STARGAZING
LIVE

STARGAZING ON YOUR COMPUTER

There are several programs which when loaded onto your desktop computer can help you explore the night sky from any point on Earth and from any date and time, showing you which stars, constellations and planets will be visible – ideal for planning a night of stargazing! Others allow you to leave the Earth and explore the wider Solar System and Universe.

There are many different programs available, and in this guide we have given you the tips to get to grips with just a few.
**WHERE TO GET IT:**
stellarium.org

**SYSTEM REQUIREMENTS:**
- Windows® 98, XP, Vista, Mac OSX or Linux
- At least 400MHz CPU
- At least 128MB RAM
- Graphics card
- At least 1.0 GB free space on your hard drive

**WHAT’S IT ALL ABOUT?**
Stellarium is your very own personal planetarium. With this application, you can plan a night’s observing whether you’re equipped with a telescope, binoculars or simply your eyes.

If the weather isn’t on your side, you can still enjoy the night sky from any location at any time of the year in this virtual environment. It’s full of stunning images of the planets, galaxies and much more.

**TOP FEATURES:**
- See what the night sky looks like from any location on Earth at any time: past, present or future
- See the current phase of the Moon and watch it change over the days ahead
- Explore the patterns drawn between the stars by 13 different ancient cultures
- Switch between looking at the entire night sky as if viewed with the eye and zooming in close to see nebulae, galaxies and planets as if viewed through a large telescope

**GETTING STARTED:**
When you open Stellarium, it will start you off at the date and time currently set on your computer and at the location of Paris, France. Before changing your location, you can get a feel for controlling your view using the mouse.

- To move around the sky – click and drag
- To zoom in and out – move the mouse wheel or use the page up/down keys
- To select an object in the sky – left click on the mouse. Relevant information such as distance and magnitude will be displayed on screen. To centre on the selected object – press the spacebar

**CHANGING LOCATION:**
- Move your mouse to the lower left of the screen
- Click on the compass icon at the top of the icon bar
- Click on the map, search for a nearby town or city or for accuracy enter your current longitude and latitude
The rest of the icons on the side of the screen give you access to a host of settings. Amongst the most useful are the date/time window and the search window.

In the search window type the name of the object you are looking for and hit ENTER. This will turn your view to face the object.

Note: If the object is below the horizon at your current time then it will not be visible because the Earth is in the way!

Moving your mouse over the very bottom of the screen reveals other options to change your perspective of the night sky and there are some particularly useful ones that help you take advantage of all that Stellarium has to offer.

The first block of three icons on the left are all related to the patterns in the night sky – the constellations. From left to right they are:

1. Display/hide the lines between the stars
2. Display/hide the constellation labels
3. Display/hide artwork for constellations

The third block of icons includes two ‘cheats’ to help you find objects in the sky. From left to right they are:

4. Display/hide ground – Look at stars and planets not visible for your time and location
5. Display/hide compass points
6. Display/hide atmosphere – Cheat to see stars and planets clearly even if it is during the day

The final important features are the time controls on the right. Here you can speed up, slow down and rewind time as you desire:

- Speed up time – press I (press repeatedly to move faster and faster through time)
- Slow down time – press J (again press repeatedly to move slower through time and eventually reverse through time)
- Normal time rate/Pause time – press K

TRY THIS!

Try your hand at seeing some of the moons of Jupiter up close. Open Stellarium and use the Search button on the side toolbar to search for Jupiter. Hit ENTER and Stellarium will lock on to Jupiter, even though it may be under the horizon (depending on the time of day).
Please note that Jupiter is only visible above the horizon in the UK for part of the year.

Press I on the keyboard to speed up time until you can see Jupiter above the ground and then press K to return to normal time speed.

Use the scroll wheel on your mouse or the Page Up key to zoom in to Jupiter. It will change from appearing as just a bright object in the sky to the type of image you can see through a large telescope, with cloud bands visible and perhaps even the Great Red Spot – a giant storm raging on Jupiter!

