

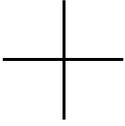
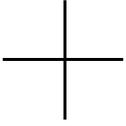


**Deep Space**  
**Explorer**

User's Guide

FOR MACINTOSH AND WINDOWS

WRITTEN BY  
MIKE PARKES



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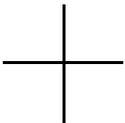
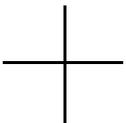
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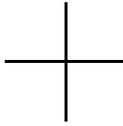
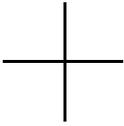
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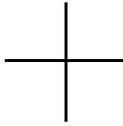
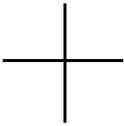
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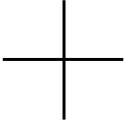
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## Chapter 1

# Introduction

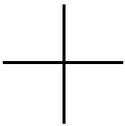
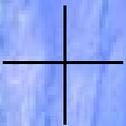
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### **Welcome**

Welcome to Deep Space Explorer, the perfect tool for discovering the wonders of our universe. Deep Space Explorer will help you learn about the structure of our universe and the many strange and amazing creatures it contains, from glowing galaxies to the dark centers of black holes.

No more are you trapped on Earth, seeing only those few stars and galaxies in our local neighbourhood. With Deep Space Explorer, you can leave the cradle of humanity behind and rocket through our solar system, into the heart of the Milky Way galaxy, and even farther into the dark reaches of intergalactic space. You can put yourself at the helm of a mighty starship, navigating through the universe faster than the speed of light.

Thank you for purchasing Deep Space Explorer. Enjoy the program!



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### Outline Of This User's Guide

All users of Deep Space Explorer should read chapters 1 and 2 of this User's Guide to get a basic grasp of how to use the program. After this, you may want to explore on your own and only refer to the User's Guide if you have questions about a specific feature, or you may wish to read the entire User's Guide cover to cover. Below is a brief summary of each chapter in the User's Guide.

Chapter 1: "[Introduction](#)" tells you how to get Deep Space Explorer up and running for the first time.

Chapter 2: "[Basics](#)" covers the most important features in the program.

Chapter 3: "[Objects](#)" describes the different types of celestial bodies included in Deep Space Explorer and the information you can learn about each body.

Chapter 4: "[The Tully Collection](#)" goes into more detail about the new galaxy database at the heart of Deep Space Explorer and how you can use this database to study the large-scale structure of our universe.

Chapter 5: "[Altering the Look](#)" shows you how to modify the look of Deep Space Explorer to suit your own taste.

Chapter 6: "[Creating Multimedia](#)" shows how save files and make videos and images using Deep Space Explorer.

Chapter 7: "[Spaceship Mode](#)" describes the controls for the special mode in Deep

Space Explorer which simulates piloting a spaceship.

Appendix A: "[Glossary](#)" defines some of the specialized terms used in this User's Guide.

Appendix B: "[FAQ](#)" is a list of the questions most commonly asked by users of Deep Space Explorer and answers to these questions.

### Special Fonts

Three special fonts are used throughout the text:

1) **Command Font:** This font is used to indicate a button, keystroke, or menu choice.

Example: Click the **Home** button to restore your default settings.

2) **File Font:** This font indicates a folder or file, either on your hard drive or the Deep Space Explorer CD. File and folder names are always enclosed in quotations.

Example: Locate the "Manual .pdf" file on the CD.

3) **Glossary font:** A word displayed in this font is defined in the "[Glossary](#)" on page 51.

Example: One of the more common galaxy types is the *elliptical galaxy*.

## Installation

To run Deep Space Explorer, you need to install two programs: Deep Space Explorer and *QuickTime*. If you already have QuickTime 5.0.2 or later on your computer, you do not need to install it again. To install Deep Space Explorer and QuickTime, follow the installation instructions below.

### Windows:

- 1 Insert the compact disc in the CD-ROM drive. A window will pop up onscreen with the options “Install QuickTime 4” and “Install Deep Space Explorer”.



- 2 Choose “Install QuickTime 4” from the onscreen menu and follow the instructions that appear. You will be asked to select an installation option for QuickTime. **Make sure that you choose the “Recommended Install” option!** Certain features in Deep Space

Explorer will not work unless you choose this option. At some point in the installation, you may also be asked if you want to register QuickTime Pro. This is a more advanced version of QuickTime not included with Deep Space Explorer. Leave this window completely blank and hit the **Next** button to continue installing the regular version of QuickTime. If you encounter an error message when installing QuickTime, please see [“QuickTime”](#) on page 53. Once you have successfully installed QuickTime, proceed to step 3.

- 3 Choose “Install Deep Space Explorer” from the onscreen menu and follow the instructions that appear. If you encounter problems, please see [“Installation Problems”](#) on page 55. A successful installation will place a Deep Space Explorer icon on your desktop.

### Macintosh:

- 1 Insert the compact disk into the CD-ROM drive.
- 2 Open the “Read Me First” file for instructions and late-breaking product and compatibility information.
- 3 Drag the “Deep Space Explorer” folder from the CD to your hard disk.

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### Starting Deep Space Explorer

Once you have installed Deep Space Explorer, you can start it as follows:

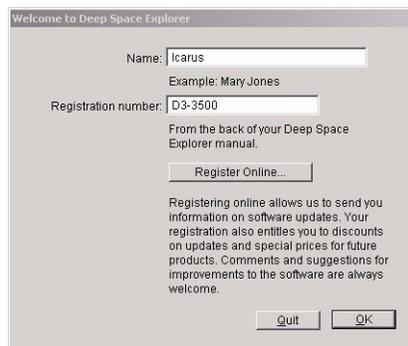
**Windows:** Double-click the Deep Space Explorer icon on your desktop or click the **Start** button on your desktop and then choose

**Programs->Deep Space Explorer->Deep Space Explorer.**

**Macintosh:** Double-click the Deep Space Explorer icon in the "Deep Space Explorer" folder.

### Registering

A unique registration number for your copy of Deep Space Explorer is printed on the last inside page of this User's Guide. When you run Deep Space Explorer for the first time, you will need to enter this number to open the program.



You should also register your copy of Deep Space Explorer with SPACE.com. If you have Internet access, just click the **Register Online** button to do this.

