

# Celestia User's Guide

## General Instructions

For version 1.3.2

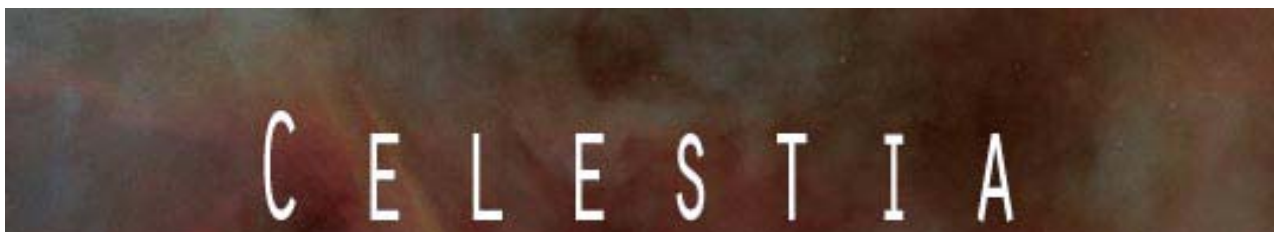


Earth from *Celestia* space – click [here](#) once only, to go to this location now

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## Introduction to Celestia

Many of us have looked up at the stars on a dark night and wondered what it would be like to launch ourselves into space and soar among the stars. What do the astronauts of the Space Shuttle really see when they look down upon our beautiful Earth turning slowly below? What wonders might we encounter if we could visit Saturn alongside the *Cassini* spacecraft and sail right through its rings? If you have ever wondered about these things and would like to find out the answers, we of the *Celestia* community are happy to introduce you to *Celestia*!

*Celestia* is a free real-time space simulation that lets you visually experience our universe in three dimensions. *Celestia* was the initial inspiration and creation of Mr. Chris Laurel, a Seattle, WA computer programmer who in 2001, decided to write a free software program to be made available to everyone on the world-wide-web that would place you in control of a virtual reality world of the Solar System. His vision and dedication gave birth to a program that is unlike any other space simulation program in existence. *Celestia* doesn't confine you to the surface of the Earth as many other programs do. Instead, Chris created a dynamic capability to travel throughout the Solar System and anywhere else in space, at any speed, at any moment of time and in any direction you choose. If you wish, you can fly via your own "hyperdrive" spacecraft to visit stars within the spiral arms of the Milky Way beyond the confines of our Sun. You can even travel completely out of the Milky Way galaxy and view it from deep space.

When *Celestia* version 1.0 first appeared available for download on the Internet, space enthusiasts all over the world discovered and quickly realized the potential of this beautiful program. Within a year, many talented people worldwide joined Chris in a collaborative volunteer effort to make *Celestia* into not only a *good* graphical space simulation but into a *great* one, capable of producing a meticulously accurate virtual world of space rivaling the visual quality seen only in Hollywood films.

They have succeeded. As of this writing, over 1600 members of the public are part of the *Celestia* forum community. Over 2.2 million people have downloaded the program for use at home or school. The list grows daily and includes talented graphic artists, computer programmers, astronomers, astrophysicists, planetarium directors, animators, engineers, teachers, students, professionals from scores of occupations and ordinary citizens in over 25 countries around the world. We invite you to join the *Celestia* forum at <http://www.shatters.net/forum/profile.php?mode=register>.

*Celestia* is available free of charge for Windows, Linux, and Mac OS X from <http://www.shatters.net/celestia/download.html>. Hopefully, you've already downloaded *Celestia* and are ready to install it and experience the beauty of space. Here is just a taste of what you will be able to encounter:

- ❖ Hover over each of the nine planets in our Solar System as they rotate slowly below you. See clouds actually drift by (where applicable). Look carefully and you may see mountains, canyons and craters on the planet surfaces with shadows being cast by them as the Sun sets low on the horizon.
- ❖ Take a spin down to the Earth's surface at a lazy speed or at thousands of miles/km per hour in your own spacecraft. Skim over the oceans of Earth as you actually fly below the clouds. See the sky turn a pale blue and eventually, transform into the crimson color of a sunset. Soar back into space in time to see the lights come on in the cities of Earth and glow an eerie white as the dark side of Earth turns below you.
- ❖ Position yourself above the giant gas world of Jupiter and watch as its large moons drift across the face of the planet, casting eclipse shadows on its banded clouds and Great Red Spot.
- ❖ Hover far beyond Saturn, speed up time and count its many moons revolving around its magnificent ringed body like pearls swirling on an invisible necklace. Watch as one moon eclipses another.
- ❖ Follow along with the spacecraft *Cassini* as it makes a dramatic rendezvous with Saturn in 2004. Be there to see the *Huygens* probe detach from *Cassini* and drop down to mysterious Titan in January 2005.

- ❖ Journey to the frozen wasteland of Pluto and its moon Charon and imagine their icy coldness as the Sun's faint light casts pale shadows across their cratered ice surfaces.
- ❖ Take up station behind the comet Halley, set *Celestia's* clock back in time and follow this famous comet on a trip into the inner Solar System, sailing past Earth with its gaseous blue tail streaming out behind it.
- ❖ Visit the mysterious new world of *Sedna*, a lonely comet/asteroid large enough to be a planet, recently discovered orbiting the Sun far beyond Pluto.
- ❖ Set your spacecraft speed and journey from the Earth's surface up to the International Space Station or the Hubble Space Telescope. Test your skill rendezvousing with them as they orbit Earth every 90 minutes.
- ❖ Fly out to the very edges of our Solar System, locate and follow behind Voyager 1 and 2 as they speed farther and farther away from their creators back on Earth, headed on a one way journey through the blackness of frigid space toward distant stars that will take them millions of years to reach.
- ❖ Set your ship at faster-than-light speed and sail to Rigel Kentaurus A and B, located 4.3 light years from Earth. See if you can find their tiny red dwarf companion Proxima Centauri, the closest star to our own Sun, or choose to observe rotating sunspots on any of a whopping 2,000,000 other stars drawn by your computer in the *Celestia* universe (to see all of those stars, a separate add-on is required).
- ❖ Download some of the many stunning add-ons available for *Celestia* and your experience becomes filled with even more wonders. Visit the *Discovery*, a spaceship from the film "2001, a Space Odyssey", dark, abandoned and adrift somewhere in Jupiter space with the *HAL* computer inside.
- ❖ Journey to the edges of a massive rotating Black Hole as it spins near its stellar companion.
- ❖ Journey to Earth's future and be witness to the end of our planet as a swollen Red Giant sun consumes it.
- ❖ Witness a pulsar imbedded deep in the Crab Nebula spinning rapidly as it sends its twin beacons of light through the nebula gas.
- ❖ Travel back in time to witness a re-creation of what the Earth looked like billions of years ago. Be there as Orpheus, a planet the size of Mars crashes into it, creating our Moon and sending it into an orbit within a few thousand miles of Earth.
- ❖ Travel forward to the year 2800 CE to observe giant mirrors melt the Martian polar ice caps and help to terraform the planet into a verdant world of water, plants and cities of the future.
- ❖ Drop "up" to the massive rotating Space Station V from the film, "2001 a Space Odyssey" in the year 2400 CE and see if you can land your "*Celestia I*" spaceship in its cavernous landing bay.
- ❖ Time travel to the future and witness a massive "Space Elevator" connected by cable to the Earth thousands of km below.
- ❖ Visit exotic fictional solar systems, complete with orbiting mining colonies, wormhole portals in space, and scores of planets, moons and spacecraft. We even have a *Dysen Sphere* for your viewing pleasure.
- ❖ Are you a Star Wars fan? The *Celestia* community has made available for download an entire *Star Wars* solar system. Orbit the planet Tatooine and you will be amazed at the realism of its arid deserts. Fly via hyperjump over the ice world, Hoth or to the green world of Endor but be careful for tractor beams. Somewhere in that solar system will be the giant imperial Deathstar, glinting as the light from the system's yellow Sun actually reflects off its evil metallic skin as a huge Star Destroyer and imperial tie fighters keep guard.
- ❖ Approach an entire fleet of Borg Cubes as you command the USS Enterprise E from the StarTrek series.

These are just a few of *Celestia's* features. Each week, new features are being added by *Celestia's* programmers and other talented contributors. It is a program undergoing a rapid evolution in computer graphics. Add-on features, for example, will include entirely new solar systems with dozens of planets and moons drawn in vivid detail, gaseous nebula clouds, new galaxies, stars, globular clusters and spacecraft both real and imaginary. Periodically as new features are added, this User's Guide will also be revised. If this list above excites you, let's get started on our journey into the heart of *Celestia*.

## Night Sky Demo

*Celestia* is a stunning program to observe and explore the Solar System and beyond. To help you discover some of its beauty and secrets, *Celestia* has a short journey already laid out for you. To see it, launch the program as described below, pull down the **Help** Menu and select **Run Demo**. When done, press the [Esc] key.

## NEW - Scripts and Educational Journeys

*Celestia* developers have created a score of other detailed scripted journeys that take you as an observer to a variety of fascinating places. To access and download them, visit *Celestia's* “add-on” repository website at <http://www.celestiamotherlode.net/index.html> and click on the link for “**Scripts**”. Download the script of your choice and place it in the *Celestia* main folder, which will be usually located on your C:/ drive, in your **Program Files** directory. You can then launch it from within *Celestia* (see later instructions).

The ability of *Celestia* to educate the public about Astronomy and space has also led to the development of a series of detailed **Educational Activities** that take *Celestia* users on a series of detailed virtual tours of the universe. Designed for all general audiences and for students in 7<sup>th</sup> – 12<sup>th</sup> grades, these Activities teach you a host of facts about specific astronomical topics, while employing the stunning power of *Celestia* to take you there visually. They even come with student worksheets that can be printed, copied and distributed by teachers to students for a grade, and meet all National Educational Standards in Science. To access them, go to <http://www.celestiamotherlode.net/index.html> and click on the link for “**Educational**”.

## Program download and add-ons

*Celestia* is a computer program written in the computer language C++. The code is Open Source, and may be examined and modified by anyone under the terms of the GNU Public License. For experienced programmers who have an interest in improving the program, you can find the *Celestia* source code at <http://www.SourceForge.net>. Click this link: [Celestia](#).

In addition to the actual program, *Celestia* can include many other add-on files (graphics and data) that the program can use. If you choose to download the entire library of over 500 *Celestia* **add-ons** designed to date by its many contributors, they can take up over **4 GB** (gigabytes) of disc space. For many people with limited computer memory and/or internet download speed, that is very large. To offer *Celestia* in a reasonable fashion, therefore, the basic default program is provided for download with a comprehensive but limited set of files, sufficient to experience its capabilities without overtaxing your computer. “Links” (web addresses) to guide you to the additional add-on files available are listed on the web within the User's forum and the *Celestia* website. To fully experience what *Celestia* has to offer, we urge you to seek out and download some of these other add-on files. At one time, the add-ons were spread out across over 60+ websites. Fortunately, volunteers have been assembling a central repository for them. It is not complete, but is growing rapidly. Its web address is: <http://www.celestiamotherlode.net/> and should be your first stop for add-ons.

Another site with over 100 of the add-ons compiled can be found here: <http://celestia.myftp.org/?lang=en>. In addition, these sites all have add-ons to use:

[Jeam.tag's add-on site \(In French, but all links work\)](#)

[Praesepe's Files](#)

[Mike's add-on list](#)

[Celestia basic textures](#)

[Selden's Resources](#)

[Texture Foundry](#)

[BT's Celestia add-ons](#)

[Don's Celestia Central](#)

[NASA's Celestia add-on files](#)



[Celestial Visions](#)[Jack's spacecraft add-ons](#)[Maxim's site](#)[John's Download site](#)[Frank's Educational Activities](#)[Jim's Celestia page](#)[Bob Hegwood's site](#)

Please note that the above links may be temporary. Websites come and go based on member's arrangements with hosting servers. However, the above sites are an excellent start. If I left out someone's add-on website, please forgive me. Remember that there are over 100 such sites scattered throughout the forum. To see links to more of them, visit and browse the forum at <http://shatters.net/forum/index.php>.

**The Celestia** default program and package for computers running Microsoft Windows® 95, 98, ME, 2000, XP, or NT 4.0 is offered as a fully "executable" program. It will install itself into your computer. The current Windows version is 11.6 megabytes in size and is called **Celestia-win32-1.3.2.exe**. It is available for download at <http://www.shatters.net/celestia/download.html>. If you have a computer that is less than 2 years old, this is the only file you will need to get started. If you have an older computer, or one with a graphics card with less than 32 megabytes (MB) of memory (see below), the **Celestia package with low-resolution textures** is only 4.5 MB in size and may run better on your system. You can find it at the same website above. Please note that you do not need both of them. See hardware comments in the next section below for more detail.

**Celestia** is also available to Apple Macintosh users running Mac OS X (Celestia version 1.3.1). The comments mentioned above for Windows also apply to the Apple version of **Celestia**. You can find the MAC version at <http://prdownloads.sourceforge.net/celestia/celestia-osx-1.3.1-1.dmg>.

**Celestia** version 1.3.2 is available for Linux in two different versions (Mandrake and SUSE8) in a single tarred, gzipped source archive at <http://www.shatters.net/celestia/download.html>. Which version you choose to install depends upon which desktop environment you have installed. The most polished version of **Celestia** for Linux requires KDE3 (**Celestia** is not compatible with earlier versions of KDE.) If you do have KDE3, it's highly recommended that you choose the KDE version of **Celestia**, as it's under the most active development. **Celestia** can also be compiled to use *Gnome/Gtk*, although *Gnome* interface is not up to par with KDE and Windows UI. It's still possible to build **Celestia** even if you don't have either *KDE3* or *Gnome*.

#### Required Libraries:

All versions of **Celestia** for Linux require that you have OpenGL installed. More and more distributions are shipping with OpenGL, so if you've recently installed or re-installed Linux, there's a good chance that you already have a working OpenGL configuration. In order to build **Celestia**, you need to have the OpenGL developers packages installed. They should be available on your distribution CD or ftp site if they're not already installed. After you've successfully built **Celestia**, you will want to be able to run it with hardware 3D acceleration. For this, you'll need a Linux OpenGL driver from your graphics chipset maker. If it's not already installed, you'll have to download it from the chipset maker's web site. NVIDIA and ATI are the two largest graphics hardware makers, and both offer Linux drivers in the drivers section of their web sites. **Celestia** requires the image format libraries *libjpeg* and *libpng*; both should be present on all up to date Linux installations. In order to build the *Gnome/Gtk* version of **Celestia**, the *gtkglarea* library is necessary. It is available at <http://www.student.oulu.fi/~jlof/gtkglarea/> if not already installed on your computer.

## Computer Hardware Requirements

**Celestia** is a sophisticated program that not only positions and graphically depicts our complete Solar System in 3D; it also plots and tracks a sky full of hundreds of thousands (to millions) of stars in real time. This takes computer power and computer memory. **Celestia** also has available hundreds of add-on files. Some of them are

large model and graphics files that require lots of RAM memory. Thus, identifying what level of computer performance you need to enjoy the program depends upon what level of detail you wish to achieve.

In general, to run the basic *Celestia* program, your computer should have a CPU (processor) that has a speed of at least 800 million cycles per second (800 MHz). Typically, computers bought new within the last 2 years have adequate CPU speeds. If your computer is more than 2 years old or is a Pentium III or equivalent with a processor speed slower than 800 MHz, *Celestia* may run slowly and you will be disappointed.