Here you can see some of the moons and their names: Io, Europa, Ganymede and Callisto. These are the Galilean moons discovered by Galileo Galilei through his early telescope in the 17th Century.

If you have a pair of binoculars you can go outside and use them to see the moons for yourself as tiny pinpricks of light alongside Jupiter!

**ADVANCED FEATURES:**

- Explore the sky as seen from another planet in the Solar System (in ‘Set Your Location’)
- Change your location to somewhere in the southern hemisphere, to see how different the sky looks, and the different constellations which have now been revealed
- Visit a location on the equator and speed up time to see how the stars move over the course of a night
- Search for and lock the view to one of the more famous deep sky objects (such as the Andromeda Galaxy or the Orion Nebula) then zoom in to reveal how it looks through a powerful telescope
- Visit the ‘Starlore’ section in ‘Sky and viewing options’ in the sidebar, and take a look at asterisms (star patterns) from a number of different civilisations. There are many similarities, as well as differences
CELESTIA

WHERE TO GET IT:
shatters.net/celestia/download.html

SYSTEM REQUIREMENTS:
Windows® 98, XP, Vista, Mac OSX or Linux
At least 1GHz CPU
At least 512MB RAM
Graphics card with at least 128 megabytes of video RAM
At least 2.0 GB free space on your hard drive

WHAT’S IT ALL ABOUT?

Celestia is a space flight simulator that can take you from above the Earth to the Moon, the planets, other stars and even across vast distances to other galaxies beyond our own.

The software is open source, which means that it is free to everybody, and it has a strong online community, producing more content that can be added to the basic package.

TOP FEATURES:
- Three dimensional models of all the planets in our Solar System using real photographs taken by spacecraft
- More than 100,000 stars in our galaxy that you can visit up close
- Artists’ impressions of the planets around many of these distant stars
- The International Space Station in full detail, orbiting the Earth every 90 minutes
- The view of the Milky Way from hundreds of thousands of light years away so you can see the spiral structure of the galaxy in which we live

GETTING STARTED:

Celestia can be customised for the experience you want – whether it’s to see your current distance to target and the orbits of the planets, or simply to admire the view of Jupiter from one of its unusual moons.

There are menus for many options along the bar at the top of the screen, but the quickest and easiest way to change your setup is to use your keyboard.

- Display/Hide planet labels – press P
- Display/Hide moon labels – press M
- Display/Hide constellation lines – press /
- Display/Hide constellation labels – press =
- Display/Hide orbits – press O
- Display more/less information about speed, distance and time – press V to cycle through the options of no information displayed; a little information displayed; and lots of information displayed.
Some other keys that will help you see how planets and moons move in our Solar System are the time controls. You can watch the Earth spin, the Moon move around the Earth or the planets move around the Sun.

Use the following controls:
- Speed up time – press L (press repeatedly to increase speed)
- Slow down time – press K (press repeatedly to move slow speed)
- Normal time rate – press \ (very useful if you’re getting dizzy moving through time!)
- Reverse time – press J (then press L to speed through time backwards)
- Set time back to current time – press !

TRY THIS!
A good place to start exploring the Solar System and beyond is to travel from Earth to one of the planets.

Whenever you start Celestia, you will begin from planet Earth. Any of the planets in the Solar System can be selected by pressing numbers 1 to 8 on your keyboard. Since Earth is the third planet from the Sun it can be selected by pressing 3 on your keyboard.

Let’s visit Jupiter. This is the fifth planet so just press 5 to select it. To go there, press G. You will see five of Jupiter’s moons, there’s more than sixty altogether. Press M to display their labels. To visit them up close, click on them and press G.

If you find yourself crashing into Jupiter you may be travelling at speed by accident or you may have pressed G more than once. Pressing S stops all motion and scrolling your mouse wheel will allow you to zoom in and out.

