/JPL/Space Science Institute

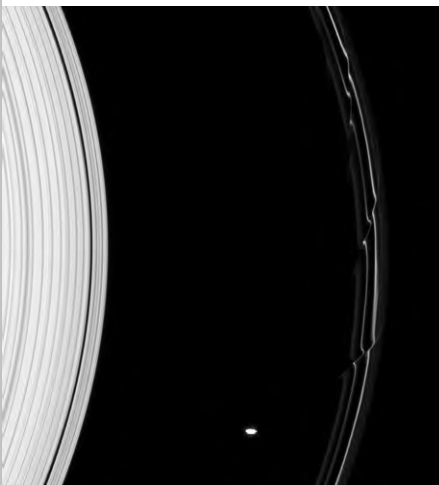
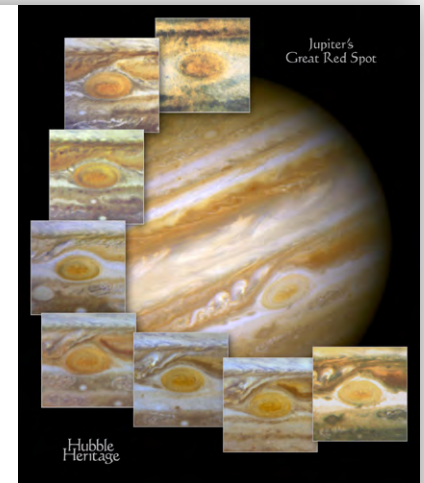
### 3 The Red Spot of Jupiter, a giant atmospheric storm that has been observed for centuries and can sometimes grow to be as large as three Earths across.

From Galileo: <http://photojournal.jpl.nasa.gov/catalog/PIA00296>

From Voyager: <http://antwrp.gsfc.nasa.gov/apod/ap020205.html>

From Hubble: <http://photojournal.jpl.nasa.gov/catalog/PIA01593>

**Figure 3.** The Red Spot is the largest known storm in the Solar System. With a diameter of 15,400 miles, it is almost twice the size of the entire Earth and one-sixth the diameter of Jupiter itself. Photo Credit: Hubble Heritage Team (STScI/AURA/NASA) and Amy Simon (Cornell U.)



### 4 The F ring of Saturn, especially the regions where it gets “kinky” as the shepherd moons pass by.

Cassini image with Prometheus: <http://photojournal.jpl.nasa.gov/catalog/PIA10489>

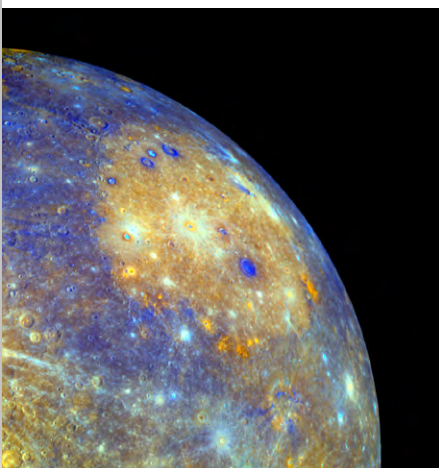
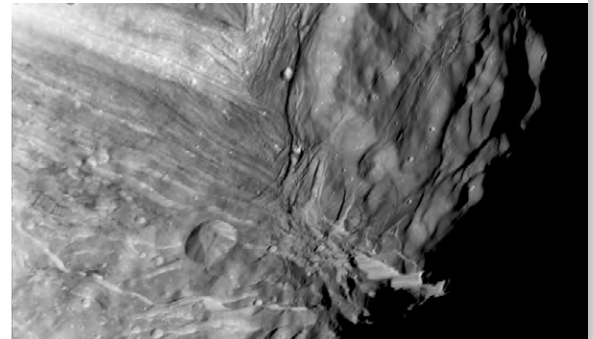
Cassini image with Pandora: <http://photojournal.jpl.nasa.gov/catalog/PIA07579>

**Figure 4.** The gravity of Prometheus alters the orbits of the fine, icy particles in Saturn’s F ring, creating dazzling structures like those seen here. Each of these diagonal features, called “streamer-channels” by ring scientists, represents a single close approach of Prometheus (86 kilometers, or 53 miles across) to the inner edge of the ring. Photo Credit: NASA/JPL/Space Science Institute

### 5 The Verona Cliffs, on Uranus’ moon Miranda, perhaps the most impressive lover’s leap in the solar system.

Voyager close-up: <http://photojournal.jpl.nasa.gov/catalog/PIA01354>

**Figure 5.** Miranda, innermost of Uranus’ large satellites, is seen at close range in this Voyager 2 image, taken Jan. 24, 1986, as part of a high-resolution mosaicing sequence. Voyager was some 36,000 kilometers (22,000 miles) away from Miranda. Photo Credit: NASA/JPL



### 6 The giant Caloris Basin on Mercury, one of the great “hot spots” in the solar system (it’s located at one of the longitudes where the Sun is overhead when the planet is closest to the Sun).