Otherwise, you can complete and return the registration form to us.

Registering makes it possible for us to notify you of any upgrades, bug fixes, or plug-ins as they become available. You may also be eligible for reduced prices on other space and astronomy programs written by SPACE.com. If you ever need to change any of your registration information, visit

[www.starrynight.com/register](http://www.starrynight.com/register).

### Updates

To make sure you have the latest version of Deep Space Explorer, you can choose **Help->Check For Updates** from the Deep Space Explorer menu. This will take you to the "Updates" section of our website.

### Getting Help

An electronic version of this User's Guide was installed on your computer when you installed Deep Space Explorer. You can access this User's Guide by choosing **Help->Manual** from the menu.

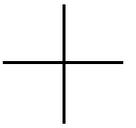
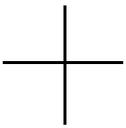
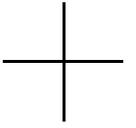
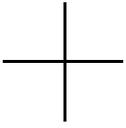
If you have technical questions which are not answered in this manual, please check our online Deep Space Explorer technical support FAQ by choosing **Help->On-line Help** from the menu.

If you still have questions, e-mail us at [support@starrynight.com](mailto:support@starrynight.com).

### Starry Night Products

Deep Space Explorer is only one in a line of astronomy products made by SPACE.com. We also produce the Starry Night family of astronomy software products, which are designed to help you with stargazing and ground-based astronomy. More information on these products is available at our website, [www.starrynight.com](http://www.starrynight.com).







## Chapter 2

# Basics

---

### Where am I?

When you start Deep Space Explorer, you will see a black sky filled with points of light. Each one of those points is a galaxy, made up of billions of stars. The bright spiral galaxy directly in front of you? That's our own Milky Way. Your starting point in Deep Space Explorer is just outside the Milky Way, 700 000 light years from home. Your distance from the sun is always shown along the bottom of the screen. Look closely and you will see that a few other galaxies also appear as detailed images, not dots. These are relatively nearby galaxies. Read on to learn how to move around this strange new world.

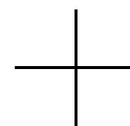
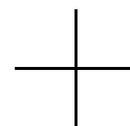
### Heads-Up Display



Point the mouse at any object you see onscreen. This activates Deep Space Explorer's

**Heads-up Display (HUD).** You can use the HUD at any time to identify an object. Three pieces of information will come up.

**Object Name:** The name of the object. Usually this name will be the object's number in an astronomical catalog. However, if you are



pointing at a star, planet or named galaxy, these will be identified by name.

**Magnitude:** An object's magnitude is a measure of its brightness. The confusing thing is that the *brighter* an object is, the *lower* its magnitude is. An object with magnitude -5 is much brighter than an object with magnitude 0, which is much brighter than an object with magnitude 5. Magnitude is calculated differently for galaxies, planets and stars.

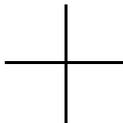
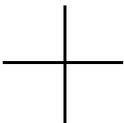
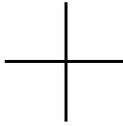
For galaxies, Deep Space Explorer shows the *absolute magnitude*, which is a measure of the galaxy's intrinsic brightness. The largest galaxies (including our Milky Way) have magnitudes -21 or -22. The smallest dwarf galaxies have magnitudes of around -10. There is a complete range of galaxy magnitudes between these extremes.

For stars in our Milky Way, Deep Space Explorer shows the *apparent magnitude* (as seen from Earth). This compares the brightness of stars as seen from Earth. The brightest star in our sky is Sirius, which has an apparent magnitude of -1.47. Any star that has an apparent magnitude less than 6 will be visible from Earth on a dark night without the use of binoculars or a telescope. The key difference between apparent magnitude and absolute magnitude is that apparent magnitude depends on your location. If galaxy A has a lower absolute magnitude than galaxy B, we can say with certainty that galaxy A is intrinsically brighter than galaxy B. On the other hand, if star A has a lower apparent magnitude (as seen from Earth) than star B, it may be intrinsically brighter than star B, but it may not. It may just be closer to

Earth than star B, making it appear brighter. If we were located on an extrasolar planet orbiting Polaris, star B might have the lower apparent magnitude and appear brighter than star A.

Planets within our solar system do not have a fixed apparent magnitude (as seen from Earth). This is because the brightness of these planets changes as the planets move around the sun. Instead of the apparent magnitude as seen from Earth, Deep Space Explorer shows you the apparent magnitude as seen from your current position. As you move closer to the planet, its apparent magnitude will decrease, meaning that it is getting brighter. As you move away from the planet and it gets dimmer, its apparent magnitude will increase.

**Distance:** How far away you are from this object. This piece of information is dynamic- as you travel around in space and move closer to or farther away from the object, its distance will change. You may be unfamiliar with some of the distance units: AU, LY, MLY. See "[Distances from Sun](#)" on page 14 for definitions of these units. The distance to galaxies is not easy to measure. See "[Galaxy Distance](#)" on page 29 to learn how we measure these distances.



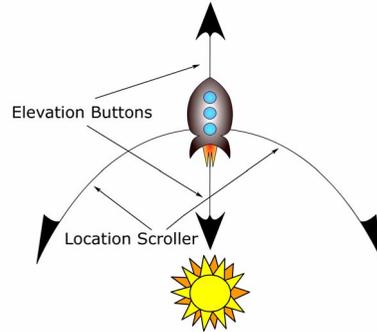
## Moving Around

While your view of the Milky Way is very pretty, you didn't buy Deep Space Explorer to look at a static image. You want to learn how to move about this magnificent universe of ours! There are three distinct tools for changing your location in Deep Space Explorer:

- 1 The *Location Scroller* tool.
- 2 The Elevation buttons.
- 3 The *Spaceship* button.

Both the Location Scroller tool and the Elevation buttons adjust your position in reference to a certain celestial object- this is the object you are centred on. By default, you are centred on the sun. In "[Getting Information](#)" on page 22, you will learn how to centre on a different object.

The elevation buttons change your *distance* from the centred object, while keeping your *direction* the same. The location scroller tool does the opposite, changing your *direction*, but keeping your *distance* from the object constant. One way to think of this is to picture yourself at a point on the surface of an inflatable sphere, centered on the object. Using the Elevation buttons is like inflating or deflating the sphere, whereas using the Location Scroller tool is the equivalent of moving around on the surface of the sphere.