The basic *Celestia* program also requires a minimum of 128 megabytes of RAM memory. The graphics files that *Celestia* use are large, and if your computer does not have at least 128 MB of RAM, *Celestia* may run very slowly, not run at all or may lock up. In addition, if you wish to explore *Celestia's* *maximum* capabilities, you will need up to 512 MB of RAM.

Most importantly, the program has become very sophisticated and its many members have added gigabytes of textures and files to it. As a result, *Celestia* now really needs a **3D video graphics accelerator** in your computer. This is hardware circuitry that draws complex graphic images on your video display monitor. Graphics cards are available for purchase at any computer/electronics store and are easy to install. They retail for between \$100 and \$200, and will dramatically improve your computer's performance in any graphics intensive application. *Celestia* should run with any 3D accelerator card with at least 32 megabytes of video memory. However, a 64 MB to 128 MB Video RAM card is required if you intend to use *Celestia's* more detailed graphic files, and for the biggest add-ons, 256 MB of graphics memory is desirable. If you have such a card, *Celestia* will run smoothly and its graphics will be complete, crisp and sharp. If it runs too slowly, is blurry, locks up, or objects appear to be moving with jerky motions, you may need to locate a faster computer or one with more memory or graphics capability.

**\*\* PLEASE READ CAREFULLY:** *Celestia* uses the OpenGL API to render 3D graphics. In order to get the most from *Celestia*, you should have a modern OpenGL graphics card with the latest drivers from the manufacturer. If you have problems running *Celestia*, verify that your graphics card is capable enough to run *Celestia*, and that the drivers are up to date. If in doubt about the OpenGL driver, download and install a new one. It will be available free from your card maker's web site.

Please Note: While a graphic video card might use Open GL processing, *Celestia* does not run well on all such card brands or models. Several graphic cards handle images in a manner that *Celestia* may not control properly. To date, *Celestia's* features work best on the video chipsets manufactured by NVIDIA, Inc. Those video cards sell under the model names "GeForce", FX and "Quadro". If a compatible Open GL card is not present in your computer, *Celestia* can still offer you a beautiful space experience, but some of its advanced features may not display. These include shadows on mountains and craters (bump mapping), sunlight reflections off water (specular highlights), shadows of moon eclipses, and atmospheric haze.

As development of *Celestia* continues, better support for graphics hardware will continue to be introduced. If not all the features of your graphics card are supported yet, be patient. Better yet, join the *Celestia* development team and help improve the program.

## **Installation and Uninstallation**

If you have a video card incorporating a graphics accelerator with at least 32 MB of memory, install the full *Celestia* installation (i.e. – *celestia-win32-1.3.2.exe*). If your computer is an older model, does not have a graphics accelerator or does not support Open GL processing, obtain the *Celestia* package with low-resolution textures and install that. The views you see in *Celestia* will be simpler and less detailed, but this version of the program and its files require less RAM and it may run more smoothly. If you don't know if you have a graphics accelerator card or not, download the full version and try running it. If things do not run smoothly, you may not have such a card. Also, see the *Celestia* website for additional troubleshooting, at

<http://www.shatters.net/celestia/faq.html>. Alternatively, the main *Celestia* package includes some low-resolution image files. While running *Celestia*, you can switch from one resolution of graphics to another by tapping the [Shift+R] keys on the keyboard (for high resolution), or just the [R] key (to change to low resolution images). This may speed up your program. Note, however, that not every image in *Celestia* is represented by both a high and low-resolution image. If you tap the [R] or [Shift+R] keys and nothing happens, it just means there is no smaller or larger resolution image of that planet, moon, asteroid or spacecraft in your *Celestia* texture files to use.

### **Windows Operating System (95, 98, ME, 2000, NT, XP):**

Once you have obtained and downloaded the executable file from the *Celestia* website, simply click twice (double-click) rapidly on its name with your left mouse button. The file will begin running and will install *Celestia* in your C:/Program Files Directory. In general, just click "Next" whenever it asks a question. *Celestia* has its preferred choices and unless you have good reasons for altering them, we suggest you follow them.

### **Macintosh OS X Operating Systems:**

To install the Macintosh version, click on the installation file and follow the on-screen menu instructions.

**NOTE** – *Celestia* uses a special hyperlink file internally within the program called a .cel:url file. When you click on a .cel:url, the program treats it as a kind of "address" and will respond by going to a particular place and time in the night sky. It is similar to the way web browsers such as Internet Explorer and Netscape go to certain web pages when you click on a hyperlink address.

In the Windows installation program, the install procedure automatically "registers" *Celestia* as the program that utilizes .cel:urls. In the Apple MAC OS X operating system, however, registration of .cel:url file links as "belonging" to *Celestia* is not automatic. You have to do it manually. See your OP Help menu for how to register an "extension". If you do not do this, some aspects of *Celestia* will not work properly. For example, if you click on a .cel:URL file without registering it, your web browser will launch instead and try to take you out onto the internet. You will get a message saying "page not found".

### **Linux Operating Systems:**

RPM packages are provided for the SuSE and Mandrake distribution. You can get them from the SourceForge [project page](#). If you run SuSE or Mandrake the preferred way to install *Celestia* is to get the celestia-kde and celestia-kde-texture packages for your distribution and to install them by running as root in the directory where the files have been downloaded:

**rpm -Uvh celestia-kde\***

Alternatively, or if you don't run one of the supported distribution, you can compile *Celestia* yourself. Unpack it and its libraries with gzip and tar via the command: **gzip -dc celestia-1.3.0.tar.gz | tar xvf**

Then change directory (**cd**) into the newly created directory and configure *Celestia*. Run **configure** with the appropriate command line for the version that you want to compile:

KDE

**./configure -with-kde**

Gnome/Gtk

**./configure -with-gtk**

GLUT

**./configure**

**configure** may complain if you are missing a required component, or if you have an out of date version of a required component. Check the error output from **configure** to determine what's missing, install the necessary items, and then try rerunning **configure**. If neither the KDE or Gnome versions of *Celestia* will build, try falling back to the GLUT version. There are many options for **configure**; you can view them all-together with a brief explanation for each-by running **./configure -help**. After running **configure**, compile and install *Celestia*:

**make**

**make -install**



**Note:** make -install will need to be run as root unless you've overridden the default install directory by invoking configure with the -prefix option.

Hopefully, compilation of *Celestia* will go smoothly. If it does not, it's most likely because some required package is missing. A relatively common problem is that the OpenGL developer package necessary for building OpenGL applications has not been installed. If the compiler complains that gl.h or glu.h is not found, it's a symptom of a missing or improperly installed OpenGL developer package. Once **make** completes without errors, you're ready to run *Celestia* from either your desktop of choice or the command line.

### **Uninstall:**

To uninstall *Celestia* in Windows, click the **Start** button at the bottom left of your screen, select “**Settings**”, then select “**Control Panel**”, then select **Add/Remove Programs**. Locate *Celestia* in the list that appears and click the button that says, “**Add/Remove**”. For Apple, LINUX/UNIX owners, follow your system's uninstall procedure.

**Note:** In the sections that follow, images and screenshots from the program will be displayed. Many of these images use higher-resolution graphics that are not part of the default download program, but which are available from the *Celestia* forum and other websites as add-ons. As a result, if your version of *Celestia* does not precisely match the enclosed screenshots, don't be alarmed.

**Note:** In the following Guide, many keystroke commands will be referenced. All keystrokes will be enclosed inside a square bracket [ ]. Since all of the letters on a modern keyboard are in capitals (e.g. – K or L or M), keystroke references will be in capitals also (e.g. – [ K ] means press the “K” key). You do not have to use the [Shift] key. On occasion, however, a keystroke will require the use of an actual capital letter, such as the capital letter “T”. If that happens, we will instruct you to press both the [Shift] key and the [T] key. For example, the instruction will read, “Press the [Shift+T] keys”. If the keystroke is a symbol that requires the use of the [Shift] to reach such as a colon [:] or an asterisk [\*], please press the [Shift] key at the same time as you press the symbol keystroke. For example, to type the & sign, you would actually press [Shift] and the [ 7 ] key at the top of the keyboard, together at the same time. Some keystrokes require the use of the [Ctrl] key or [Alt] key. When they do, we will instruct you.



**IMPORTANT NOTE:** On occasion, we will instruct you to “Click here” to actually launch a scene in *Celestia*. It is **VERY** important that you click that link **ONLY ONCE**. If you double click it, two separate versions of *Celestia* will launch. Since the program uses a lot of memory and computer resources, two programs running at the same time will lock up your computer or slow things down dramatically.

**Note:** **New** features since the previous version of this Guide are highlighted in **Red**.

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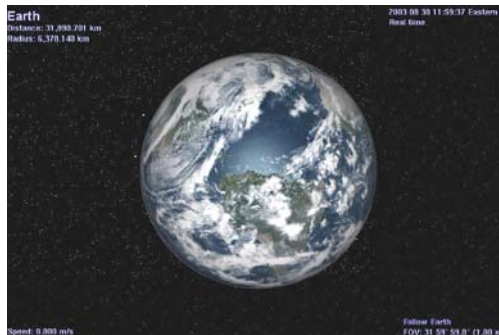
## General Operation and Keyboard commands

- 1) To launch *Celestia*, double-click on its icon on your desktop or single-click in the **Programs** menu that appears when you click your **Start** button. The program will load (it can take up to 20 seconds to open) and will position you out in space. The beauty of *Celestia* is its accuracy. The image in front of you is exactly what you would see if you were really positioned in space at that very spot at that particular time. In other words, Earth, Mars, and all of the planets, moons, stars and spacecraft visible on your screen really are located in space where *Celestia* has put them.

### The Opening Screen

Figure 1- Earth

If you wish, you may click [here](#)  
**ONCE ONLY** to go to Earth



- 2) Earth turns on its axis constantly and is always changing position. Thus, the screenshot above may or may not be the same scene you see when you open *Celestia*. However, it will be similar.
- 3) In the top left corner will be some information about your target (Earth) (if you see no text, press the [V] key once on your keyboard to turn on your text display). “**Distance**” gives you the distance from the surface of the object to your viewpoint. The **Radius** of the object will be listed in kilometers. **NEW** – The **Apparent Diameter** will be a value in degrees representing the size of the object in front of you as seen from your current viewpoint. If you move closer or farther away from the object, its apparent diameter will get larger or smaller respectively.
- 4) In the lower left corner will be your **Speed** through space. At the moment, your ship is stopped (relative to Earth) so your speed is zero. Later, we will begin to fly on our own and your speed will be listed here.
- 5) In the top right corner will be the **current date and time**. In Astronomy, times are given in Universal Time (UTC) (commonly referred to as Greenwich Mean Time), and this is what *Celestia* uses by default. If you find it more convenient, you can access the **Time** menu at the top of the program screen and check the box to make *Celestia* show your local time zone instead. The date is listed in the format (year month day). Note that time will be in 24-hour format. Thus, 1:00 PM will be 13:00:00 hours. *Celestia* can also speed up or slow down time or travel forward or backward in time with the touch of a button. Now, you are experiencing the program in “**Real time**”.
- 6) In the lower right of the screen will be a message telling you that you are “**Following**” Earth. Wherever it goes, you go. Thus, although Earth is actually moving rapidly through space, you are moving with it.

### Field of View:

- 7) Under the “**Follow Earth**” text will be your “**Field of View**” or “**FOV**” setting. This is the amount of sky your view takes in. *Celestia* starts you out with an FOV that it calculates, based upon your screen size, resolution and monitor settings. It ranges from 15° to 45°, which means your monitor is displaying about 15° - 45° of the sky (most people have a total visual field of 120°). However, you can change the FOV easily by holding down the [Shift] key on the keyboard, [left-clicking] your mouse button and dragging the mouse forward or backward. Try it. As the FOV gets smaller, the scene enlarges. It is similar to a telescope

magnification. You can also press the [ . ] key or the [ , ] keys to change field of view from the keyboard. Enlarging the FOV allows you to magnify objects in the distance, while still keeping the planet in the foreground. In general, an FOV of about 32° presents a sky view that draws objects at about the size you see them in space. If you wish to return to the default FOV that your program opened with, and you have a mouse wheel, click/push the [wheel button] down once. Please note that if you change your screen window size by dragging its borders, *Celestia* may assign and change the FOV, based on the new screen size.

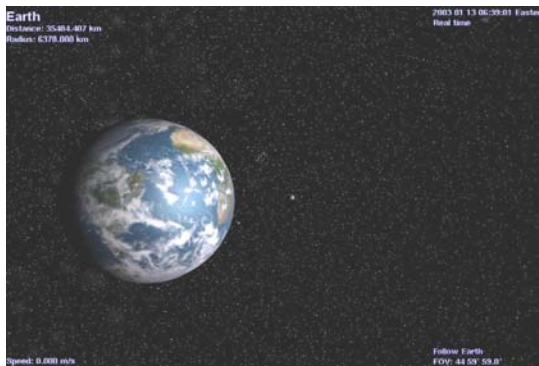
- 8) You can also instruct *Celestia* to launch the program with a particular starting FOV, rather than sizing it based on your screen settings. To do so, locate the file named “**start.cel**”, which is in the *Celestia* main Directory folder. **Right-click** on it and choose the option that says, “**open with**”. A list of programs on your computer will appear. Locate a text editing program such as *MS WordPad* or *Notepad* and click **OK**. The **start.cel** file will open and you'll see a set of single line commands (in English). Locate the line that says,

# “set { name “FOV” value \_\_\_\_ }”. Remove the # symbol and in the space, type whatever FOV value you wish. For example:

**set { name “FOV” value 32.0 }** produces a 32° field of view that is about what your eyes would see without a telescope if looking at the Moon or a particular spot in space.

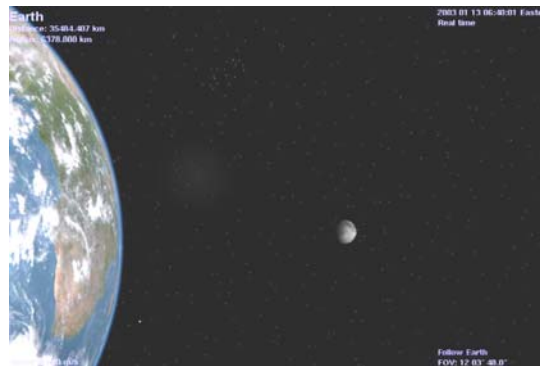
Save the file, close it and launch *Celestia*. The program will now always start with an FOV of 32°.

Figure 2 - click [here](#) to visit



The FOV here is 45°. Notice size of the moon behind Earth.

Figure 3 – click [here](#) to visit



The FOV here is 12°. Earth and moon are now enlarged.