Composite from Mariner & Messenger: <http://photojournal.jpl.nasa.gov/catalog/PIA10383>

False color from Messenger: <http://photojournal.jpl.nasa.gov/catalog/PIA10359>

**Figure 6.** This false-color image of Mercury, published in *Science magazine*, shows the great Caloris impact basin (see [PIA10383](http://photojournal.jpl.nasa.gov/catalog/PIA10383)), visible in this image as a large, circular, orange feature in the center of the picture. The contrast between the colors of the Caloris basin floor and those of the surrounding plains indicate that the composition of Mercury’s surface is variable.

Photo Credit: NASA/Johns Hopkins University Applied Physics Laboratory/Arizona State University/Carnegie Institution of Washington. Image reproduced courtesy of Science/AAAS.

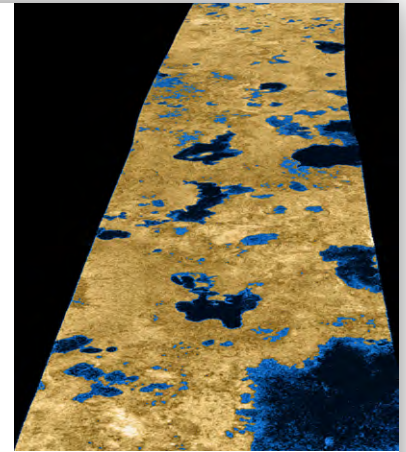
## 7 A “Lake District” on Saturn’s moon Titan, where large lakes of hydrocarbon liquid can be seen (provided you can see through the smog that envelops the moon).

False-color Cassini Radar Image: <http://photojournal.jpl.nasa.gov/catalog/PIA09102>

Titan’s “Kissing Lakes”: <http://photojournal.jpl.nasa.gov/catalog/PIA08740>

**Figure 7.** The existence of oceans or lakes of liquid methane on Saturn’s moon Titan was predicted more than 20 years ago. But with a dense haze preventing a closer look it has not been possible to confirm their presence. Until the Cassini flyby of July 22, 2006, that is. The lakes, darker than the surrounding terrain, are emphasized on this false-color radar image by tinting regions of low backscatter in blue. Radar-brighter regions are shown in tan.

Photo Credit: NASA/JPL-Caltech/USGS



## 8 Valles Marineris, the grand canyon system on Mars, which is as long as the United States is wide.

Global view (Viking): <http://antwarp.gsfc.nasa.gov/apod/ap060730.html>

A section with dramatic landslides: <http://photojournal.jpl.nasa.gov/catalog/PIA00005>

**Figure 8.** The largest canyon in the Solar System cuts a wide swath across the face of Mars. Named Valles Marineris, the grand valley extends over 3,000 kilometers long, spans as much as 600 kilometers across, and delves as much as 8 kilometers deep. By comparison, the Earth’s Grand Canyon in Arizona, USA is 800 kilometers long, 30 kilometers across, and 1.8 kilometers deep. The mosaic was created from over 100 images of Mars taken by Viking Orbiters in the 1970s.

Photo Credit: Viking Project, USGS, NASA

## 9 The erupting plume of a volcano on Jupiter’s frequently-erupting moon Io (should be viewed from a safe distance).

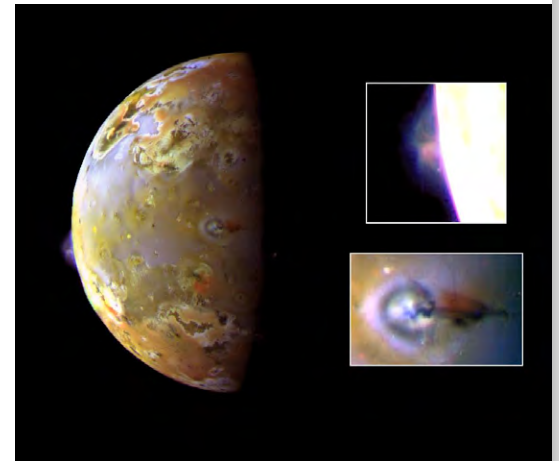
From New Horizons: <http://antwarp.gsfc.nasa.gov/apod/ap070404.html>

From Galileo: <http://antwarp.gsfc.nasa.gov/apod/ap070211.html>

From Voyager 1: <http://photojournal.jpl.nasa.gov/catalog/PIA00323>

**Figure 9.** Two sulfurous eruptions are visible on Jupiter’s volcanic moon Io in this color composite image from the robotic Galileo spacecraft that orbited Jupiter from 1995 to 2003. At the image top, over Io’s limb, a bluish plume rises about 140 kilometers above the surface of a volcanic caldera known as Pillan Patera. In the image middle, near the night/day shadow line, the ring-shaped Prometheus plume is seen rising about 75 kilometers above Io while casting a shadow below the volcanic vent.