## Elevation Buttons

These are the two buttons in the top left corner of your screen, immediately to the right of the **Spaceship** button. They control your elevation, which is the distance from the object that you are centred on.



**Decrease Elevation**



**Increase Elevation**

Each time you click one of these buttons, your elevation increases or decreases by 10 %. Test this out by clicking the Increase Elevation button several times. The image of the Milky Way should become smaller, indicating that you are moving farther away from it.

Your current elevation is always shown along the bottom of the main screen. This display updates when you use the elevation buttons to increase or decrease your elevation.

Distance from Sun: 0.736 MLY

**Distances from Sun:** Here are the approximate distances of various objects from the sun:

Name	Distance from Sun
Earth	1 AU
Pluto	30 AU
Nearest Stars	4 LY
Center of Milky Way	25 000 LY
Nearest Galaxy	80 000 LY
Size of DSE dataset	700 MLY
Edge of Universe	13000 MLY

For the distances to galaxies, even the light year is not a large enough unit, so we use *mega light years*, “MLY” for short. A mega light year is equal to one million light years.

“AU” stands for *astronomical unit*, which is defined as the average distance between the earth and the sun. It is approximately 150 million kilometres (93 million miles).

“LY” stands for *light year*, which is the distance that light travels in a year. Light travels at 300 thousand kilometres per second (186 thousand miles per second) so a light year is equal to this value multiplied by the number of seconds in a year. This is a huge number: 9.46 trillion kilometres (6 trillion miles).

### Location Scroller

To use the Location Scroller tool, just click and hold on any area of the sky and then move the mouse around. You will see your view of the sky rotate in the direction that you moved the mouse.

Practice using the Location Scroller to rotate your view of the Milky Way. You should be able to view the galaxy face-on, edge-on, or any state between these two extremes.



In the same way that you have used the Location Scroller to rotate your view of the Milky Way, you will be able to rotate other galaxies, and the faces of individual planets.

### Returning Home

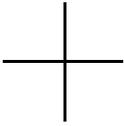
 Where is home in a product like Deep Space Explorer? Pressing the **Home** button returns you to the view that you get when you open the program, 700 000 light years from Earth, looking back at the Milky Way. If you are ever lost, just press the **Home** button to return to this familiar view.

### Location Exercises

These two exercises will help you practice changing your location using the Location Scroller and the Elevation buttons.

#### Example 1: Viewing our Solar System

- 1 Press the **Home** button.
- 2 Press the Decrease Elevation button several times, until your elevation is reduced to about 50 000 light years. You will see that we are zooming in on a cluster of stars in one of the Milky Way's spiral arms. These are the stars in the neighbourhood of our own sun.



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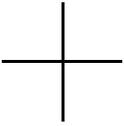
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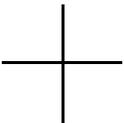
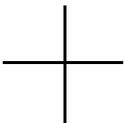
- 3 Continue pressing the Decrease Elevation button until your elevation is about 1 light year. The disk of the Milky Way will disappear as you move inside it. Stars will fly by as you continue moving closer to the sun. Eventually, you will see a small glowing halo at the center of your screen. This is the sun.
- 4 Continue pressing the Decrease Elevation button until your elevation is about 40 AU. You will see a number of loops drawn onscreen. These loops are the orbits of the planets. Use the Location Scroller to rotate your view of these orbits. You will see that all the orbits can line up in one plane, with the exception of one. The oddball planet is Pluto.
- 5 Continue pressing the Decrease Elevation button until your elevation is about 3 AU. You should be able to see 4 complete loops onscreen. Arranged in order from closest to the sun out to farthest from the sun, these orbits represent Mercury, Venus, Earth and Mars.
- 6 Press the **Home** button to return to your original view.

### Example 2: Going to the Universe's Edge

- 1 Press the **Home** button.
- 2 Press the Increase Elevation button until your elevation is about 50 MLY. You are flying away from the Milky Way, and it will shrink into nothingness. As in example 1, you will see little dots flying by you. However, these dots are individual galaxies, not

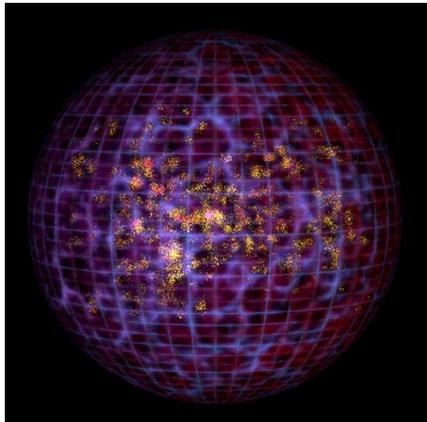
the stars that you saw in example 1. You will notice that the galaxies are not spread evenly throughout the sky, but are clustered into densely populated patches and strings, separated by voids with no galaxies at all.

- 3 Keep pressing the Increase Elevation button until your elevation is about 800 MLY. You will see that the galaxies are collapsing into the center of the screen. You have reached the edge of the dataset in Deep Space Explorer. Use the Location Scroller tool to rotate your view of the dataset and examine its structure.
  - 4 Continue pressing the Increase Elevation button. You have passed beyond the dataset used in Deep Space Explorer, and the outlying areas of the universe are represented by concentric spheres. These spheres are described in the next section. Once you have reached 14 000 MLY, you have reached the edge of the universe, and can travel no farther!
  - 5 Press the **Home** button to return to your original view.
- 



### Concentric Spheres

Once you move more than one billion light years from Earth, you are farther from Earth than any of the galaxies included in Deep Space Explorer. Looking this far out into space is equivalent to looking back into time. If we look at a galaxy which is 4.5 billion light years from Earth, we are actually seeing this galaxy as it looked 4.5 billion years ago, when our Earth was born. Deep Space Explorer represents these distant reaches of the universe with four different concentric spheres.



### Galaxy Clusters (2 billion light years):

This shows the massive clusters of galaxies that lie outside the database. These clusters bend the light from even more distant objects, letting us see farther back into space and time.

**Young Galaxies (6 billion light years):** As we look far back into space and time, we see young galaxies which are still forming. These galaxies often have unusual shapes. Astronomers are trying to determine how

these shapes evolved into the familiar spiral and elliptical galaxies that we see today.