## Set Program Options (Render menu)

- 9) When you use *Celestia* for the first time, you will need to choose some options that will tell the program how you want things done. *Celestia* will remember these settings once you initially establish them. However, during your subsequent use of *Celestia*, you may have need to change or reset these options.
- 10) **Display Mode:** To open the **Render** menu, [left-click] on the word “**Render**” at the top of the *Celestia* view screen and choose “**Select Display Mode**” or “**Toggle Full Screen**”. These are instructions to *Celestia* to change the resolution of the view screen. Choose the “**Select Display Mode**” menu first to choose the size of the viewscreen you prefer. “**Windowed Mode**” is the default choice and sets your screen to the same resolution size your display monitor is set to display. For example, most desktop computers display a default screen resolution of 800 x 600 pixels, while new Win XP systems and laptops are typically set to 1024 x 768 pixels in either 16 or 32-bit color. To find out what your computer display is set at, [right-click] on your desktop, choose “**properties**” and “**settings**”, and read the monitor resolution setting. When running *Celestia* in **Windowed Mode**, your screen gives you visible screen borders, sliders and toolbars. You can resize the

screen by dragging its corners, minimize the screen, switch between programs, etc. If instead you select a different screen resolution from the Display Mode pulldown menu, *Celestia* will immediately switch to **Full Screen Mode**, and draw the screen in that pixel size, filling up the entire screen. All of the toolbars, sliders and side borders will disappear. High-end computers and those with up-to-date video cards can take advantage of tighter packed pixel sizes and more detailed appearance, and many users prefer to view *Celestia* in **Full Screen Mode** at smaller pixel sizes. The screen is uncluttered and your view really looks like the window in a spacecraft. For some space scenes, the view can be extraordinary. However, there are disadvantages to **Full Screen Mode**. First, in order to access the toolbars, you must point your mouse toward the top of the screen and wait for the menu/toolbar to be drawn. With some video cards, the entire screen will go black for a moment as the toolbars are being drawn. Secondly, some screen modes are simply not designed for certain monitors. For example, if you set your resolution at 1280x720 on a regular CRT monitor, the screen will look warped and the planets will be ellipses, not spheres. Also, be advised that the ability of *Celestia* to redraw complex scenes in different screen sizes varies from system to system. Some users have reported lockups and program crashes when using **Full Screen Mode** at certain display sizes. We recommend you experiment with your own system and choose the resolution that works best for you. [Alt+Enter] is a useful keyboard shortcut that toggles between Windowed Mode and Full screen.

Note: If you are in **Full Screen Mode** and wish to toggle between *Celestia* and another program, simply press the [Alt + Tab] keys together.

- 11) “**View Options**” is the 3rd option in the **Render** menu, and an important one. **Left-click** this option to open the **View Options** dialog box. A list of choices will appear. Deciding which ones you want is a personal and a practical choice. If your computer is a newer model, then we recommend the options listed in the image to the right of this paragraph, and described in detail below. If your computer is slower or older and *Celestia* appears to be running slowly, deselect some of these options, as suggested in the following discussion:  
**Note:** Keyboard shortcuts to these options are listed in brackets.



## Atmospheres

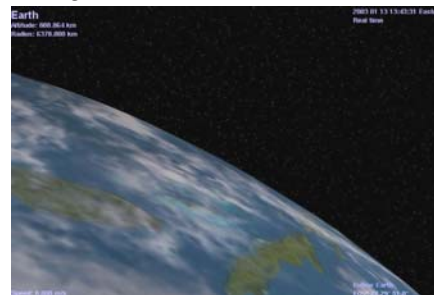
[Ctrl+A] is the keyboard shortcut to turn **Atmospheres** on or off (toggle) - *Celestia* will draw colored atmospheres above all planets and moons that have them. You will be able to see them from space and even fly through them. As you do, the sky will lighten. Atmospheres will even dim and turn color as you view them near the terminator (near the dark side). **Highly Recommended** - but does require computer resources. Try turning it off (uncheck the box) or toggle the key shortcut if *Celestia* is running too slowly on your system.

Figure 4 – Click [here](#) to visit



Earth with Atmospheres selected.

Figure 5- click [here](#) to visit



Same scene without Atmospheres selected



### Celestial Grid

[ ; ] *Celestia* places an equatorial coordinate grid on the screen showing you the celestial position and direction you are facing in space. The grid follows the standard convention of *Right Ascension* and *Declination* used in Astronomy. **Recommended – when needed** to locate a direction in space. For example, you can turn the grid on temporarily to identify direction of an object in *Celestia* then go to a real telescope and swing to that approximate coordinate. You can also use the Celestial Grid to help you decide where to place a fictional add-on or to locate an object whose RA and DEC you know from another source.

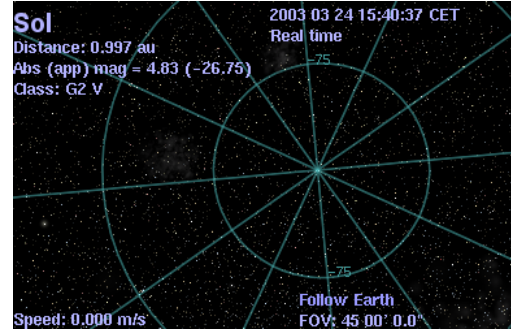


Figure 6 - Sky with Celestial grid Enabled  
Click [here](#) to visit

### Clouds

[ I ] Some of the planets in our Solar System and many fictional planets that *Celestia* users create in other solar systems have clouds drifting across their surfaces. *Celestia* has the ability to display clouds and put them in motion. **Highly Recommended** - but does require computer resources. Try turning off if *Celestia* is running slowly or if you want clear skies.

Figure 7 – click [here](#) to visit



Earth with moving clouds selected.

Figure 8- click [here](#) to visit



Same scene without clouds selected

### Comet Tails

[ Ctrl + T ] *Celestia* will accurately place a gaseous comet tail behind all comets, properly oriented to always point away from the Sun. To see those tails, you have to be close enough to the comet. **Highly Recommended** - but requires computer resources. Try turning off if *Celestia* is running too slowly.

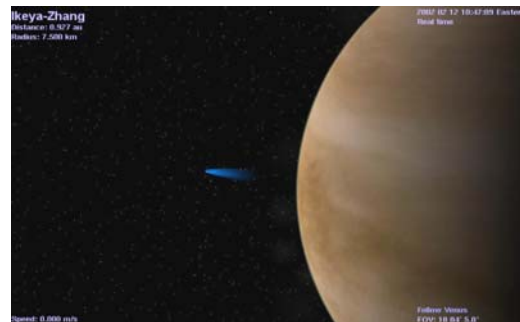


Figure 9 - Venus and comet Ikaya-Zhang in Feb, 2002  
Click [here](#) to visit



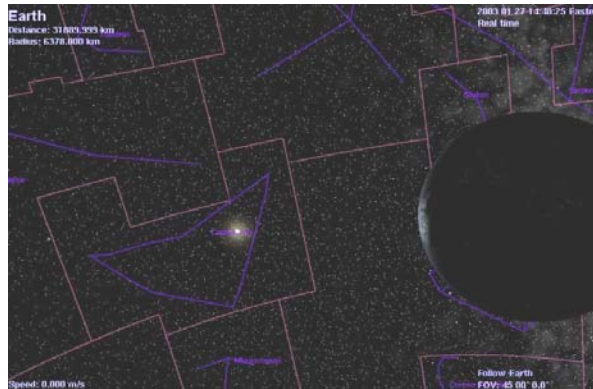
**Constellations**

**Celestia** will display both **constellation borders** [Ctrl + B] and their official “**shapes**” [ / ] for each of the 88 constellations in the sky. In the second Options menu section, you can also turn on **constellation labels** [=]. These 3 options are useful whenever you have an interest in locating a particular constellation in **Celestia**. **Recommended – only when desired.** Does not use much computer resource.

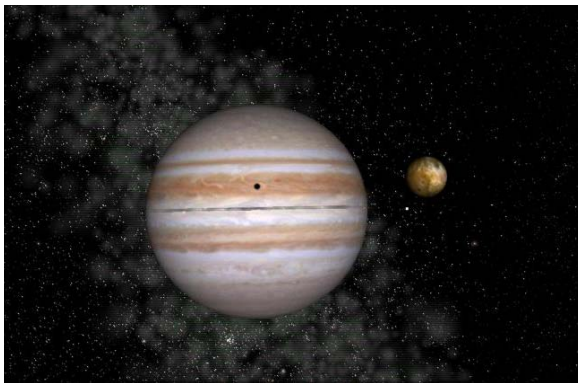
Figure 10

Constellations with borders and labels enabled. As viewed from Earth, the Sun is “in” Capricorn.

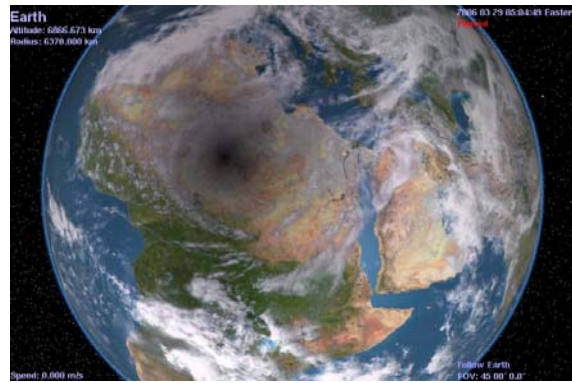
Click [here](#) to visit.

**Eclipse Shadows**

[ Ctrl + E ] **Celestia** can compute the actual position of the shadows a moon or planet will cast on a planet/moon as the object passes in front of the Sun (a solar eclipse). Turning this feature on will cause shadows to be drawn on all planets/moons whenever an eclipse occurs. It is an elegant feature, particularly when observing moon shadows drifting across the giant gas worlds of Jupiter and Saturn. **Highly Recommended** - but does require significant computer resources. *Note: On older video cards, eclipse shadows may lock up the program.*

Figure 11 – click [here](#) to visit

To eclipsing Jupiter, an example of Eclipse Shadows.

Figure 12 – click [here](#) to visit

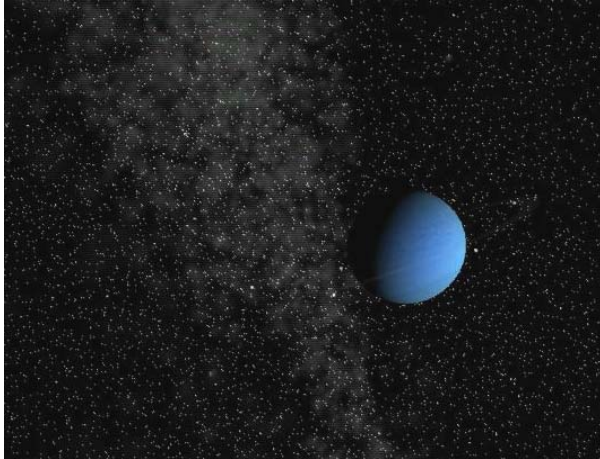
A total solar eclipse over Africa, as seen from space

**Galaxies**

[ U ] **Celestia** comes with a galaxy data file that tells the program the position of several **galaxies** in the night sky and what type they are. When this option is selected, **Celestia** will create a small, dim sketch of each galaxy and position it in the proper place in space. It will also draw the huge band of starry haze we know as the Milky Way. Selecting the option, therefore, will improve your **Celestia** experience and you will be able to see the Milky Way across the sky and dim galaxies in the distance. You can even travel to them in your spaceship. However, the galaxy sketches are simple and appear as dim “blobs”. Later versions of **Celestia** will improve on the graphics of galaxies.

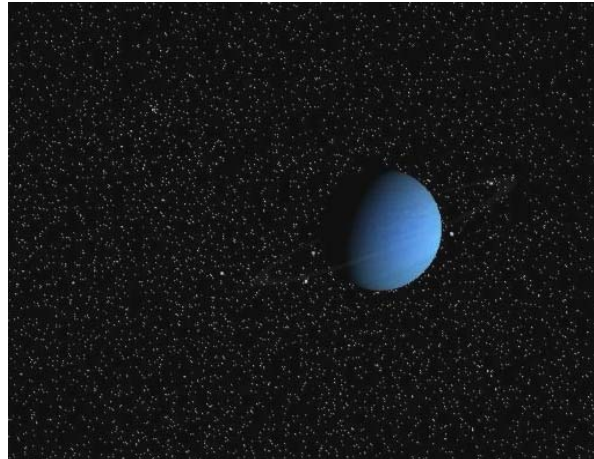
**NEW** - The Galaxy option also turns on or turns off **nebula**. Nebula add-ons such as the famous Orion Nebula or the Rosette Nebula are very popular in *Celestia*, but drawing them can really tax your computer system. If you have too many of them positioned in the sky, your system will slow down. **Recommended** - but does require computer resources. Try turning off if *Celestia* is running too slowly.

Figure 13 – click [here](#) to visit



*Neptune and Milky Way with Galaxies enabled.*

Figure 14 – click [here](#) to visit



*Same scene without Galaxies enabled*

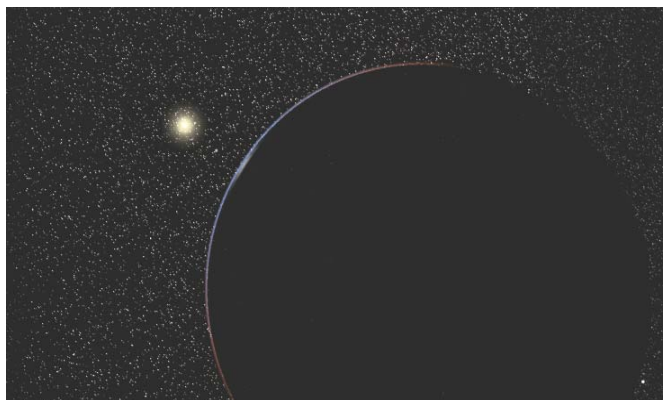
**Night Side Lights** [ **Ctrl + L** ] *Celestia* has the ability to light up the night sky. From space, the thousands of cities across our continents are ablaze with light so bright that they can be seen vividly from hundreds of km up. Turning on this option commands *Celestia* to add those lights to the nighttime vista you see from space above Earth. Night textures are also used in some add-ons to show fictional cities or volcanic lava flows at night. **Highly Recommended** - but does require computer resources. *Note: On older video cards, night-side lights may slow down or lock up the program.* Try turning off if *Celestia* is running too slowly.

Figure 15 = click [here](#) to visit



*Earth, Sun and terminator with night-lights enabled*

Figure 16 – click [here](#) to visit



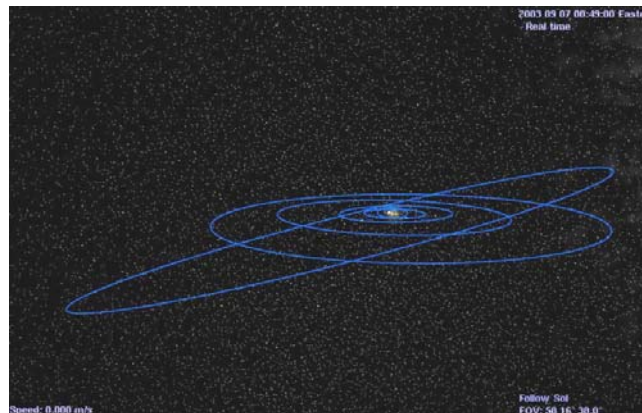
*Same scene without night-lights enabled*

## Orbits

[ **O** ] *Celestia* will draw the actual path of a space object's orbit through the solar system. The Option draws orbits of all planets, moons, comets, asteroids and spacecraft that you choose. Each orbit type is drawn in a different color, with the active orbits in **red**. For example, if you are centered on Venus and have "planet" orbits selected, Venus's orbit will be highlighted in **red**. All other planet orbits will be highlighted in **blue**. Orbits are excellent for seeing the celestial mechanics of the solar system. Turn them on, zoom out from the Sun or planet and view the orbits from above. Speed up time (see later discussion) and you will see the alignment of planets speeding around the Sun, or view the orbits of satellites as they circle around a planet. The **Orbit/Label** section of the **View Options** Menu allows you to turn specific orbit types on or off with a check mark in the box. **Recommended – when desired.** Does not use much computer resources.