Photo Credit: Galileo Project, JPL, NASA



## 10 The first human footprints on the Moon (at the Apollo 11 landing site, which might be an international museum in the future).

Scene without people: <http://antwarp.gsfc.nasa.gov/apod/ap020720.html>

With astronaut: <https://svs.gsfc.nasa.gov/4185/> (see the third illustration on this page)

A single boot print: <https://science.nasa.gov/resource/apollo-11-bootprint/>

**Figure 10.** This boot print marks one of the first steps human beings took on the moon in July 1969. It was made by American astronaut Buzz Aldrin during the Apollo 11 mission.

Photo Credit: NASA/Edwin “Buzz” Aldrin

## Runner-up destinations

- 11** Sputnik Planitia, the 900-mi wide partially frozen nitrogen sea on Pluto.  
From New Horizons: [https://commons.wikimedia.org/wiki/File:PIA19936\\_-\\_Sputnik\\_Planum\\_region\\_on\\_Pluto.jpg](https://commons.wikimedia.org/wiki/File:PIA19936_-_Sputnik_Planum_region_on_Pluto.jpg)  
In Color: <https://www.nasa.gov/image-article/intricate-surface-patterns-revealed-plutos-sputnik-planum/>
- 12** The Herschel impact crater on Saturn's moon Mimas, which, from the right angle, resembles the Death Star in the *Star Wars* movies.  
From Voyager 1: <http://photojournal.jpl.nasa.gov/catalog/PIA01968>  
From Cassini: <http://photojournal.jpl.nasa.gov/catalog/PIA06258> or <https://science.nasa.gov/photojournal/herschel-dead-on/>
- 13** Galle, the “smiley face” crater in Mars' Argyre Basin.  
From Mars Global Surveyor: <http://photojournal.jpl.nasa.gov/catalog/PIA04520>  
From Viking: <http://photojournal.jpl.nasa.gov/catalog/PIA00186>
- 14** The deep caves on the slopes of the giant Arsia Mons volcano on Mars.  
From Mars Odyssey: <http://photojournal.jpl.nasa.gov/catalog/PIA09929>
- 15** The weirdly shaped Comet 67P/Churyumov–Gerasimenko, a contact-binary, which is the product of a gentle collision between two icy interplanetary chunks.  
From Rosetta: [https://assets.science.nasa.gov/dynamicimage/assets/science/psd/solar/2023/07/ESA\\_Rosetta\\_NavCam\\_20150131\\_Mosaic.jpg](https://assets.science.nasa.gov/dynamicimage/assets/science/psd/solar/2023/07/ESA_Rosetta_NavCam_20150131_Mosaic.jpg)  
Or: [https://commons.wikimedia.org/wiki/File:Comet\\_67P\\_True\\_color.jpg](https://commons.wikimedia.org/wiki/File:Comet_67P_True_color.jpg)

## About the Author

**Andrew Fraknoi** retired as chair of the Astronomy Department at Foothill College, just south of San Francisco. For 14 years, he was the Executive Director of the Astronomical Society of the Pacific, where he edited a large collection of classroom astronomy activities called “The Universe at Your Fingertips.” He is lead author of *Astronomy*, published by the nonprofit OpenStax project, which is free online, and has become the most frequently adopted introductory astronomy textbook in the U.S. In retirement, he is also writing science-fiction stories, based on good astronomy, 13 of which have now been published. See <http://fraknoi.com> for more on his work. He can be reached at [fraknoiandrew@fhda.edu](mailto:fraknoiandrew@fhda.edu).

## A Skeptical Guide to UFO Cases and Claims

With Steven Spielberg's new blockbuster film *Disclosure Day* getting a lot of attention, science teachers will face a new barrage of public questions about UFOs (or, as they have been rebranded, UAPs). Astronomer and educator Andrew Fraknoi has put together a new, updated guide to resources on what skeptics have found about UFO cases and claims. These include what really happened at Roswell, New Mexico, and the recent spate of military images, videos, and Congressional testimony. Most of the resources cited are easily and freely available on the Web. The guide can be found at: <http://bit.ly/ufo-skeptical>.

Footage of a “UFO” captured by a U.S. Navy jet. Photo credit: DOD/U.S. Navy