**CMB (11 billion light years):** The oldest thing in the universe that astronomers can see is the cosmic microwave background (CMB). This is radiation that is left over from when the universe was only 1 million years old.

**Big Bang (14 billion light years):** Our universe began in a fireball known as the Big Bang. Astronomers believe that the Big Bang took place between 13 and 15 billion years ago. It is impossible to know what (if anything) existed before the Big Bang.

### Navigation Bar

Along the left side of the main Deep Space Explorer window you will see five panes. This is the *Navigation Bar*.



Click on a pane to show the options for that pane, and click the same pane again to collapse the Navigation Bar to its minimum size, with no options present. The panes are as follows:

**Views:** Multimedia movies that explain different topics about our universe. There are 19 different movies, and over an hour of video in total. Described in “[Viewing Movies](#)” on page 18.

**Labels:** Options for labelling different types of objects and changing the look of these labels. Described in “[Labels](#)” on page 39.

**Guides:** Grids and reference markers to help show your position in space. Described in [“Co-ordinate System Guides”](#) on page 32.

**Settings:** General settings affecting the look of the galaxies displayed in Deep Space Explorer. Described in [“Galaxy Drawing Options”](#) on page 37.

**Highlights:** Options for highlighting the different galactic groups and filaments. Described in [“Extragalactic Structure”](#) on page 34.

### Viewing Movies

Over an hour of multimedia clips are included with Deep Space Explorer. Nineteen different clips explore topics that range across the entire field of astronomy, from satellites to black holes. These videos will help you learn more about the universe, and will increase your enjoyment of Deep Space Explorer. Each clip is narrated by actress Chase Masterson, and many clips feature expert commentary by astronomer Brent Tully.



To see a list of the multimedia clips, click the **Views** pane in the navigation bar. Aside from a few introductory clips, the movies are sorted in order of increasing distance from earth, beginning with topics like satellites and the moon, and progressing to galaxies, black holes, and even the Big Bang.

Click on any clip, and the DSE *media player* will automatically open and begin playing the clip. See [“Media Player Controls”](#) on page 20 for more information on the controls in the media player.



*Tip: You will not be able to view these movies unless the Deep Space Explorer CD is in the CD-ROM drive. To learn how to move the movies to your hard drive, see [“Multimedia”](#) on page 57.*

Below is a brief description of each of the movie clips:

**Your Universe:** An introduction to Deep Space Explorer, from the perspective of an intergalactic explorer travelling through space.

**Know Your Place...** The different sizes and distances of the important objects that make up our universe.

**From Radar to Redshift:** How we measure the distances to planets, stars and galaxies.

**Rivers in the Sky:** The satellites that orbit our Earth.

**Earth, Moon, Sun: the Perfect Ballet:** The how and why of solar eclipses.

**Birth of the Family of Sol:** The origins of Earth and other planets.

**Jewels and Junk:** Asteroids, comets, and other strange bodies in our solar system.

**Extrasolar Planets:** The strange new worlds we have discovered around other stars.

**Galaxy: Home:** The structure of our home galaxy, the Milky Way.

**Black Holes:** All about black holes.

**The Tully Collection:** The database of galaxies at the heart of Deep Space Explorer.

**Galactic Lives:** The different types of galaxies in our universe.

**The Grand Architecture:** Voids, filaments and other large-scale structures that appear in the Tully Collection.

**This Matter of Matter:** The mysterious dark matter that makes up 90% of our universe.

**Collision/Construction:** How mighty galaxies smash together to create beautiful new forms.

**Edge of the Known:** New astronomy research projects that will allow us to look even farther into space.

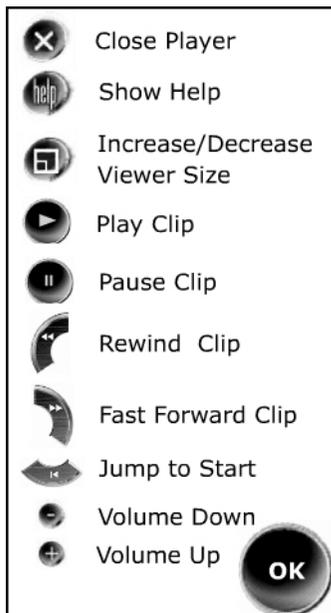
**Yesterday's News:** How our universe was different in the early years.

**The Dark Force:** The lesser-known companion of dark matter, dark energy is responsible for the expansion of our universe.

**The Way of Things:** How our universe has evolved and will evolve in the future.

### Media Player Controls

Deep Space Explorer has a unique media player, the controls of which are quite straight-forward.



**Tip:** If the original media player does not close when you press the “Increase/Decrease Viewer Size” button, you need to adjust your *QuickTime Player* preferences. Open the *QuickTime Player* (on Windows, you do this by clicking the **Start** button on your desktop and choosing **Programs->QuickTime->QuickTime Player**). Choose **Edit->Preferences->Player Preferences** and check the box reading “Open movies in new players”.

### Exploring

You will notice that each section in the **Views** pane also has an “Explore” listing. Click the icon to the left of the word “Explore” (this is a ‘+’ sign on Windows, and an arrow on the Macintosh) and the list expands. Clicking on any item in this list will change your view to show something interesting in Deep Space Explorer. Each item in the “Explore” list is a Deep Space Explorer file, not a movie. You will learn more about Deep Space Explorer files in “[Files](#)” on page 41. The key point to understand now is that you can use any of the program controls to adjust your view and explore further.





## Chapter 3

# Objects

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### Types of Objects

You're probably wondering exactly what celestial objects are included in Deep Space Explorer. They fall into three major categories.

**Planets:** All 9 planets in our solar system (Mercury, Venus, Earth, Mars, Jupiter, Saturn, Uranus, Neptune and Pluto), as well as the Sun. In addition all the major moons of these planets are included, such as Io, Titan, and Europa.

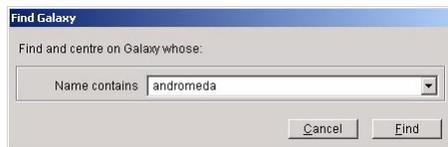
**Stars:** The 30 000 brightest stars in the night sky (as seen from Earth). Every star that you can see in the sky with the naked eye is included, plus many stars that can only be seen with binoculars or a telescope. Most of these stars are within a few hundred light years of the Sun, but a few are as far as two thousand light years away. The data on these stars comes from the Hipparcos catalogue, which is the result of a recent mission by the European Space Agency. This mission measured the distances to these stars more accurately than they had ever been measured before, which allows us to calculate their position in 3-D space.