Figure 17 - click [here](#) to visit

*Solar System with planet orbits enabled and time speeded up. The inclined orbit is that of Pluto, a large Kuiper Belt Object that may have swung into its current orbit through a past collision with another object.*



## Planets

Displays all planets as full color detailed textures. Most are based on accurate satellite photos of the planets. Normally selected (no keyboard shortcut). **Highly Recommended.**

## Ring Shadows

(no keyboard shortcut) - *Celestia* can compute and continually redraw the actual position of the shadows a planet's ring will cast on a planet below and conversely, the shadow a planet will cast on its rings. **Highly Recommended** - but does require significant computer resources. *Note: On some older video cards, ring shadows can slow down the program dramatically or lock it up entirely.* Deselect if your computer is running too slowly.

Figure 18 – Ring Shadows enabled – click [here](#) to visit

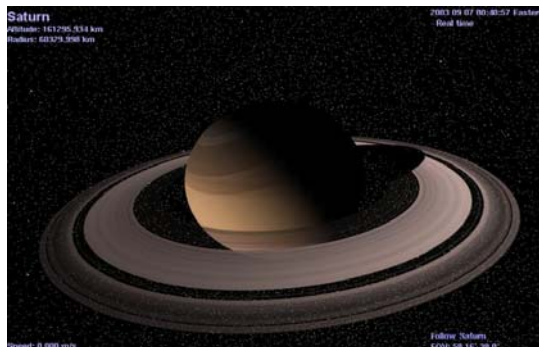
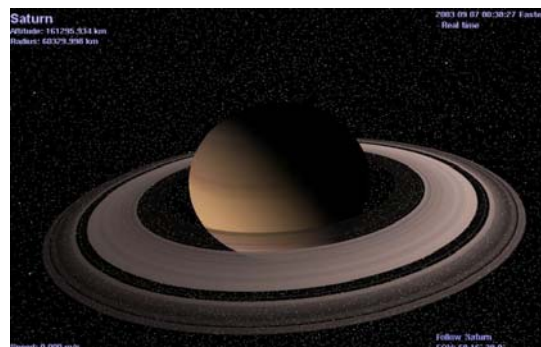


Figure 19 – Ring Shadows disabled =click [here](#) to visit





**Stars**

Displays a sky full of stars. Obviously a key part of the *Celestia* experience. Normally selected (no keyboard shortcut). **Highly Recommended.**

**Stars/As Discs or Points**

[**Ctrl + S**] *Celestia* can display stars either as points, scaled discs or fuzzy points. Which looks better is a matter of personal taste and the resolution of your monitor. In general, a **scaled disc** forms a prominent circular disc that varies in both diameter and brightness based upon the actual size, magnitude and distance of the star from you. For example, a bright Red Giant star nearer Earth will be a larger reddish disc in the sky with this option enabled, while a smaller main sequence yellow star will appear smaller and dimmer in size. Scaled discs are not designed to mimic the true visual appearance of the sky. Instead, they enable you to locate stars by type and magnitude. **Fuzzy points** take a similar approach but draw a smaller, more realistic “point” that varies in size and brightness. When your monitor screen resolution is above 800x600 or higher, fuzzy points make a clearer distinction between brightnesses of a star and can produce a realistic sky view. The 3<sup>rd</sup> option, stars displayed as **Points**, tend to be of similar brightness but look better at 800 x 600 and lower resolutions. Selecting **Points** may also make *Celestia* run faster

You can cycle between the three star styles with [**Ctrl+S**] or you can set the style by using the **Star Style** sub-menu on the **Render** Menu.

Figure 20 - click [here](#) to visit



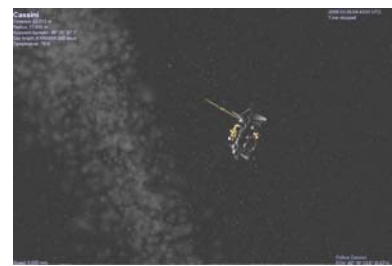
Cassini against stars 800x600 resolution – Scaled Discs enabled

Figure 21



Same scene with Fuzzy Points enabled

Figure 22



Same scene with Points enabled

**Markers**

[**Ctrl + K**] and [**Ctrl + P**] - When enabled by pressing the [**Ctrl+K**] keys, *Celestia* will draw a small square box around/in any object you select and mark. To mark an object, simply select it with a single or double click of the left mouse button so that its name appears in the upper left corner. Then, **right-click** on it and choose “**Mark**”. You can also press [**Ctrl + P**] from the keyboard to mark an object. You can mark as many objects as you like. Objects not currently selected will have a green mark. Current objects will have a red mark. To unmark an object, right-click on it and choose “**Unmark**”, or press [**Ctrl+ P**] again. To turn off all Marks, press [**Ctrl + K**] again. Marks are very useful for tracking an object in space that you’ve lost sight



Figure 23 - Voyager 2 marked

of, or for highlighting objects so that you can find them easily again. For example, you can mark the Voyager 2 spacecraft as it speeds alone out of the Solar system. No matter where you travel in space, you can always see it by scrolling across the sky to locate its mark.

**Note:** All Marks are erased and reset to zero when the program closes.

**Orbits/ Labels** **New:** - The central region in the **View Options** menu provides you the ability to turn on or off various labels for planets, major stars, moons, etc., and to select which orbit paths you want *Celestia* to draw. Turn them on or off as you desire by checking the boxes. They do not use much computer power.

**Labels keyboard shortcuts are:**

|                      |                                    |
|----------------------|------------------------------------|
| =                    | Toggle constellation labels        |
| <b>B</b>             | Toggle prominent star labels       |
| <b>E</b>             | Toggle galaxy/nebula labels        |
| <b>M</b>             | Toggle moon labels                 |
| <b>W</b>             | Toggle asteroid labels             |
| <b>Shift + W</b>     | Toggle comet labels                |
| <b>n</b>             | Toggle spacecraft labels           |
| <b>p</b>             | Toggle planet labels               |
| <b>Shift + &amp;</b> | Toggle location labels (see below) |

**Information Text** This box allows you to choose how much data you want displayed when you select an object. Pressing the [**V**] key also toggles the information display on or off through two levels of detail. If you see no text at all on the screen, press [**V**] to turn it on.

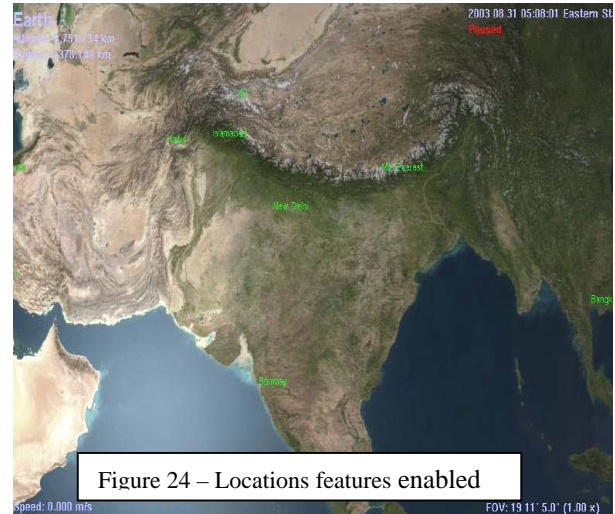
**Filter Stars** This slider determines how many stars *Celestia* will draw at one time. It regulates star number by how far away a star is from your viewpoint. By default, it is set at 1,000,000 light years. Since the diameter of our galaxy (the Milky Way) is about 100,000 LY across, *Celestia* will draw all stars in its data base at this slider setting. However, you can lower the slider and command *Celestia* to draw only closer stars. For example, if you set the slider to 100, the program will only draw stars that are within 100 light years of Earth. Since this requires far less computing power than the highest slider value, this may be useful if the program is running slowly for you. Lowering the slider will speed things up. Also, you may have a scientific need to only see the closest stars to your viewpoint.

12) **Locations** [**Shift + &**] – under the **Render** menu is a feature that directs the program to mark and label any city, mountain, sea, valley, crater, landing site or other feature you desire on a planet or moon, and display its name above its latitude and longitudinal position. To enable this feature, press the [**Shift + &**] key. *Celestia* comes with a default list of locations when it is installed onto your computer. To toggle the list of features on or off, use the menu checkboxes in the **Render** sub-menu. However, a many new locations files are being developed by *Celestia* users. Some of them are available at <http://www.shatters.net/~claurel/celestia/files/locations/> and at the *Celestia* add-on repository site at <http://www.celestiamotherlode.net/index.html> The forum will also explain how to make your own list of locations. To use a **Locations** list, locate and download a list file from the web and place it in your “**Extras**” folder in the main *Celestia* folder in/on your computer. It will then display when the **Locations** option is enabled. When observing a planet or moon from far away, only the largest or most important locations are



shown. As you approach it, more labels will appear. To change the distance at which particular labels first appear, move the slider in the **Minimum Labeled Feature Size** panel in the **Locations** sub-menu.

Locations may be manually selected by entering their names (see : **Selecting Objects by Enter/Name/Enter Method** section below). Generally, you must enter the name of the planet or moon where the location is found, as well as the location itself. For example, to locate and go to **Cairo**, press the **[Enter]** key and a sub-screen will appear in *Celestia* with a place to type an entry. Type **'Earth/Cairo'** (or 'Sol/Earth/Cairo' if you are outside the Solar System.), then press **[Enter]** again and the **[G]** key to go there. You will be taken by the program to a position located directly above Cairo. Note that if the location is on the opposite side of a planet from where you are, *Celestia* will take a shortcut through the planet and stop above the location you select, but facing into space. You will have to rotate your view to see the location (see later sections for how to rotate your view).



- 13) **Stars Visible** – { **[ ]** } or { **[ ]** } - On the **Render** menu, select “**More or Fewer stars visible**”, or toggle with the keyboard shortcuts. This tells *Celestia* how many stars to draw in the sky at one time. It controls star numbers by Apparent Magnitude (visible brightness). You can choose to display only bright stars. On the surface of Earth, our view generally includes stars of an apparent magnitude of +6.5 or less (the lower the number, the brighter the star). Setting this option to Magnitude 6.5 – 7.5 results in a realistic sky as seen from the surface of Earth on a clear night, with only about 3,000 stars visible. However, if you were living on a space station far above earth's atmosphere, you might see stars up to a magnitude of 9.0 or 10.0 with the naked eye. Because there are more stars in the sky, many *Celestia* users prefer higher star settings of 8.0 to 10.0. The keyboard shortcuts are very useful here. Experiment by using the keyboard key “**[F]**” to decrease limiting magnitude (fewer stars visible), and “**[I]**” to increase limiting magnitude (more stars visible). Note that by turning stars on or off, you are changing the amount of data *Celestia* must process each second. If you are experiencing slow performance, try reducing the star count.

Figure 25



Stars at Magnitude setting of 7.5

Figure 26



Same scene at Magnitude setting of 15.0.

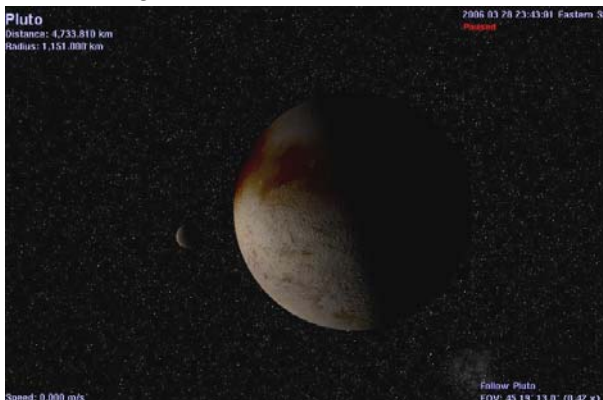
- 14) **AutoMag** - **[Ctrl + Y]** - The default download of *Celestia* actually contains about 100,000 stars up to magnitude 15.0 visible from the vicinity of Earth. A setting of 11.0 or more simulates the view you would see through a telescope. However, millions of stars have been cataloged by Astronomers and if you wish, you can download a star database from the *Celestia* website that contains over 2,100,000 stars. You can find it [here](#). If this file is loaded, and you select the maximum magnitude limit of 15.0, the sky will be ablaze with

stars. **Note that this level of star display will dramatically slow down even fast computers.** The choice is yours. Fortunately, *Celestia* helps you to set realistic star magnitudes with a feature known as **AutoMag**. To enable **AutoMag**, press the [ **Ctrl+Y** ] keys. To disable it, press them again. When **Automag** is enabled, *Celestia* will turn on or turn off stars to maintain a reasonable visual range whenever you change your field of view (FOV). It will also restrict the view to a range of 6.0 – 12.0. A screen display will advise you of your changes.

15) **Star Style** – Toggles between scaled disc, fuzzy points and points, as discussed earlier.

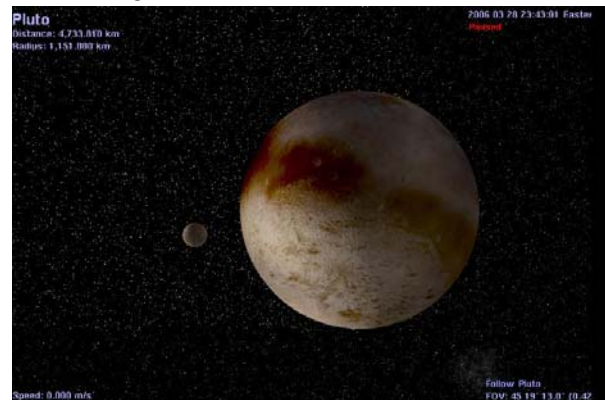
16) **Ambient Light** - [ **Shift + {** ] or [ **Shift + }** ] - On the “Render” menu, select “**Ambient Light**”. Since space is a near vacuum, there is very little light scattered and shadows are completely black. You can set the ambient light level to “**none**” to simulate this and get the most realistic views of space. However, there are times when a bit of extra light is useful or aesthetically pleasing. For example, go to the dark side of any planet and adjust ambient light from **None** to **Low**, then to **Medium**. You’ll discover that portions of a planet’s dark side become visible with some light scattering. Having a bit of extra light is also good for seeing spacecraft. When they’re on a planet’s dark side, they almost disappear in the shadows. Low or medium light allows you to track them better. Use [ **Shift + {** ] to decrease ambient light and [ **Shift + }** ] to increase it through several step levels. Remember that no light scattering (None) is the accurate view when in space.

Figure 27 – click [here](#) to visit



Pluto and its moon Charon with Ambient Light set to None

Figure 28



Same scene with Ambient Light set to Low.

17) **Antialiasing** - [ **Ctrl + X** ] - On the **Render** menu, select “**Antialiasing**”. These are instructions to *Celestia* to use certain graphical processing and smoothing techniques when it draws lines on the **viewscreen**. In general, **Antialiasing** evens out the lines used to draw sharp edges of spacecraft, orbit paths and constellation figures. **Highly Recommended** - but does require computer resources. Try turning off if *Celestia* is running too slowly. Note that anti-aliasing may not be available if you do not have a higher quality graphics video card on your computer.