If you ever get disorientated anywhere in or out of the galaxy, just press H to select the Sun and G to go there.
ADVANCED FEATURES:

To fly as if in a spacecraft you can use the following keys to take full control:

- Speed Up = A  
  (the longer you hold it the faster you accelerate)
- Slow Down = Z
- Stop Completely = S  
  (single press)
- Reverse = Q  
  (press again to move forward again)
- Move up/down and left/right = < > < >

Fly out from the Sun by holding down the End key. Fly past the nearby stars until you can see the Milky Way in its entirety. At this distance our star, the Sun is no longer visible separately, but you can see our neighbouring stars and galaxies. To go even further, check out the next guide for the Digital Universe.

Although the Solar System is easy to navigate using numbers 1 to 8, you may wish to visit another object by typing its name. This could be anything from the International Space Station (ISS) to an exoplanet or even a local galaxy! To try this: Press ENTER, type the name of the object you want to visit, hit ENTER again and finally press G to go there.

For the advanced user, much more content can be added to Celestia, including beautiful Hubble Space Telescope images of nebulae, 3D models of spacecraft and lots more. To see the full range of free additions visit: celestiamotherlode.net
DIGITAL UNIVERSE

WHERE TO GET IT:
haydenplanetarium.org/universe/download
Choose the Uncut version for the full package

SYSTEM REQUIREMENTS:
Windows® 98, XP, Vista, Mac OSX or Linux
At least 1GHz CPU
At least 512MB RAM
Graphics card with at least 128 megabytes of video RAM
At least 1.0 GB free space on your hard drive

Note: A wide range of computer setups will be able to run this software but slower machines will not be able to view some items smoothly. This guide includes ways of optimising Digital Universe to provide a better experience on your computer.

WHAT’S IT ALL ABOUT?
This powerful piece of software can visualise the Universe in stunning detail. For decades astronomers have been counting the galaxies outside of our own galaxy. When you look into the night sky, all the stars you see belong to our galaxy, but the biggest telescopes in the world have been able to map whole other galaxies at vast distances. There is so much depth in Digital Universe that this guide will concentrate on just a few stunning aspects and show you some wonderful structures formed by millions of galaxies. Like Stellarium and Celestia, it is all open source, so new data can be added to keep you up to date with the latest galaxy counts.

TOP FEATURES:
- Freely move around above the Milky Way and zoom out all the way to the edge of the visible Universe
- Move around vast groups of galaxies using just your mouse
- Show 10 different maps of the Universe that have helped astronomers see grand superstructures in space
- See the universe in 3D with a cheap pair of 3D glasses (red cyan type, not included) by typing `stereo redcyan` in the Cmd box

GETTING STARTED:
You can explore our own galaxy, the Milky Way, using Digital Universe but Celestia is better suited to the task. Instead, this guide focuses on the extragalactic atlas and shows the real power of this software.

When you've downloaded Digital Universe, unpack it as required for your particular operating system and go into the folder Digital Universe. Double click on the file with the name 'extragalactic'.

Start off looking back at the Milky Way, with some local galaxies marked. Flying around beyond our galaxy is easy using just the mouse. It is recommended that laptop users plug in an external mouse rather than using the built-in touchpad.

- Move view around – click and drag the left mouse button
- Zoom in and out – click and drag the right mouse button right and left. Letting go of the mouse after dragging left or right will leave it zooming out or in
- Stop moving – left click anywhere in the screen
Try zooming out and notice how you accelerate away from the Milky Way. This means you can travel vast distances because you are not travelling at a slow constant speed.

Go back to starting view – Click the grey ‘Home’ button at the top of the window. Use this button if you ever get lost in Digital Universe.

Along the top of the screen there are buttons all the way along marked g1, g2, etc. These switch on and off different maps of the Universe. The first four are not needed for the extragalactic atlas so move the scroll bar underneath to the right to see the rest of the buttons.

The Cmd section allows you to type in commands which customise your experience. The commands in this guide can help if you have a slower computer.

TRY THIS!