**Galaxies:** The heart of Deep Space Explorer is a database of 28 000 nearby galaxies. These galaxies span an area approximately 700 million light years wide. This database is described in detail in "[The Tully Collection](#)" on page 29.

### Finding Objects

To find any of the objects mentioned above, just choose **Edit->Find** from the menu and type in the name of the object you want to find. You can search for a star or galaxy by its name or catalogue number.

***Tip:** If searching for an object by its catalogue number, make sure you type in the catalogue code. For example, to find Messier object 87, you would type "M87", not just "87".*



Then press the **Find** button, and Deep Space Explorer will pan around and center on the object for you. You can control the panning speed by adjusting the "Panning Speed" slider in the **File->Preferences** menu. The next section shows you how to find out more about any object.

### Getting Information

You learned how to find some basic information about an object using the HUD in "[Heads-Up Display](#)" on page 11. To get more information, point the cursor at an object (you should see the cursor icon change to a pointer) and then right-click (Windows) or **Ctrl-click** (Macintosh). This opens up a contextual menu with specific options for the object you have clicked on. The options in this menu are described below.



**Select:** Selecting an object turns on the HUD information for that object, and this information remains onscreen even when you move the cursor away from the object. It is possible to select multiple objects by holding down the **Shift** key while right-clicking on a second (or third, or fourth...) object and selecting that object. If you do not hold down the **Shift** key when doing this, objects that you have previously selected will be deselected. To deselect all objects, choose **Edit->Select None** from the menu.

**Centre:** Centring an object places it in the middle of the screen and also causes this object to become the new base about which you move using the Elevation buttons or the Location Scroller tool. In [“Moving Around”](#) on page 13, we learned that both the Location Scroller tool and the Elevation buttons adjust your position in reference to the object you are centred on. Remember that by default, you are centred on the Sun. If you centre on the Andromeda Galaxy, using the Elevation buttons now change your distance relative to the Andromeda Galaxy, not the Sun. When you are centred on an object other than the sun, the bottom of the main screen displays both your distance from the sun and your distance from the object you are centred on.

The Centre command can be used together with the Location Scroller tool and the Elevation buttons to show you close-up 3-dimensional views of any object in Deep Space Explorer, as shown in the following example.

**Example 1: Viewing Jupiter**

- 1 Choose **Edit->Find** from the menu and type in “Jupiter”, then press the **Find** button. This will centre on Jupiter.
- 2 Use the Decrease Elevation button to zoom in until Jupiter almost fills the screen.
- 3 Use the Location Scroller to adjust your view of Jupiter, so that you can move around and see all sides of the planet. You will see that half of the planet is lit up by the sun, while the other half is in shadow.

**Go There:** This option automatically changes your location to the object you clicked on. It achieves the same purpose as centring on the object and using the Decrease Elevation button until the object fills the screen, but it does this in an animated fashion, simulating a “flight” to the new object. As you fly through space, your current distance from the object will be shown along the bottom of the screen, along with your distance from the sun.

**Centre Group:** Each galaxy belongs to a larger group of galaxies. You can learn more about groups in [“Groups and Filaments”](#) on page 33. This option will place that group at the center of your screen.

***Tip:** The “Centre Group”, “Highlight Group”, “Centre Filament” and “Highlight Filament” options are only available for galaxies, not planets or stars.*

**Highlight Group:** This displays a special marker for all other galaxies that are in the same group as the object you have clicked on.

**Centre Filament:** Many (but not all) galaxies can also be classified as belonging to a filament. You can learn more about filaments in [“Groups and Filaments”](#) on page 33. This option centres on the filament containing your object.

**Highlight Filament:** This displays a special marker for all galaxies belonging to the same filament as the object you have clicked on.

**Show/Hide Info:** This displays more information about the object in the top left corner. All of these information fields are described in “[Onscreen Info \(Galaxies\)](#)” on page 24. If information is already displayed in the top left corner, clicking this option again hides the info.

**Online Info:** This option allows you to search our Internet database for more information about the object. See “[Internet Database](#)” on page 28 to learn how to use the Internet database.

### Onscreen Info (Galaxies)

Choosing **Show Info** from an object's contextual menu displays information in the top left corner of the screen. The information shown is different for stars and galaxies.

<b>Milky Way</b>	
Absolute Magnitude:	-21.12
Distance:	0.714 MLY
Catalogue number:	PGC -1
Object type:	Spiral Sc
	-31996.3 ly (Supergalactic X)
	-3242.2 ly (Supergalactic Y)
	29274.0 ly (Supergalactic Z)
Galaxy diameter:	0.156 MLY
Galaxy thickness:	15590.6 ly
Group ID:	22
Filament ID:	+02+00-00
Filament name:	GA Coma-Sculptor Cloud

For galaxies, the following information is displayed (in addition to the object's magnitude and distance, which you already now about):

**Catalogue number:** Most galaxies do not have a proper name, but are instead identified by their position in one or more astronomical catalogues. Some of the

more prominent galaxy catalogues are the NGC (New General Catalogue), IC (Index Catalogue), and PGC (Principal Galaxy Catalogue).

**Object Type:** This field lists the galaxy type according to the revised Hubble sequence of galaxies, which is a method of classifying galaxies according to their age, amount of interstellar gas, and rate of star formation. There is a continuum of possibilities between galaxies with no gas and only old stars at one extreme, and galaxies with lots of gas and a dominant component of young stars at the other extreme. You are probably familiar with the difference between spiral and elliptical galaxies, but there are 18 different galaxy types.

*Elliptical galaxies* have only very old stars and no interstellar gas or star formation regions. They are puffed up into rugby ball or helium balloon shapes. We can subdivide elliptical galaxies farther by how round they are.  $E^-$  galaxies are almost perfectly spherical, whereas  $E^+$  galaxies are quite flattened.  $E^0$  galaxies are somewhere in-between. M87, the giant elliptical at the heart of the Virgo Cluster, is a classic example of an elliptical galaxy.