18) **Vertex Shading** - [ **Ctrl + V** ] Not in the Render menu but controlled via keyboard, Vertex Shading is a computer graphics drawing technique that draws (renders) graphical shades (haze, shadows, specular reflections off of water or ice, etc.) on *Celestia* objects. To see such shading, you must have a graphics accelerator card that renders shading via a process known as *Open GL*. However, as mentioned earlier, not all graphics cards can handle vertex shading properly. *Celestia* now handles Vertex Shading automatically.

With higher end cards, *Celestia* gives you five choices for Vertex Shading. They are: **Basic**, **Multitexture**, **Nvidia Combiners**, **Open GL** and **Open GL/Nvidia Combiners**. The number of these available render paths you can cycle through with [ **Ctrl+V** ] depends on the graphics card and driver version you have. By default, *Celestia* detects the type of graphics card you have and starts up your program with the highest quality rendering possible. If you have an Nvidia Open GL Graphics card, all five choices will be offered. Using the [ **Ctrl+V** ] keyboard shortcut, select the last choice (**Open GL/Nvidia Combiners**); observe Earth and then cycle through the other choices. You will see surface shadows and a haze appear or disappear on Earth. If you have another brand of graphic accelerator card, cycle through whatever choices *Celestia* presents to you. If you have no graphics card at all (i.e. – your computer has a minimal built-in graphics processor), the **Basic** or **Multitexture** settings are your only choices.

Figure 29 – click [here](#) to visit



Open GL/Nvidia Combiners render path selected

Figure 30



Same scene with Basic render path only

Note: Keyboard shortcuts for turning on and off (toggling) the options and features described above, along with other keyboard shortcuts, are listed in printable format [at the end of this document.](#)"

## Alternate Textures and Surfaces

- 19) *Celestia* comes with a moderate collection of textures (graphical files) that the program uses to draw the surfaces of planets, moons, asteroids, spacecraft, etc. *Celestia* takes great care to try to include textures that are true and complete or partial photographs of the planet or moon. In that way, the program's images are impressively accurate. However, add-ons developed by forum members and others are available for download from various websites in the *Celestia* community that define **Alternate Surface** maps for some space objects. For example, you can command *Celestia* to load an image of the Earth as it may have looked 4 billion years ago, soon after it formed. Its surface will be covered with craters and lava flows. Another Alternate Surface available for Earth is this latitude and longitude grid (figure 31), that overlays a map of the equator, prime meridian, Tropics of Cancer and Capricorn, etc. onto a modern image of the planet. A third popular Alternate texture is of Earth at the time of the Ice Ages. See the planet covered in ice, and the extent of the ice sheet boundaries. Alternate surfaces are also often used for global maps of temperature, elevation or other data.

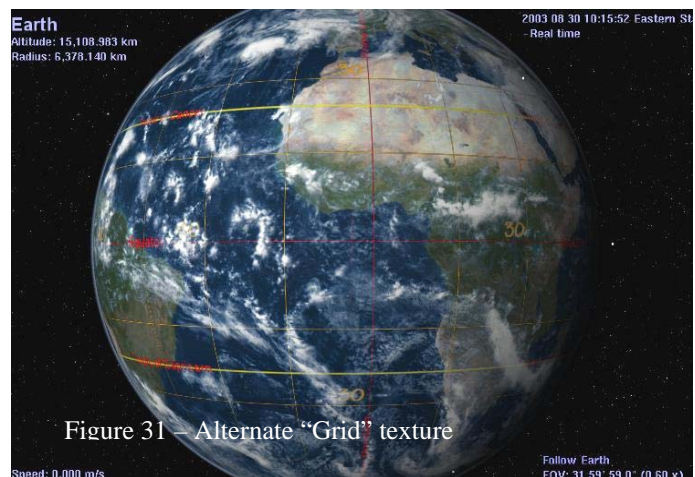


Figure 31 – Alternate "Grid" texture



- 20) Only one Alternate surface is displayed at a time. To choose an Alternate Surface, **right-click** on the object. If an Alternate Surface is available (has been installed in your program files) it will appear in the menu that is displayed. Simply click on its name and *Celestia* will load and draw the Alternative texture. To return to the original “normal” texture, right-click on the object again, choose “**Alternate Surfaces**” and select the “**Normal**” texture.

There are times when you might wish to have two alternate textures displayed at the same time, representing different bodies. For example, you might have an image of the Primitive Earth and the Primitive Moon in your texture files and want *Celestia* to draw both of them together. To do this, you must locate those files in your *Celestia* texture folder and name both of those files with the same name. For example, if you name the Primitive Earth texture “**Primitive**”, and the primitive Moon texture “**Primitive**” and place them in two different folders, both will be drawn. The step by step procedure for doing this is a bit too complex to cover here in depth. A posting on the *Celestia* forum will help you accomplish this, if you so desire.

- 21) **Limit of Knowledge Textures** [ **Shift** and **+** ] key - The surfaces of some of the bodies in our Solar System have only been mapped or photographed incompletely. By default, *Celestia* uses surface maps that have the unknown regions filled in with plausible surface features, typically cloned from some part of the body that has been imaged. But *Celestia* also includes a set of maps called '**limit of knowledge textures**' (LOK) that depict the unknown areas as blank, clearly showing where our spacecraft have and have not aimed their cameras. The [ **+** ] key toggles between the default 'interpretive' maps and the limit of knowledge textures. You can also load them with a **right-click** and selection of “**Limit of Knowledge**” from the context menu.

## **Movement**

- 22) General movement in *Celestia* is one of the highlights of this amazing program. It is easy and versatile. Movement keys are very important for enjoying the *Celestia* universe. For example, if you wish to go into an orbit hovering above a planet, drop down to its surface or fly in your spaceship to the edge of the Milky Way, you will need to change direction, orientation and distance in space frequently. There are 16 keyboard or mouse general movement commands. Let's return to our opening scene of the Earth (to do so, click [here](#))
- a) **[Right-click]** on the scene in front of you and while holding down the right mouse button, move your mouse (**Right-click-drag**). Earth will rotate left, right, up or down. You can view it from any perspective you wish.
  - b) **[Left-click]** your mouse and while holding the button down, drag the mouse. The whole scene will shift as a whole (**Left-click-drag**).
  - c) Tap the **[down ↓ arrow]** on the keypad or **[# 2] on numeric keypad**. Your view of Earth will **pitch** upward. Before you use the numeric keypad, make sure you press the key labeled “**Num Lock**” at the top of the numeric keypad. If so, there should be a little light lit up above the numbers on your keyboard.
  - d) Tap the **[up ↑ arrow]** on the keypad or **[# 8] on numeric keypad**. Your view will **pitch** downward.
  - e) Tap the **[left ← arrow]** on the keypad or **[# 7] on numeric keypad**. Your view will rotate (**roll**) clockwise.
  - f) Tap the **[right → arrow]** on the keypad or **[# 9] on numeric keypad**. Your view will **roll** counter-clockwise.
  - g) Tap the **[# 4] key on the numeric keypad** of the keyboard. The view will swing (**yaw**) to the left
  - h) Tap the **[# 6] key on the numeric keypad**. The view will swing (**yaw**) to the right as a whole.
  - i) Tap the **[# 5] key on the numeric keypad** to stop all pitch, roll and yaw movement.

- j) Hold down the [**Shift**] key and press one of the [**Arrow**] keys (e.g. [ **Shift**+→ ] ). You will “orbit” around the object in view, either left/right, or up/down. This is convenient to see all of an object quickly.

Note. The speed with which the view turns when you press the above keys is initially set at a particular value (120) in one of the files that *Celestia* uses to operate. That file is called **celestia.cfg**, and can be found in the main (root) directory of the *Celestia* folder. If you find that your view is turning too fast or too slowly for your taste when you press a movement key, that document can be opened by you and the **Rotate Acceleration** (turning speed) of the above keys can be lowered or increased. To do so, double-click on the file. If a menu comes up asking you which program you wish to use to open the document, choose “WordPad” (for Windows systems) or the proper plain text editor for MAC and Linux systems. When open, locate the line “**RotateAcceleration 120**” and change the number either higher (to turn even faster) or lower (to turn more slowly). For example, **RotateAcceleration 35** will result in your view turning more slowly when you hit a movement key. Some users prefer the increased control it gives them, particularly if they use the *Celestia* spaceship.

**NEW** - You will also find that a variety of other commands in the **celestia.cfg** file can be changed by you to alter the way *Celestia* does things. Read the document's text directions and make any changes you wish. After changing, save the change by clicking the **File** and **SAVE** menu choices, and close the document, then relaunch *Celestia*.

- k) [**Right-Click + Left-Click + Drag**] – (press all together) - your position will **advance toward** or **recede away** from the object.
- l) [**Ctrl + left Drag**] – same as (k) above.
- m) [**Roll Center Mouse Wheel**] (if you have one) forward or backward – same as (k) above.
- n) Press the [**End**] key on the keyboard. This is the same as (k) but using the keyboard only. Your position above any object will rapidly **recede away**. Hold down the key and you can move light years away.
- o) Press the [**Home**] key on the keyboard. Your selected object will rapidly **advance toward** you.

The above five keys resemble a “zoom” ability. However, they don't magnify an image; they just reposition you toward or away from it. Because this feature operates exponentially, you can move smoothly and rapidly from a distance of one meter to one million light years away from a *Celestia* object without sacrificing precision at small distances, or experiencing long time delays traveling long distances.

- p) Press the [ **Shift** + \* ] on the keyboard. This is a **Lookback** command. It will reverse your view so that instead of looking forward, you will look behind you (a rearview window). It is very stimulating when flying from one planet to another or traveling in your spaceship. You can see forward and then examine your journey from the rear view, watching the planet or moon you just left recede from you.

## **Joystick Control** [F8]

- 23) You can also control your movement via a joystick (Windows only). The commands for joystick control of *Celestia* are listed in the back of this document, in the **Keyboard and Mouse Command Summary**. Press the [ **F8** ] key to turn Joystick control on or off.



## Selecting Objects

- 24) In *Celestia*, you will usually have some object selected. If so, the program will list its name in the upper left corner. It can be a star, planet, moon, asteroid, comet, spacecraft, galaxy/nebula or location. The simplest way to select most objects is to **point** at it with your mouse and **[left-click]** on it (note - point/click does not work with **Locations**). Return to *Celestia* and try clicking once on a star to select it. The information display changes to details about the star. Note that you have not actually gone there or changed anything yet. You've simply told *Celestia* that you have selected a new object (if you see no text on the screen, type the **[V]** key on the keyboard.)
- 25) To go to the star you just selected, you have four main ways to make the journey (practice doing all four):
- A) If you **right-click** on the selected star, and select "**Goto**", *Celestia* will take you at hyper-light speed directly to that star and position you in space at a convenient distance.
  - B) Alternately, you can press the letter **[ G ]** on the keyboard. That is the shortcut command for "**Goto**".
  - C) You can select the star and fly to it in your spaceship. It takes longer but sometimes the journey is half the fun of getting there. How to operate your spaceship is explained later below.
  - D) You can also select an object using keyboard commands, then use the **advance [Home]** key, or **recede [End]** key to get there. To do so, simply point at a star or planet, **left-click** on it with the mouse so that it is selected and tap both the **[ C ]** and the **[ F ]** keys on the keyboard. The **[C]** key tells *Celestia* to center a selected object in the middle of your viewscreen. **[Double-clicking]** quickly on an object will also center it. The **[ F ]** key tells *Celestia* to **follow** the selected object, keeping it the same distance from you even though it is moving through space. Let's try it!. Point at a star, **left-click** on it to select it, and tap the **[ C ]** key. It will swing and become centered. Then press the **[ F ]** key. The words "**Follow \_\_\_\_ (star's name) \_\_\_\_**" will appear in the lower right of the screen. Now that you are following that object, go to it by holding down the **advance [Home]** key. When you get there, back away from the object using the **recede [End]** key.
- 26) **Go to Surface [ Ctrl + G ]** – If you are following an object, pressing this key combination will take you directly to the surface, looking at the horizon. Although it will work for all space objects, it's designed for planetary bodies, moons, etc.
- 27) **GO HOME [ H ]** - To return to our Solar System from anywhere in the universe (a very useful thing), press the **[ H ]** key on the keyboard. That will select "Sol" (the Sun). Tap the **[ G ]** key and you will be whisked back to our Sun. **Note: You will use these two keystrokes constantly as you explore the *Celestia* universe and wish to return home.**
- 28) To cancel a current **selection**, hit the **[Backspace]** key once on the keyboard. To cancel a **navigation** command such as **Follow** or **Track** or **Center**, press the **[Esc]** key in the upper left of your keyboard. You will now be adrift in space. Objects will still be selected and you can return to going to them, following them or tracking them, etc. by simply hitting the **[G]**, **[F]** or **[T]** keys again.
- 29) **[Right-Click]**: There is another way to select objects and is one you will use often. To demonstrate it, click [here](#). You will be taken to a position above the planet, Jupiter. **[Right-click]** on Jupiter to bring up a menu of options. One of them is "**Satellites**". Choose it and a list of Jupiter's moons will appear. **Left-click** on any one of them and press the **[ G ]** key to travel to it. You can use the right-click feature when the object you visit orbits the Sun or planet directly. If there is no "Satellites" option in the menu that appears with a right-click, that means the planet or moon has nothing else orbiting it.

All of these keyboard key shortcuts are again summarized in a later section.

## Navigation Menu

- 30) *Celestia* has a complete menu dedicated to space navigation that you can use often. Some of the choices are single commands (e.g. – Select Sol). Others open dialog boxes that give you some choices to make, or ask for some input. Specifically:

### Select Sol [ H ]

- 31) The Navigation **Select Sol** menu item directs *Celestia* to “select” our Sun (called by its Latin name, Sol). You can select and locate it in space from anywhere, even from far outside of our solar system. It is very useful to do when you are far from home and simply want to return to our solar system. The keyboard shortcut for selecting Sol is [ **H** ]. Please note that all you have done at this point is select the Sun. You have not gone there or even centered it in your viewscreen. To do that, you must enter a 2<sup>nd</sup> command, as described later below.

### Tour Guide

- 32) The tour guide opens a pulldown list of a few of the more interesting objects you can visit in *Celestia*. Select the “**Tour guide**” option in the Navigation menu to bring up the guide window, choose a destination by clicking on the pulldown arrow and selecting from the list, click the “**Go To**” button, and click **OK** to close the window. You're off. We urge you to visit some of these stops on the tour. NOTE: As you become more experienced with *Celestia*, you can edit this file in your Directory and add your own tour stops.

### Select Object

- 33) The Navigation **Select Object** option opens a dialog box that enables you to type the name of an object you wish to visit and then go there. Select this option from the menu and in the space provided, type “**Moon**” and click **OK**. Now, hit the [ **G** ] key and you will zoom to an orbit above our Moon. Try another space object. Note that this option does not work for **Locations**.