This part of the guide is a recipe for galaxy gazing further and further away from the Milky Way. Even though light travels at almost 300,000 kilometres per second, it still takes a long time to travel vast distances in space. This means that when telescopes look at very distant galaxies, they are gathering light that is millions or even billions of years old. This is how astronomers can study youthful galaxies. Each map switched on in this recipe brings more distant and ancient galaxies into view.

Remember: each bright point you see along the way is not a star – it’s a galaxy made of billions or even trillions of stars for some of the biggest galaxies. This next section gives some information about the maps that you can refer back to when you want to remind yourself of what you’re looking at.

Tully Galaxy Catalogue (g9=Tully)
Red in this survey represents galaxies bound together by gravity in groups called clusters and the other colours mark galaxies in the same strands. Play around with your view to see the large web-like structures in our extragalactic neighbourhood.

Sloan Digital Sky Galaxy Survey (g14=SloanGals)
The Sloan Digital Sky Survey is an immense project to map hundreds of millions of galaxies using a telescope purpose-built for the job. It gathers the light that our eyes can actually see, but at 2.5 metres wide, it can see much, much further than our eyes.
Sloan Digital Sky Quasar Survey (g16=SloanQSOs)

These are some of the earliest galaxies visible with telescopes and are so bright they were once thought to be a new type of star. They are active, with a supermassive black hole at its heart, vigorously consuming the material around it.

Microwave (WMAP) All-Sky Survey (g17=wmap)

This is the oldest light astronomers can gather with telescopes and is a light ‘echo’ 300,000 years after the Big Bang. It is called the Cosmic Microwave Background or CMB. The map contains some concentric patches of green, yellow and red. These irregularities are the markers for the birth of the web-like structure of the Universe that you’ve seen.

Next up is the recipe for the journey all the way to the edge of the Universe. In this guide, this font is used to denote the commands that you would type into the Cmd box.

- Click the ‘g9=Tully’ button to switch this data off and click ‘g8=local’ to show a local set of 246 catalogued galaxies. Now we’re ready to move out
- Zoom out until you see all the local galaxies that are marked by green points
- Now we can bring back in the Tully galaxy survey of almost 30,000 galaxies by clicking ‘g9=Tully’

Now click on the ‘g14=SloanGals’ button. With over half a million galaxies available to view, your machine may find it difficult to move around smoothly. Also the grand superstructure of the Universe is tricky to see with this much going on at once. This can be remedied by typing in the Cmd box just above the graphics window: g14 every 8 and hit ENTER. This will display every 8th galaxy in the survey.

Before displaying the next map type into Cmd: g16 every 8. This will also make this map smoother to look around. Now click the ‘g16=SloanQSOs’ to display the next set of galaxies called quasars.

Finally after zooming out beyond this set of over 90,000 quasars, click ‘g17=wmap’ to display the Cosmic Microwave Background.

There are other data sets to explore and you can adjust the amount of information you are seeing by typing in the Cmd box: g followed by the number for the data set you are looking at, followed by every and a number. The higher the number, the fewer points you will see and the easier it is for your computer to move around smoothly.

Well done on reaching the limit of the visible known Universe!
ADVANCED FEATURES:

See the Universe in 3D with a cheap pair of 3D glasses (red cyan) by typing `stereo redcyan` in the Cmd box.

Adjust the slider at the top of the screen to adjust the relative brightness of the data points in your currently selected survey. To change this setting for other surveys type `g` and its number in the Cmd box first before attempting to drag the slider.

Use buttons g19-23 to get a sense of scale in the Digital Universe. The boxes in each grid go from 100,000 light years to 20 billion light years. Remember that one light year is just under 10 million, million kilometres.

Get full screen display by typing `winsize` then the resolution of your screen then `+20+20` into the Cmd box, followed by `Enter`. For example: `winsize 1024 768 +20+20`. Then type `detach` in the Cmd box to separate the controls from the window.

The detail in this guide doesn’t match the 200 page full guide online, but those wanting a more involved experience can find all the information needed here: haydenplanetarium.org/universe/duguide