*Lenticular galaxies* are a transition type between elliptical and spiral galaxies. They have a barely detectable disk, but otherwise resemble elliptical galaxies. Lenticular galaxies were forming new stars until quite recently. Lenticular galaxies are also known as S0 galaxies, and we can subdivide them (in order of increasing disk visibility) into  $S0^-$ ,  $S0^0$ ,

S0<sup>+</sup>, and S0a. Messier object M85 is a lenticular galaxy.

**Spiral galaxies** are big galaxies with lots of interstellar gas and star formation regions. The gravitational force of billions of stars makes the galaxy rotate and flattens it into a thin disk which surrounds a central bulge. This disk contains bright spiral arms, where interstellar gas is compressed to form new stars. We can subdivide spiral galaxies by the relative size of the central bulge and the tightness of the central arms. Sa galaxies (such as M104, the Sombrero Galaxy) have very tightly wound spiral arms and a large central bulge. Sc galaxies (such as M51, the Whirlpool Galaxy) have loose spiral arms and a much smaller central bulge. Intermediate between Sa and Sc galaxies are types Sab, Sb and Sbc. Our own Milky Way is an Sc galaxy.

Some smaller galaxies do not fit into any of the above categories. The reason is that gravity is less powerful in smaller galaxies, and the galaxy does not spin as rapidly, so it is not compressed into as well-defined a shape as the larger Sa, Sb and Sc spirals. We use the classifications Scd, Sd, Sdm, and Sm (in order of decreasing spiral structure) for **spiral irregular galaxies**, galaxies without much of a central bulge or well-defined central arms, but still some semblance of spiral structure. These galaxies have lots of gas and star formation. The Large Magellanic Cloud is an Sdm galaxy.

Finally, there are the **irregular galaxies**, which show almost no spiral structure and have lots of “lumps” where star formation is occurring. We subdivide irregulars into

Im (some hints of structure) and I0 (no structure at all). As with Sd and Sm galaxies, irregulars tend to be smaller galaxies where gravity has not bound the galaxy into a recognizable spiral pattern.

**Supergalactic X, Y, Z Co-ordinates:** These three values define a galaxy’s position in the **supergalactic co-ordinate system**, explained in “[Supergalactic Co-ordinates](#)” on page 31. You can use an object’s supergalactic co-ordinates to determine its position in relation to the earth and sun.

**Galaxy Diameter/Thickness:** Diameter is the length of the galaxy in the plane of its spiral arms, and thickness is the length of the galaxy in the plane perpendicular to its arms. You will find that the diameter and thickness of elliptical galaxies are similar, while spiral galaxies will have a diameter much greater than their thickness.

**Group ID:** The ID number of the larger **group** to which the galaxy belongs. See “[Groups and Filaments](#)” on page 33 for more on groups.

**Filament ID:** The ID number of the larger **filament** to which the galaxy belongs. See “[Groups and Filaments](#)” on page 33 for more on filaments. Not every galaxy belongs to a defined filamentary structure, so not all galaxies will have this option in their onscreen info.

### Onscreen Info (Stars)

The info displayed onscreen when you choose **Show Info** from a star's contextual menu is quite different than the information shown for galaxies.

<p><b>Arcturus</b>            Apparent Magnitude (from Earth): -0.07            Distance: 480.6 ly</p> <p>HIP number: 69673            Bayer: Alpha            Flamsteed/other: 16            B-V colour: 1.24            TYC number: TYC1472-1436-1            Variability: tiny, &lt; 0.06 Mag            Proper motion (from Earth) RA: -1.0932 arcsec/year            Proper motion (from Earth) Dec: -1.9992 arcsec/year            Temperature: 4106 Kelvin            Luminosity: 1196 suns            Absolute magnitude: -0.33 (visual)            Radius: 69 solar radii            Double/multiple: binary, &lt; 10" sep</p>
---

For stars, the following fields are shown (in addition to the object's magnitude and distance, which you already now about):

**HIP number:** The star's number in the HIPPARCOS star catalogue.

**Bayer:** The star's Bayer catalog letter, if any. The Bayer letter is from the Greek alphabet. The brightest star in a given constellation is named Alpha (the first letter in the Greek alphabet), the second brightest is named Beta, and so on.

**Flamsteed/other:** This gives the star's Flamsteed number, if any. The Flamsteed system orders stars not by brightness, but by their position relative to the western boundary of the constellation they are in. The star closest to the constellation's western edge is labelled 1.

**B-V colour:** This is a way of measuring a star's colour. An average star has a B-V value of around 0. If a star has a negative B-V value it is on the bluish side of the spectrum. If it has a positive B-V value it

is on the reddish side of the spectrum. The more negative or positive a star's B-V value, the more blue or red it will appear. A star's colour is directly related to its temperature: blue stars are hotter and red stars are cooler.

**TYC number:** The star's number in the Tycho star catalogue.

**Variability:** This indicates whether a star's apparent magnitude (and, therefore, its brightness) varies with time, and by how much.

**Proper Motion:** Stars are not fixed in space, and most are in fact moving quite rapidly. Because of their great distance from us, however, their positions appear constant. Only on a timescale of hundreds or even thousands of years can we actually see their position shift as seen from Earth. These fields describe how much the star's earth-based co-ordinates are shifting each year due to the star's movement.

**Temperature:** This is the star's surface temperature, given in degrees Kelvin (to get a star's temperature in Celsius, just subtract 273 from its temperature in Kelvins). The sun has a temperature of about 5700 K.

**Luminosity:** Luminosity measures the light output of a star, in comparison with the sun.

**Absolute magnitude:** Another method of quantifying the light output of a star, and therefore its intrinsic brightness. The lower the absolute magnitude, the brighter the star. You will note that all stars have absolute magnitudes much larger than even the smallest galaxy, indicating that

every galaxy is intrinsically much brighter than a star.

**Radius:** This measures the star's radius, in terms of the sun's radius. Red giant stars can be hundreds of times larger than the sun.

**Double/multiple:** This field indicates whether a star is part of a multiple star system. About half the stars in the sky are part of a multiple star system.

### Onscreen Info (Extrasolar Planets)

Certain stars in Deep Space Explorer are special because they contain their own planets. See "[Show Extrasolar planets](#)" on page 39 to learn how to identify these special stars. If you choose **Show Info** for a star that has extrasolar planets, you will see a few pieces of additional information:

**Mass:** the mass of the extrasolar planet. All the extrasolar planets discovered to date have been very heavy, so masses are given in terms of Jupiter masses, not Earth masses.