### Goto Object

- 34) Choosing this option from the Navigation menu opens the “**Go to Object**” dialog box. There are two uses for this dialog box. First, it can be used to find your exact position in relationship to objects you may already have selected. For example, if an object (such as the planet Venus) is already selected when you choose this option, the information fields you see in the Dialog box will contain your current position in relationship to Venus. This will include the object's name, and your Latitude, Longitude and Distance above its surface. This is very useful when you are positioned above something and you want to know exactly where that spot is. If no object is selected, the fields will be blank.
- 35) You can instead, change the values and go somewhere else. For example, type **Mars**, enter **30** for the latitude, **5** for the longitude and **5000** (km) for distance. Click “**GoTo**”. You will be taken to a position 5,000 km above the surface of Mars, at 30° N latitude and 5° E Longitude. You will automatically be placed in “Sync orbit” around the object, meaning that as it turns, you will turn with it so you are always above the spot you desire. This is an excellent way to position yourself for eclipse events or above craters, etc. Please note, however, that when you arrive, you may be on the dark side of a planet. In that case, you may have to reset the clock to a time when daylight is shining on your position (see later discussion), or you can move your position to a different longitude.
- 36) Note that Longitudes are + values for positions East of (0°E) and negative (-) for longitudes West of (0°E). For example, longitude -40 would be 40° W. “Distance” is distance to the surface of the object.

### Center Selection [C] or [Shift+C]

- 37) This command will direct *Celestia* to reposition any object that you have previously selected in the center of your viewscreen. It is used frequently in *Celestia*. For example, if you select a star anywhere in the sky by left-clicking on it, you can center it by simply choosing this menu command in the Navigation menu, or pressing the [ C ] key on the keyboard. Double-clicking on the object will also center it in your viewscreen.
- 38) If you were orbiting a planet or star when you selected and chose to center a new object, you might or might not lose sight of your original object as the viewscreen moved to center the new object. To compensate for that possibility, *Celestia* provides the [ Shift + C ] key combination. Pressing both of them together causes the viewscreen to swing to center the new object you selected, without losing sight of the original. To test this out, click [here](#). You will be taken to a position behind the Moon, with the Earth off to the right. Earth has been pre-selected, but is not yet centered. To do so, press the [ C ] key. The view will swing to the right and the Moon will almost move off screen to the left. Return to your starting view by clicking the above link again, but this time, press the [Shift+C] keys together. Earth will again center, but the Moon will still be fully visible. Your view will take up position at a new position behind the Moon. This feature is obviously useful if you do not want to lose sight of the original object as you sight and center on a new one.

### Go To Selection [G]

- 39) Previously mentioned, this command will direct *Celestia* to go directly to your selection, and position you a pre-calculated distance above it. You can use it with any of the Selection options mentioned here or in the following paragraphs. For example, if you select an object with a left mouse click, choosing this command from the Navigation menu, or pressing the [G] key as a shortcut, will send you directly to the object you selected at high speed. If you choose it again or press the [G] key again, you will move closer to the object. [G] is used constantly in *Celestia*.

### Follow Selection [F]

- 40) This menu and keyboard command will direct *Celestia* to lock onto the object selected and follow it. As it moves through space on its orbit, you will move also. The object can turn below you on its axis (if it is rotating) so the longitude will change constantly, but you will stay the same distance and latitude above it. It is routinely used when you wish to take a position in space above a star, planet, moon, asteroid or a spacecraft and is highly recommended. The keyboard shortcut for "Follow" is [ F ] and will be used very frequently.

### Sync Orbit Selection [Y]

- 41) This feature lets you hover directly over the same position/spot above an object that you have selected. For example, if you are above Earth with Africa below you, selecting **Sync Orbit** will tell *Celestia* to keep you positioned above Africa all the time. As the Earth turns below, so will you. To see that effect, click [here](#). Many of our satellites (navigation, weather, spy, GPS, TV and radio) are in synchronous orbit around Earth. You can use the command in fact, to hover above a particular satellite as it orbits its host planet or moon. The keyboard shortcut for Sync Orbit is [ Y ].

### Track Selection [T]

- 42) This command tells *Celestia* to track a selected object, keeping it centered in view. The keyboard shortcut for **Track Selection** is [ T ]. To be useful, the selected object should first be released from other effects, then reacquired and tracked. For example, if you are currently following and/or are centered on Earth, first release your hold on it with the [Esc] key. Earth will begin to move away from you at the speed it actually travels in space (about 47,100 mph, or 78,500 km/hr). If you watch long enough, it would drift off the screen. However, if you left-click on it to re-select it and choose the **Track Selection** command, Earth will still be drifting away but your view will swing to center and track it. A particular excitement is to chase one of our

interplanetary spacecraft or an asteroid using the **Track Selection** Command. To see this in dramatic action, click [here](#). You will be taken to a position in space above the asteroid **Gasptra**. You are tracking it and as you watch it coming at you, your view will swing as it flies by (just missing you) and you watch it recede.

### Chase Selection [“]

- 43) Although not in the Navigation Menu, this command is available by pressing the quotation [ “ ] key on the keyboard [ **shift** + “ ]. It instructs **Celestia** to chase a selected object in space. It is similar to the “Follow” command but locks you above the object at the same position while the object is moving. Try comparing the two commands.

### Lock Selection [:]

- 44) Not available in the Navigation menu but available through a keystroke [ **Shift** + : ], the **Lock** command is used in conjunction with other commands to bind two separate celestial objects together in space. For example, click [here](#) to select Jupiter and follow it. You will be positioned above Jupiter with its moon Io prominently in front of you. Notice that Io is slowly moving in its orbit around Jupiter. Now, left-click once on Io to select it, and press the [**Shift** + : ] keys. The display in the lower right corner will now say, “Lock Jupiter – Io”. The command will place you in a position that remains stationary above both objects, even as they move in space. To see that effect, click [here](#). You will be taken to the same spot with time speeded up and the two objects locked to each other. The sky behind them will be moving, but your viewpoint will be “locked”. This command is also particularly useful for watching spacecraft orbiting around planets. Go to and “follow” the spacecraft of your choice, then [**left-click**] on the planet below, press the [**Shift** + : ] keystrokes and the spacecraft will be locked around the planet. As it orbits, you will have sight of both of them. To see what we mean, click [here](#). You will be locked above Earth with the Hubble Space telescope orbiting below you.

- 45) Note: When interacting with an object, you can choose the Follow, Center, SyncOrbit, Track, Chase and Lock commands at any time. Center and Track can be used alone or in combination with the other commands. The others will execute only the last command given. For example, if you are “Following” an object and press the Chase or Sync Orbit command, it will replace the Follow command. If you press the [T] “Track” key, however, you will both be following and tracking your target object (both work together). If you type the [Esc] key, the current object will be released from all commands. To “unlock” two objects, replace the lock command with another one such as the [F] command, or press the [Esc] key.

### Solar System Browser:

- 46) At the top of the screen, select the **Navigation** menu and choose **Solar System Browser**. A complete list of all objects being tracked in our Solar System by **Celestia** will appear. Next to planets or moons may be a + sign, which indicates that around them are more objects to choose from. Select any one of them and choose either to “**Center**” it, or “**Go To**” it. Centering is useful when you want to see where an object is in space without going to it, or when you want to use your spaceship to journey to that planet, and you want to locate and center it first. **Go To** is used when you just want to get there fast. You should use this navigation menu frequently, since it is the complete list of all objects in the solar system, including all moons and spacecraft. Try it. Go to Neptune, Saturn, or one of their moons. Please note that if you are in another star's environment or solar system, its list of planets, moons and space objects will appear in the Browser instead. Also please note that the default download of **Celestia** comes with only a few spacecraft. However, over 40 other spacecraft are available as add-ons from the **Celestia** add-on repository and other sites, and will all appear here in the **Solar System Browser** list if you install them all in your files. To get add-ons, see our prior discussion.

Star Browser:

- 47) Select the **Navigation** menu and choose “**Star Browser**”. A list of some of the stars being tracked by *Celestia* will appear. Clicking on the column headers at the top of the menu will sort the stars different ways. For example, if you click on the word, “**Distance**”, *Celestia* will sort the list of stars by distance from our Sun. If instead you click on the column header titled “**Type**”, *Celestia* will sort the list according to the star's stellar classification (O,B,A,F,G,K,M, W).
- 48) The slider at the bottom of the list determines how many stars will appear in the list, from just 10 stars, to as many as 500. You have your choice of “**nearest**”, “**brightest**” or stars “**with planets**”. For example, if you choose 500 stars with the slider and click the “brightest” dot, *Celestia* will list the 500 brightest stars in the sky as seen from your current position. If you are in orbit around Pluto, it will list the 500 brightest stars as seen from Pluto.
- 49) Although extrasolar planets have not yet been seen directly or photographed, gravitational and other evidence strongly points to their existence. To give you an “up-to-date” astronomy experience, *Celestia* includes some hypothetical planets that have been placed around candidate stars. In addition, *Celestia's* many users have designed fictional solar systems that they have placed around some of the stars in our sky. When downloaded, their solar systems will appear here in the star browser list also. Selecting the “**With planets**” option will enable you to locate the stars that have planets, including fictional ones. Remember though that the star has to be reasonably close to Earth. This menu will only display the first 500 stars that have planets. If a solar system is far out in space, it may not be visible in the list. To practice such a journey, locate the star **51 Peg** in the star browser list (make sure you choose the “**with planets**” option), and select “**Go To**”. You will fly at great speed to a bright yellow star much like our Sun. A planet will be seen near it. Either point to it and left-click to select it, or right-click on the star **51 Peg** when you get there and select the planet (named “**b**”). Press the [G] key on the keyboard and you will be taken to the planet, which will appear as a big blue/green gas world similar to Uranus. Using your movement keys as described earlier in paragraph 22), you can move around this tiny solar system. Notice that the Solar System Browser in the Navigation Menu is no longer listing our solar system. It now lists the one planet system of 51 Peg. To return to Earth, press [H] to select the Sun, then [G] to go to it.

Eclipse Finder

- 50) The last menu item in the Navigation menu is **Eclipse Finder**. When selected, *Celestia* will calculate and provide you dates of all partial and total solar or lunar eclipses for all planets and moons in its database, and offer you the option to go there to witness the eclipse. Simply select the type of eclipse (solar or lunar), the planet and the date range you desire, and click “**Compute**”. When a list comes up, pick one, click the “**set date** and **GoTo the planet**” button, close the dialog box by clicking the “**Close**” tab and enjoy the show. As an example, here is a very exciting double eclipse of Jupiter by two of its moons (Io and Europa) that took place in January, 2003. The shadows of both moons can be seen on Jupiter's clouds. Once the eclipse is finished, Europa (the moon closest to you), then eclipses Io (the more distant moon). To see it, click [here](#), and watch it unfold by examining both Jupiter and Io. All eclipse shadows in space are actually composed of an inner shadow (the Umbra) and outer shadow (the Penumbra). *Celestia* draws both. See figure 12 for an example of a total solar eclipse on Earth. The Umbra is the darker inner shadow.

**Important Notes:** To see eclipses, you must have “**Eclipse Shadows**” selected in the **Render Options** menu. Also note that once you examine an eclipse, you will be in a new date in *Celestia*. To return to your current date and time, press the [ Shift + ! ] key.

There is a limit to what *Celestia* can display between dates that are far apart. For example, Jupiter has 63 moons. They all have the capability to pass between Jupiter and the Sun very frequently. If you ask *Celestia* to compute a list of solar eclipses between say 1920 and 1990, the list will become so long that it will lock up the program. Therefore, when dealing with the four outer gas giant planets of Jupiter, Saturn, Uranus and Neptune, (they all have lots of moons), please keep your request dates between a narrow range of a year or so.



- a. Although *Celestia* will try to position you exactly above the eclipse event, it doesn't always get it right. You may find yourself above an eclipse but not see anything.
- b. Once you have activated the Eclipse Finder and gone to view an eclipse, the program will attempt to "Lock" you to the next object you select, even if you don't want to be locked. For example, if you click on a star to select it after viewing an eclipse through the finder, *Celestia* will lock the planet you were watching with the star. If you then try to go there or anywhere else, the program may stop working. If this happens, try pressing the [Esc] key. Then try selecting and going to another object. We will have a fix soon for these bugs. Please be patient.

## Select Objects by Keystroke

- 51) There is another way to select planets. The nine (9) planets in our Solar System have been given numbers from **1** for Mercury to **9** for Pluto. The Sun is number **0**. To go to one of them, you can simply press the number at the top of the keyboard (not on the numeric keypad to the right) and hit the [G] key. For example, pressing [3] and [G] will take you to the 3<sup>rd</sup> planet, Earth. If you are in another (fictional) solar system, number keys will also work, but it will be that solar system's objects that will be selected. *If you press the [H] key, then [G], you will always be taken back to our Sun "Sol", no matter where you are in the universe.*

## Selecting Objects by Enter/Name/Enter Method

- 52) You can also select an object or a Location via a convenient keyboard command. Hit the [Enter] key and the "**Target Name**" window will appear at the bottom of the screen. Type the name of some object you wish to visit, such as a planet or moon or star or spacecraft, or location. As you begin to type, *Celestia* will present you with a list of objects that begin with the letters you are typing. For example, if you type the letter [M], *Celestia* will display a list of up to 12 objects in its data base that begin with an "M", such as Mars, the Moon, Mir, Mercury, etc. Note that the program has room to display only 12 objects. *Celestia*, therefore, starts with all objects closest to you and displays the first 12 it finds in its database. As you type the 2<sup>nd</sup> letter in your object's name, the list will now display only those objects that contain both letters. For example, typing "**Ma**" will reduce the list to only Mars, and perhaps another object you may have as an add-on (e.g. the "Magellan" spacecraft). You can complete typing the name, or you can simply press the [Tab] key to cycle the cursor from word to word in the list. When you reach the word you desire, just press the [Enter] key again and *Celestia* will complete the spelling for you (auto-complete) and select the object. Now to go there, all you have to do is press the [G] key or use the [Home] key. Try it. Press the [Enter] key and type a single letter. A list of objects will appear. Type a 2<sup>nd</sup> letter. The list will shorten. Use the **tab** key, cycle through the remaining objects to any one you wish and press [Enter] again. You will have selected that object. Once selected, you can use all the object commands such as Center, Follow, Lock, Track, Goto, etc.
- 53) If you are seeking a named **Location** on a planet or moon, you must enter the name of the planet or moon where the location is found, as well as the location itself. For example, instead of typing simply 'Cairo', you must enter '**Earth/Cairo**' (or 'Sol/Earth/Cairo' if you're outside the Solar System.) The slash mark / is needed.
- 54) One problem that you may encounter is what to call an object. You can use common names or Bayer and Flamsteed designations and HD or HIP catalog numbers when entering stars and space objects in all of the Navigation and Enter menus. *Celestia* stores star data taken from the HD catalog but if a star isn't in the HD catalog, the HIPPARCOS data set number is used (the prefix is "HIP"). Both the 1<sup>st</sup> name or number and 2<sup>nd</sup> name of the object/star can be spelled out or abbreviated (3 letters), with a space between them. Examples:

Upsilon And

Ups Andromedae

Ups And

51 Peg

Note: This is 51\_Peg, not 51Peg

51 Pegasi

HD 173739

HIP 5643

Planets, moons, asteroids and artificial satellites may be named by their common name (e.g. Mir or Jupiter or Io), or they can also be specified using *Celestia's* "path" syntax. Type the name of the star, followed by a forward slash, then the planet name/, then the moon or satellite name, etc. For example:

51 Peg/b

Sol/Earth

Sol/Earth/Moon/Apollo11

Sol/Earth/ISS

Sol/Jupiter/Europa

## Flying your Spaceship

- 55) What good is a space simulation program if you cannot fly around in it? The designers of *Celestia* have created a seamless and beautiful way to fly through the *Celestia* universe. You are in command of your own hyperdrive spaceship. The video screen in front of you is its window. You can use this ship to fly through the Solar System, chase planets, drift above moons, try your hand at rendezvousing with spacecraft or visit another star. Start some beautiful music playing and your journey can become more stirring. Right now, your ship is stopped. Let's get it moving. Click [here](#), and you will be positioned about 6,400 km above India.
- 56) Now, press and hold down the letter [ **A** ] on the keyboard for a second or two. This is the **throttle** for your spaceship. You will begin moving forward. Your speed is shown in the lower left of the screen. You will start slowly (in meters/sec). As you hold down the [ **A** ] key, *Celestia* increases your speed exponentially. Accelerate to between **18** and "**20 km/s**" (20 kilometers/sec or 43,000 mph), which is a bit faster than our fastest spacecraft (the Voyagers) have ever flown. Don't worry about exact speeds, just get close. Earth will begin getting bigger as you fly toward it on a collision course. To change course, simply tap the arrow or other movement keys described in step 22), and your view (and forward direction) will change to a new orientation. You will miss and fly by Earth.
- 57) To **slow down**, press or hold down the [ **Z** ] key. Your speed will drop (the **Brake**).
- 58) To **reverse course** instantly, simply press the [ **Q** ] key. Now, you will begin flying away from Earth at the speed you selected. Press [ **Q** ] again and you move forward again. This command is useful if you overshoot a target. Just reverse course and the target will again come into view in front of you.
- 59) To emergency **stop**, press the [ **S** ] key.
- 60) *Celestia* gives you the opportunity to accelerate to a "hyperspeed" billions of times faster than light (**c**). Just keep holding down the [ **A** ] key to speed up. The [ **A** ] and [ **Z** ] keys are exponential speed controls. As you gain speed, the stars will wiz by you like a scene from StarTrek. You will quickly be taken out of the Milky Way entirely and into the blackness of the space between the galaxies. You can journey to the very edges of *Celestia's* universe. There is not much to look at out there. Swing the sky around and you may be able to notice some dim galaxies. Generally, to see the Milky Way from outside of its confines, start your spaceship moving anywhere inside of our solar system, press the [ **Q** ] key to reverse course, accelerate to a warp speed of about **10 ly/s** (light years/sec) and watch. The stars and then the Milky Way itself will begin to recede from you. Hit the [ **S** ] stop key and enjoy the view. If you are following an object in our solar system, press [ **Ctrl+K** ] to turn on Markers, then press [ **Ctrl+P** ] to mark your object. A green box will appear in the disc of the Milky Way showing you where our solar system resides. To return, press the [ **H** ] and [ **G** ] keys, or hit

the [Q] key to reverse course again, start your ship moving forward and you will fly back to your point of origin. Please remember that *Celestia* only tracks a tiny few of the over 200 billion stars in the Milky Way. Galaxies contain FAR more stars than this program can track.

*Celestia* also provides shortcut keys for specific Spaceship speeds:

|    |   |
|----|---|
| F1 | Stop                                    |
| F2 | Set velocity to 1 km/s                  |
| F3 | Set velocity to 1,000 km/s              |
| F4 | Set velocity to speed of light          |
| F5 | Set velocity to 10x the speed of light. |
| F6 | Set velocity to 1 AU/s                  |
| F7 | Set velocity to 1 ly/s                  |

You can use these shortcuts to get moving at a particular speed, then use the [A] or [Z] keys to boost or lower your speed further.

## Telling Where You Are

- 61) *Celestia* will provide you a general idea of where you are in space by simply looking at the information view display. The top left corner identifies which object you've selected and how far away from it you are. By changing objects, you can determine a rough estimate of where you are in space. However, if you have taken up position above a star, planet, moon, etc., *Celestia* will tell you not only how far you are from it, but what latitude and longitude above it you are positioned. To see that, pull down the **Navigation** menu and select "Goto Object". As long as you have an object selected, you will see your Distance, Latitude and Longitude from it. If you are completely lost, simply go home by pressing the [H] and [G] keys.

## Adjusting Time (TIME MENU)

[L], [K], [J], [Spacebar], [N], [!]

- 62) Many events in space take place at certain times. Planets experience seasons, spacecraft are launched and eventually fall back to Earth, moons eclipse the Sun on specific dates, comets pass by, space probes fly by target planets and take their measurements, etc. *Celestia* gives you the opportunity to set a specific date and time, or to speed up or slow down the passage of time. Your time will appear in the upper right corner of the screen. For example, to see a planet turning under you, simply speed up the clock and it will rotate faster. Conversely, since objects in space move at thousands of km/sec, they will disappear from view if you release your hold on them. To slow things down a bit and watch them move away, you can slow down time.

- 63) You can use the **Time** menu at the top of the viewscreen to change the passage of time. Simply pull down the menu with your mouse and choose an option. However, most folks use the simple keyboard shortcuts. They are:

|             |  |
|-------------|--|
| [Spacebar]  | stop or pause time                               |
| [L]         | Time becomes 10x faster (repeat for faster time) |
| [K]         | Time becomes 10x slower (repeat for slower time) |
| [J]         | Reverses time (it flows backward)                |
| [N]         | Returns to Real Time                             |
| [Shift + !] | Sets time to the current clock time              |

- 64) For example, to see things move faster, position yourself hovering above Neptune and several of its moons by clicking [here](#). Notice that Neptune is not visibly turning (in real time, it takes 19 hours to turn once on its

axis). Now, press the [L] key twice to speed up time to **100x faster**. Neptune will visibly turn below you and its moons will noticeably orbit the planet. To see how slowing down time can be useful, let's visit the Hubble Space Telescope again. To do so, click [here](#). The HST is stationary because you are following it. To see just how fast it is really traveling in space, release your hold on it by pressing the [Esc] key. Hubble will recede from you at over 24,000 mph. Now, press the [F] key to again follow Hubble and the [G] key to go to it. Slow down time with the [K] key to about **-1000x slower**, and release Hubble by pressing the [Esc] key. It will now slowly drift away from you.

65) To change a date in *Celestia*, pull down the **Time** menu and choose “**Set Time**”. A dialog box will appear with pull down arrows, allowing you to reset the date and time. The new time will be in Universal Time (UT). To set the time to the current date and time, choose the “**Set to Current time**” button in the Set Time dialog box, or press the [!] key on the keyboard. **Note:** At present, you cannot manually reset a date in the future past the year 9999. Resetting a date in the past can be done with this menu command backwards to the year 1800. Dates beyond those boundaries can be reached by speeding up the clock and letting time run.

66) **Important Note:** *Celestia* has programmed some of its spacecraft to appear in space and then actually fall back to Earth (disappear) on the day that they really did so. For example, the Russian space station Mir was launched on 02/20/1986 and fell back to earth on 03/21/2001. To see Mir in orbit above the Earth, you will have to reset the date to some period between those two dates.

### Light Travel Delay

67) *Celestia* has a feature called **Light Travel Time Delay**. Light travels at a speed of 300,000 kilometers per second. The sunlight we see on Earth actually left the Sun eight minutes before it reached your eyes. Pressing the [?] key [ **Shift+?** ] will display the one-way light travel time from the camera position to the currently selected object. The minus [-] key controls light time delay adjustment; if it's turned on, a message will appear and the displayed time of day in the upper right-hand corner of the screen will have the light time delay subtracted. If you move your position, the time will move with you. Most lists of solar system phenomena give times that include light time delay. When observing these events with *Celestia*, automatic light time adjustment is extremely helpful.

68) For example, if a transit of a moon of Saturn is set to occur at 14:00 hours and you are one light hour away from Saturn, pressing the [-] key will reset the time to 13:00 hours, so that you can witness the event in real time. If you press [**Home**] and move closer to Saturn, the time will decrease as you approach the planet. **Note:** Time delay does not function for stars, including our Sun.

## **NEW: FILE Menu – Open Script**

69) Pull down the *Celestia* FILE menu and the first choice will be “**Open Script**”. A script is a file with a .cel extension that commands *Celestia* to go certain places. It can also have text. The short Night Sky DEMO you may have taken at the beginning of this document is controlled by a script named “**Demo.cel**”. If you have not taken it yet, click on the **Help** menu in *Celestia* and choose “**Run Demo**”. Press the [Esc] key when done.

70) Scripts are files written by *Celestia* developers and users to take you on a particularly interesting journey. It controls the program and all you have to do is sit back and watch. There are dozens of script files now available. You can find many of them as add-ons in the *Celestia* Motherlode website. Look for “script” in the add-on definitions. If you do download a script, place the file into your *Celestia* main directory or into a folder dedicated to scripts. Then, to launch/run the script, simply pull down the [**Open Script**] menu from the



Celestia **FILE** menu, navigate to (look in) the location of the script file, and open it. For example, to open the Demo script, navigate to **C:/Program Files/Celestia**, and it will be listed as a file in that Directory.

- 71) **NOTE:** When a script is running, it not only controls where you go in Celestia, but it also changes some of the “Render” options that we discussed earlier. For example, a script may turn off the clouds, or turn on Constellation labels in order to explain some particular point. When the script is done, it may ... or may not restore your Render options to the way you wanted them. We recommend that after a script has run, you go back to the **Render** menu and make sure your preferred options are set just the way you like them.

## **FILE MENU - Saving Images, Movies and Locations**

- 72) *Celestia* gives you the opportunity to capture and save an image on your screen as an individual graphic file (such as the figures seen in this User's Guide). You can also save a series of images as a movie file and play it back later in your computer. Thirdly, if you like a particular location and would like to return to that exact spot and time quickly, *Celestia* can save your location internally within the program as a “bookmark” or as an external “hyperlink” which can be pasted into another software program.

### **Save Image [F10]**

- 73) To save a **graphic** file (in .jpg or .png format), simply set up the screen exactly as you want it, pull down the “**File**” Menu and select “**Capture Image**” (or press the **[F10]** key). A menu will appear. Choose the folder you wish to put the file into, name the file, decide if it is to be saved as a jpg or png file and click “**SAVE**”. JPG files are common graphic files that have good quality and occupy less computer memory because they are first compressed by the program into a “smaller” size for storage. Compression, however, always results in some small loss of image quality, in exchange for smaller file size. Thus, jpg images can be convenient to use in e-mails, websites and documents where quality is not overly critical, and too large an image size might slow down the software or make it difficult to transfer over the internet. Note, however, that before you can view a jpg file, your computer must first uncompress it, which takes a bit of time. PNG files are also somewhat compressed graphic files but they maintain a higher image quality due to the way they save data. As a result, they do require much more computer memory. For example, an image save by *Celestia* would use about 60 KB of RAM memory in jpg format, and 360 KB of RAM if saved as a png file. If you wish to use a *Celestia* image in a high quality presentation requiring the best image, save the file in png format.
- 74) To view a jpg or png image, click on it and your default graphic image viewer or browser in your computer will open it. You do not need *Celestia* running. You can paste and view images anywhere you wish.

### **Save Movie**

- 75) *Celestia* gives you the opportunity to create an animation/movie of anything you experience in the program's universe. For example, if you wish to position yourself beyond Jupiter and fly past it at high speed with the planet whizzing by, you can record that maneuver in a movie. You can record a rare solar eclipse as it happens or demonstrate the occultation of a star by a planetary limb. You can execute any command you wish while taping a movie. For example, you can accelerate in your spaceship, move the screen with your mouse, zoom in or out, speed up time, etc. In this manner, you can set up your own movie “demo” of celestial places or events for others to see.
- 76) To save a **movie** file (in .avi format), set up the screen as you want it and set the time moving forward at the speed you desire. We suggest you then temporarily pause time with the **[Spacebar]** key while you complete the movie preparations. Pull down the “**File**” Menu and select “**Capture MovieImage**”. Choose the folder you wish to put the movie into, and type a file name for the movie. Then choose the size of the video.

Generally, “320x240” or “640x480” file are the preferred sizes. 320x240 creates a smaller sized image and requires less computer RAM to store. 640x480 and higher are larger sized sets of frames and require considerably more RAM. Next, choose a frame rate. We recommend “**24 frames per second**”. 24 fps is used in film, 25 fps is used for PAL (Europe) video and 29.97 for NTSC (US/Canada) video. 15 fps is often adequate for displaying video on the web. The lower the frame rate, the smaller is the size of the file that is stored. This is something to consider. A 2-minute movie can require over 100 MB of RAM when saved in fast and larger frame rates.

- 77) Click “**SAVE**”. Another menu will appear, asking if you wish to save the file compressed or uncompressed. A compressed file requires less disk space than an uncompressed file, but may not look as good when played back, and the process of compressing video can dramatically slow down *Celestia*. *Celestia* is set to save movie files uncompressed. To save a compressed file, choose the format you desire. You may wish to try different choices and determine which one works best for your computer. The free DivX video codec available from [www.divx.com](http://www.divx.com) provides excellent compression and quality, and is quite fast. If you want to create many video files with *Celestia* and are concerned with file size, we recommend you download and install DivX onto your computer, then save your videos as a compressed DivX file.
- 78) Click “**OK**”. A red box will now appear on your screen. You can move what is in that box by clicking on the screen with your standard movement keys. When ready to start taping your movie, start time moving forward if it was paused (press [spacebar] again), and press the [F11] key on the keyboard. Recording will begin. To stop, press the [F12] key. The recording will stop and the red box will disappear. Your movie is saved. To cancel a movie at any time, simply press the [F12] key.

### Save Location (BOOKMARKS)

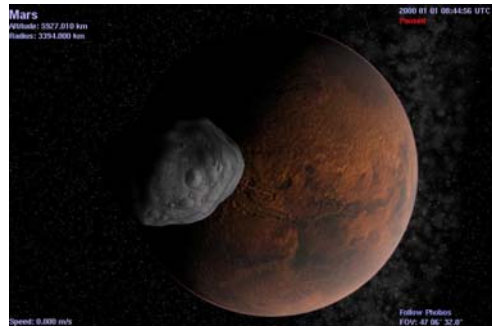
- 79) To save a particular **location**, simply set up your position and time as you would like it, pull down the **Bookmarks** Menu and choose **Add Bookmarks**. Type a name and click **OK**. *Celestia* will save a positional and time bookmark in its database. To return to that location at the exact time you saved, simply click on the **Bookmarks** Menu again whenever you wish, choose a saved location from the list and you will go there instantly. To delete a location, rearrange the list or otherwise organize them, use the **Organize Bookmarks** option in the pulldown menu. The Location/Bookmarks feature is very handy to have and use. For example, if you have taken some time to position yourself in a particularly good view location in space or at the beginning of a celestial event, save that position with a bookmark and you can come back to it or show others the same event by an instant click on the bookmark.

## Cel://URLs

- 80) *Celestia* makes it possible to share locations and export them out of the program by inserting them in a web page or other document, through **cel://URLs**. A cel://URL is a string of text (a hyperlink) that contains your current ship location, orientation, time, render options and field of view. With it, you can take a snapshot of your precise position, time and view in space, and save it as an external hyperlink (a URL). If you then paste that text string into a document that recognizes hyperlinks (word processors, web browsers, notepads, etc.), a user clicking on that link will automatically launch their own copy of *Celestia* and be taken to the exact position in space that you were viewing. It can be used anywhere you would use an http hyperlink. Obviously, the user must have *Celestia* on their computer for this feature to work. For example, cel://urls have been used extensively in this document to take you to different locations associated with the figures. Another example below is a cel://url that captures the position of Phobos, one of Mar's moons, orbiting high above the planet in January 2000. Click on the link below, and you will be taken to that exact position, time and place in *Celestia*.