**Semi-major axis:** the average distance of the planet from its star. Distances are given in astronomical units (remember that 1 AU is the distance from Earth to the sun). You will find that most extrasolar planets are much closer to their parent star than Earth is to the sun.

**Period:** the time that it takes the extrasolar planet to revolve once around its parent star.

**Eccentricity:** eccentricity measures how close an orbit is to a circle. An orbit with eccentricity 0 is perfectly circular, and an

orbit with eccentricity close to 1 is extremely stretched out.

**Inclination:** how much the orbit is tilted, relative to our view from Earth. An inclination of 0 means that we are seeing the orbit edge-on, and an inclination of 90 means that we are seeing the orbit face-on.

**Radius:** the size of the planet, again relative to Jupiter.

*Note: Some stars have more than one extrasolar planet. If this is the case, the star's onscreen info shows the info for the largest extrasolar planet.*

## Internet Database

Selecting **Online Info** from an object's contextual menu brings up a page on our Internet database which has a listing of web links which have more information about the object. The left side of the page will also give you the option of searching other sites on the Internet, both general-purpose search engines and astronomy-specific pages, for information on your object.



### Example 2: Finding Web Pages for the Moon

- 1 Choose **Edit->Find** and type in “moon” to center on the moon.
- 2 Right-click or **Ctrl-click** on the moon and choose **Online Info** from the contextual menu. At this point your browser should go to our Internet database and retrieve a page that contains several links to places on the Internet with more information about the Moon. Click on any of these links to read interesting facts and trivia about the Moon, and to see lots of pictures and figures.

Some of the links in our Internet database will appear for all objects (these may be changed if better sources become available). These links are described below.

**Digitized Sky Survey:** The Digitized Sky Survey (DSS) is a collection of images obtained with two Schmidt telescopes and converted into digital format by the Space Telescope Science Institute. The digitized data allows the user to generate an image of any area in the sky. Clicking this link on our webpage will automatically generate a DSS image of the object you originally clicked on in Deep Space Explorer.

**HEASARC Astrobrowse:** Clicking this link will search dozens of astronomy databases for information on your object. A new window will open with each database being searched listed on the left side. When the search for that database has been completed, a green “happy-face” icon will appear beside the name of the database. You can then click the name of the database to retrieve the information.



## Chapter 4

# The Tully Collection

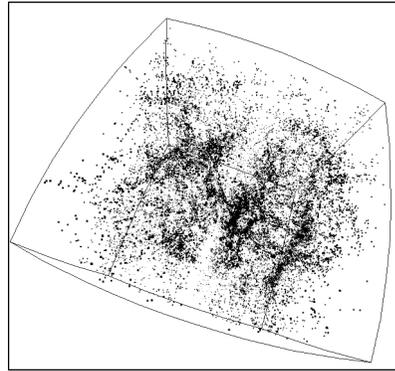
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The heart of Deep Space Explorer is a 3-D database of 28 000 nearby galaxies. This database was compiled by astronomer Brent Tully and colleagues, hence it is referred to in this guide as the ***Tully Collection***. This chapter describes how you can use the controls of Deep Space Explorer to organize and make sense of this database.

### **Galaxy Distance**

The galaxy database in Deep Space Explorer is very special because it shows the 3-D position in space of each galaxy, not just the galaxy's position as seen from Earth. To convert a galaxy's apparent position in our night sky into a 3-D position, we need to know the distance to the galaxy. This can be calculated by measuring the light that comes from a galaxy. Galaxies which are moving toward us will produce a light curve that is slightly bluer than usual, while galaxies moving away from us will be slightly redder. This phenomenon is known as the ***Doppler shift***, and the specific case of objects appearing redder because they are moving away from us is known as "redshift". Scientists can calculate the speed of any galaxy in this way. With the exception of a few galaxies close to our Milky Way, we find that ALL galaxies are red-shifted, which means they are moving away from us. The reason behind this is the overall expansion of the universe,

everything moving away from everything else. In fact, the faster a galaxy is moving away from us, the farther away it is. For every million light years of distance, a galaxy will move away from us 23 kilometres/second faster. So a galaxy 10 million years distant moves away from us at a speed of 230 kilometres/second, while a galaxy twice as far away moves twice as fast, 460 kilometres/second. We can use this technique to measure the distance to galaxies.



### What's In And What's Out

The 28 000 galaxies in Deep Space Explorer are only an infinitesimal fraction of those known to exist in our universe. How did we decide what to put in the database and what to leave out? The database of galaxies fills a box with dimensions of 700 million light years on each side, with Earth at the center. Galaxies inside this volume were included in the database, and more distant galaxies outside the boundaries were left out. The boundary was chosen because, frankly, at larger distances our ignorance is too great. Currently, information exists in only selected patches about the distribution of distant galaxies. In most directions, current surveys become very incomplete beyond the boundary of the volume explored here. In Deep Space Explorer, you can turn on a bounding box for the Tully Collection by checking the option "Show bounding box around entire dataset" in the **Guides** pane.

Even within this volume there are serious aspects of incompleteness. The most obvious is the bite taken out of the data in the plane of our Milky Way. Thick dust regions in the plane of the Milky Way block the light from distant galaxies. Radio waves and x-rays can penetrate these dust regions more easily than visible light, so new research programs using these methods are having some success locating galaxies along the plane of the Milky Way. However, there is still a gap of about 10 degrees coincident with the Galactic plane where there is almost no information about the universe beyond our galaxy.

There is a second obvious incompleteness in the data. Only those galaxies which are bright enough to be seen and measured from earth can be included in the database. A galaxy's brightness depends on two things: how much light it emits (known as intrinsic luminosity) and how far away it is from Earth. The intrinsic luminosity of galaxies varies by a factor of ten thousand or more, from tiny dwarfs with only a few million stars to giant ellipticals 100 times

larger than our Milky Way. Obviously, these giant ellipticals can be much farther away from earth and still be visible. Tiny dwarfs are only visible if they are very nearby, intermediate brightness galaxies are included to intermediate distances, and giant galaxies are included to the distance boundary of the data base. This sampling artifact explains why the database includes lots of dwarf galaxies in our vicinity but few at large distances.