[Click here for a ticket to Mars](#)

Figure 32 – image captured via  
cel://URL



- 81) Please note that cel://URLs are hyperlinks. You should only click on them **once** (single-click, not double-click). In fact, if you click one twice, it will launch two copies of *Celestia* at once. Since *Celestia* uses a great deal of computer memory, two running programs could lock up your computer. If everything seems to stop or slow down after using a cel://URL hyperlink, or if the screen view does strange things, you probably clicked it twice. Close one or both of the *Celestia* programs, relick just once, and things should improve.
- 82) To save your position in *Celestia* as a hyperlink, you can use the **Bookmarks** menu mentioned earlier. You can also press either [Ctrl+C] or [Ctrl+INS]. This will save the hyperlink to your computer clipboard. To paste that link into a web browser, simply position your cursor in the address field at the top of the browser and press [Ctrl+V]. To paste the link into a text document or a PowerPoint presentation, you may be able to simply paste the link by positioning the cursor on the page and pressing “Paste” from the toolbar menu, or [Ctrl+V] from the keyboard. If successful, the link will paste into your document and change color when you hit the **Enter** key. Clicking on it will launch *Celestia*. If that doesn’t work, you may have to paste the link by “inserting a hyperlink”. See your application software for directions on how to do that. You can also link a Cel://URL to an image. For example, right-clicking on graphic images in word processing and presentation software will usually offer you the option to insert a hyperlink. If you select it, paste the Cel://URL into the hyperlink address. Clicking on the picture itself will then launch *Celestia*. To see this in action, return to figure 32 above and this time, click once on the image, not on the text above it. You will be taken to Mars.
- 83) As evidenced in this document, Cel://URLs are ideal for showing others a particular discovery or position made in the world of *Celestia*. For example, perhaps you’ve positioned yourself to witness the passing of a Near-Earth asteroid as it whizzes past Earth, or have assumed a position off the North Pole of the Sun with orbits selected and the entire solar system orbiting below you. Saving that location to a cel://URL and pasting it on the web or in an e-mail for others to activate is an ideal way to share your *Celestia* experience. You’ll find cel:// URLs also used frequently in the *Celestia* forum.
- 84) Note: Be careful using cel:// URLs with add-ons. If you save the camera position near a body that is part of an **add-on** you previously installed, someone who later clicks on the URL will likely see a very dull view of empty space unless they also have the same **add-on** installed.

**Also please note:** When you click a cel://url, *Celestia* must reset your View Options to match the cel://url commands (the same as in scripts). When you are done visiting the location or enjoying the view that the cel://url brought you to, there is no quick reset command to return your view settings to the way you had them before. You will have to open the Render menu and make sure the check boxes you desire are again selected. Alternatively, you can choose all of the options you desire and create your own cel:url hyperlink as a **Bookmark**. Call it “Reset”. Then, if someone else’s cel:url resets your program to settings you do not want, simply click on the bookmark and *Celestia* will reset your parameters and take you to that location.

## Multiview (VIEW MENU)

- 85) *Celestia* can also show you views from different camera positions simultaneously. This can be very helpful for visualizing phenomena like eclipses, where you want to watch a view from the Sun, the eclipsed planet or moon, and the occluding body all at the same time. Planetary encounters by spacecraft are another category of events where multiple views can be illuminating.
- 86) When multiple views are enabled, one of the views is the active view and is marked by a thin highlighting frame around it. All Movement commands will affect just the active view. Other commands such as setting the time or date or Render menu commands are global, affecting all views. New views are created through the keyboard commands of [Ctrl+U] and [Ctrl+R]. [Ctrl+U] splits the active view horizontally, leaving two identical views side by side. Pressing [Ctrl+R] performs a vertical split that gives two vertically stacked views. A newly created view can be further split by pressing [Ctrl+U] or [Ctrl+R] again; you can continue this until the views become impractically small. The [TAB] key is used to cycle the active view. A view that is no longer required may be removed by pressing the Delete [DEL] key. [Ctrl+D] will delete all views except the currently active view.
- 87) Views can also be created and deleted with the **View** menu. The **View** menu also contains two additional options not available via a keyboard command. When checked, **Show frames** puts a frame around each Multiview. The other View menu setting is **synchronize time**. Ordinarily, time is synchronized between all views, but if you deselect time synchronization, you can set the current time in each view independently by clicking within the view frame and using the Time menu to change the date or time. Turning time synchronization back on resets the time in all views to that of the active view. Note that the time *rate* cannot be set per-view; the rate commands and pause affect every view.

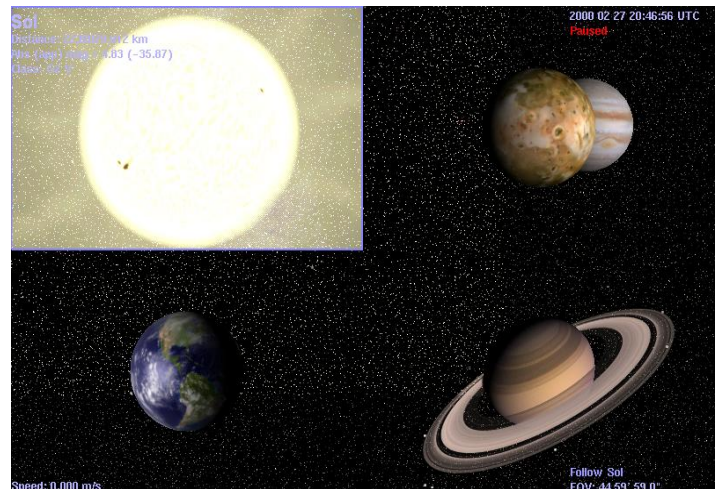


Figure 33 –Four *Celestia* Multiviews seen at once

## Other Documentation Available

This concludes the general User's Guide to operating *Celestia*. The Celestia community, however, has also prepared a variety of other tutorial and manuals that teach you what image files are, how *Celestia* loads and uses them, and how data files of various kinds are used to instruct *Celestia* in what to do and where to do it. Look for them under the **Documentation** link at <http://www.celestiamotherlode.net>. One of our forum members, Don Goyette, has also written a comprehensive guide that will teach you how to create scripts, which are a series of lists that *Celestia* follows one at a time to take a space journey. For example, you can design a script to open *Celestia* orbiting a Red Giant star thousands of light years away. Then as you watch, your spacecraft will accelerate and fly back to Earth at warp speed. You can also insert text messages for the viewer to read. It is an excellent tutorial on how to develop scripts. You can find it and download it in a variety of formats on his website at [SCRIPT GUIDE](#).



## **Credits**

This User's Guide was written by Frank Gregorio, a high school teacher in Manassas, VA..

Version 1.3.2

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*Celestia* – courtesy of :

Developers: Chris Laurel  
Clint Weisbrod  
Fridger Schrempp  
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Christophe Teyssier  
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See Keyboard summary on next page

## Celestia Keyboard and Mouse Command Summary

(Print these two pages as a convenient keystroke summary)

This command summary can also be accessed within *Celestia*. Simply pull down the **Help** menu and click on “**Controls**”.

### Mouse Functions:

|                                     |   |
|-------------------------------------|---|
| <b>Left – click on object:</b>      | select object   |
| <b>Right drag:</b>                  | orbit the selected object in any direction  |
| <b>Left drag:</b>                   | orient scene in any direction   |
| <b>Rotate Mouse Wheel:</b>          | adjust distance to selection  |
| <b>Right + Left drag:</b>           | adjust distance to selection  |
| <b>Ctrl + Left drag:</b>            | adjust distance to selection  |
| <b>Shift + Left drag:</b>           | change field of view (FOV) (e.g. => telescopic view)                                  |
| <b>Wheel (middle button) click:</b> | toggle field of view between 45 degrees and the previous field (e.g. telescopic view) |
| <b>Left double click</b>            | center selection  |
| <b>Right - click</b>                | bring up context/select menu  |

### Render Functions - Keyboard:

|                  |  |
|------------------|--|
| <b>R</b>         | Decrease texture resolution  |
| <b>Shift+R</b>   | Increase texture resolution  |
| <b>P</b>         | Toggle (turns on or off) planet labels                               |
| <b>M</b>         | Toggle moon labels   |
| <b>E</b>         | Toggle galaxy labels   |
| <b>B</b>         | Toggle star labels   |
| <b>W</b>         | Toggle asteroid and comet labels                                     |
| <b>N</b>         | Toggle spacecraft labels   |
| <b>=</b>         | Toggle constellation labels  |
| <b>&amp;</b>     | Toggle Location labels   |
| <b>V</b>         | Toggle info text   |
| <b>U</b>         | Toggle galaxy rendering  |
| <b>O</b>         | Toggle planet orbits   |
| <b>I</b>         | Toggle clouds  |
| <b>;</b>         | Toggle Celestial grid (Earth-based equatorial coordinate sphere)     |
| <b>/</b>         | Toggle constellation diagrams  |
| <b>Ctrl+A</b>    | Toggle atmospheres   |
| <b>Ctrl+B</b>    | Toggle constellation boundaries                                      |
| <b>Ctrl+E</b>    | Toggle eclipse shadows   |
| <b>Ctrl+L</b>    | Toggle nightside lights  |
| <b>Ctrl+S</b>    | Toggle stars as points, discs or fuzzy points                        |
| <b>Ctrl+T</b>    | Toggle comet tails   |
| <b>Ctrl+V</b>    | Cycle through vertex shading options                                 |
| <b>Ctrl+W</b>    | Toggle wireframe mode (displays objects as wireframe models)         |
| <b>Ctrl+X</b>    | Toggle antialias lines mode  |
| <b>Ctrl+Y</b>    | Toggle autoMag = auto adaptation of star visibility to field of view |
| <b>[</b>         | If autoMag OFF: Decrease magnitude (fewer stars visible)             |
|                  | If autoMag ON: Decrease magnitude at 45 deg field of view            |
| <b>]</b>         | If autoMag OFF: Increase magnitude (more stars visible)              |
|                  | If autoMag ON: Increase magnitude at 45 deg field of view            |
| <b>Shift + {</b> | Decrease ambient light   |
| <b>Shift + }</b> | Increase ambient light   |
| <b>Alt+Enter</b> | Toggle full screen display mode on or off                            |

### Navigation Functions - Keyboard:

|               |   |
|---------------|---|
| <b>H</b>      | Select the Sun (Home)   |
| <b>C</b>      | Center on selected object   |
| <b>G</b>      | Goto selected object  |
| <b>Ctrl+G</b> | Goto surface of the object  |
| <b>F</b>      | Follow selected object  |
| <b>ENTER</b>  | Select a star or planet by typing its name, then press <b>Enter</b> again |
| <b>Y</b>      | Orbit the selected object at a rate synchronized to its rotation          |
| <b>.</b>      | Increase Field Of View (FOV)  |
| <b>,</b>      | Decrease Field of View (FOV)  |

|                         |   |
|-------------------------|---|
| <b>Shift + :</b>        | Lock on selected object. Point at 2 <sup>nd</sup> object and press again to pair the two. |
| <b>Shift + "</b>        | Chase selected object (orientation is based on selection's velocity)                      |
| <b>T</b>                | Track selected object (keep selected object centered in view)                             |
| <b>HOME</b>             | Move closer to object   |
| <b>END</b>              | Move farther from object  |
| <b>Up arrow</b>         | Your view pitches downward (also see # 8 key on numerical keypad)                         |
| <b>Down arrow</b>       | Your view pitches upward (also see # 2 key on numerical keypad)                           |
| <b>Left arrow</b>       | Your view rolls counter-clockwise (also see # 7 key on numerical keypad)                  |
| <b>Right arrow</b>      | Your view rolls clockwise (also see # 9 on numerical keypad)                              |
| <b># 4 number key</b>   | on numerical keypad - Your view yaws (swings) to the left                                 |
| <b># 6 number key</b>   | on numerical keypad - Your view yaws to the right   |
| <b># 5 number key</b>   | on numerical keypad – instantly stops yaw, pitch or roll                                  |
| <b>Shift+arrow keys</b> | Orbit around the object automatically   |
| <b>Shift + *</b>        | Look back view (rear view)  |
| <b>1-9</b>              | Select planets around nearby Sun  |
| <b>Esc</b>              | Cancel hold on object, cancel command or script action                                    |
| <b>Backspace</b>        | Cancel current selection  |

### Time Functions - Keyboard:

|                  |   |
|------------------|---|
| <b>Spacebar</b>  | Stop or pause time (or if paused, resume time)                              |
| <b>L</b>         | Time 10x faster (repeat for faster time)                                    |
| <b>K</b>         | Time 10x slower (repeat for slower time)                                    |
| <b>J</b>         | Reverse time (it flows backward)  |
| <b>\</b>         | Return to Real Time   |
| <b>Shift + !</b> | Set time to the current clock time  |
| <b>Shift + ?</b> | Display light-travel delay between observer and selected object             |
| <b>-</b>         | Subtract light-travel delay from current simulation time (toggle on or off) |

### Joystick Functions – typical (Note: joystick buttons differ in function – experiment with yours):

|                  |  |
|------------------|--|
| <b>F8</b>        | Enable joystick (press again to disable)           |
| <b>X axis</b>    | yaw  |
| <b>Y axis</b>    | pitch  |
| <b>L trigger</b> | roll left (button C on a Microsoft Sidewinder Pro) |
| <b>R trigger</b> | roll right (button D)                              |
| <b>Button 1</b>  | slower (trigger on Microsoft Sidewinder Pro)       |
| <b>Button 2</b>  | faster (thumb button on Sidewinder Pro)            |

### Multiview Functions - Keyboard:

|               |                                    |
|---------------|------------------------------------|
| <b>Ctrl+R</b> | Split view vertically              |
| <b>Ctrl+U</b> | Split view horizontally            |
| <b>TAB</b>    | Cycle active view                  |
| <b>DEL</b>    | Delete active view                 |
| <b>Ctrl+D</b> | Delete all views except active one |

### Spaceship commands - Keyboard:

|                |  |
|----------------|--|
| <b>A</b>       | Increase velocity                              |
| <b>Z</b>       | Decrease velocity                              |
| <b>Q</b>       | Reverse direction                              |
| <b>X</b>       | Set movement direction toward center of screen |
| <b>S or F1</b> | Stop   |
| <b>F2</b>      | Set velocity to 1 km/s                         |
| <b>F3</b>      | Set velocity to 1,000 km/s                     |
| <b>F4</b>      | Set velocity to speed of light                 |
| <b>F5</b>      | Set velocity to 10x the speed of light.        |
| <b>F6</b>      | Set velocity to 1 AU/s                         |
| <b>F7</b>      | Set velocity to 1 ly/s                         |

### Other commands - Keyboard:

|                    |                           |
|--------------------|---------------------------|
| <b>D</b>           | Run demo                  |
| <b>F10</b>         | Capture image to file     |
| <b>F11 and F12</b> | Start and stop Movie Save |

**Ctrl+INS or Ctrl+C**      Copy location URL to clipboard (Windows)