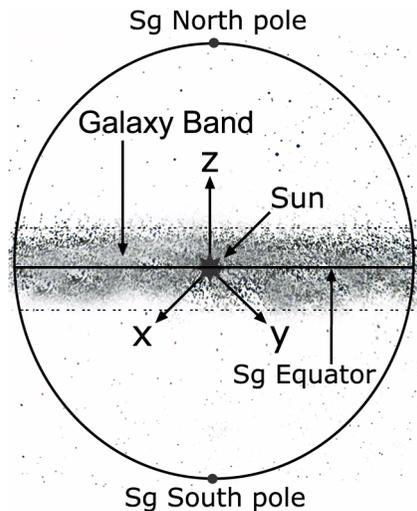
#### Example 1: Viewing the Tully Collection

- 1 Press the **Home** button
- 2 Use the Increase Elevation button to blast off until you are about 800 MLY above the sun. You should see the dataset begin to collapse into a box-like shape.
- 3 Turn on the boundaries of this box by opening the **Guides** pane and checking the box that reads “Show bounding box around entire dataset”. This will show you the exact edge of the Tully collection.
- 4 Use the Location Scroller tool to rotate your view of the Tully collection. You should see a slice through the middle of the bounding box that contains very few galaxies. This is the plane of the Milky Way, where we have been unable to identify many galaxies due to obscuration of the distant galaxies by dust.

#### Supergalactic Co-ordinates

So how can we define an object’s 3-dimensional position within the Tully Collection? Deep Space Explorer uses a special *supergalactic co-ordinate system* for this purpose. It turns out that a large fraction of the nearest few thousand galaxies are concentrated in a narrow band, as seen from Earth. We define the center of this band as the supergalactic equator.

We can then define 3 co-ordinates in relation to this equator: supergalactic X, supergalactic Y, and supergalactic Z. These co-ordinates usually have units of mega light years (MLY). The co-ordinates of galaxies relatively close to Earth are sometimes given in units of light years (ly). Remember that one MLY equals one million ly. The supergalactic X and supergalactic Y axes are both in the plane of the supergalactic equator (and perpendicular to each other), while the supergalactic Z axis is perpendicular to this plane.



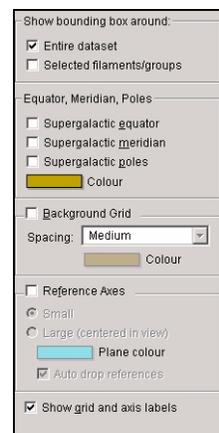
So what do a galaxy's supergalactic co-ordinates tell us? Two key things: its distance from the sun, and its position relative to the supergalactic equator.

Galaxies with large supergalactic X, Y or Z values are far from the sun, while objects with small values are relatively nearby. For example, the supergalactic co-ordinates of the Large Magellanic Cloud (in units of MLY) are (-0.117, -0.084, -0.098) while the supergalactic co-ordinates of NGC 2484 are (343.7, 305.6, -315.7). We can predict that NGC 2484 is much farther away from us than the Large Magellanic Cloud, and this is indeed the case. The Large Magellanic Cloud is one of our nearest neighbours, at a distance of 0.174 MLY. Compare this with NGC 248, which is at the edge of the Tully dataset, 557.9 MLY from the sun.

Objects with large supergalactic X and/or Y values (relative to their supergalactic Z values) are in the densely populated band

of galaxies near the supergalactic equator. For example, the spiral Triangulum galaxy has supergalactic X,Y,Z, co-ordinates of (2.372,-1.456,0.004). Because the Z value is much smaller than the X and Y values, the Triangulum galaxy is almost exactly along the supergalactic equator. On the other hand, galaxies with large supergalactic Z values (relative to their supergalactic X and Y values) are far from the supergalactic equator.

### Co-ordinate System Guides



You can find the position of any galaxy relative to the supergalactic co-ordinate system using the options in the **Guides** pane. Check the box “Show grid and axis labels” at the bottom of this pane to turn on the labels for any of the guides.

***Tip:** The supergalactic co-ordinate system is centred on the sun, and you therefore need to be near the sun for the information from the guides in the **Guides** pane to be meaningful. When you want to use any of these guides to find a galaxy's position in the supergalactic co-ordinate system, first press the **Home** button to place yourself above the Milky Way, and then use the **Decrease Elevation** button to lower yourself until you are within a few thousand light years of the sun.*

**Equator, Meridian, Poles:** These checkboxes turn on/off the supergalactic equator, meridian and poles, respectively. The meridian is a line perpendicular to the equator. If you turn these guides on when you are inside the Milky Way, you will find that the disk of the Milky Way (the area of space where you see many bright stars and a central bulge) is almost parallel to the supergalactic meridian (about 6 degrees away from parallel). If you click on the “Colour” bar in this section of the **Guides** pane, you can change the colour of these guides.

**Background Grid:** This option draws a complete supergalactic grid, letting you see the poles, equator and other lines of latitude and longitude. The “spacing” option controls how wide the spacing is between the lines of latitude and longitude on the grid. You can choose from one of three settings: fine, medium or coarse. Clicking the “colour” rectangle lets you change the colour of the supergalactic grid.

**Reference Axes:** Use these controls to see how your current onscreen view of space is oriented with respect to the supergalactic co-ordinate system. The “small” option draws the three supergalactic co-ordinate axes in the upper right corner (x in green, y in yellow, z in red). The “large” option draws a grid at the center of the screen representing the supergalactic equatorial plane, with the three co-ordinate axes protruding from the center of the grid. The grid is always centred on the object that you are currently centred on. Clicking the “Plane Colour” rectangle lets you change the colour of the grid.

**Auto drop references:** If you have turned on the “large” reference axes, “auto drop” marks the 3-D position of the brightest three objects in the sky, relative to both the object you are centred on and the supergalactic equator. If you select an object by right-clicking on it, its 3-D position will also be marked.

### Groups and Filaments

When you looked at the entire Tully collection in “[Viewing the Tully Collection](#)” on page 31, you probably noticed that the galaxies were not randomly distributed throughout the cube, but formed patterns of clumps, strings, walls and voids. This is evidence that galaxies are only components of even larger structures. We split these structures into two major divisions: groups and filaments.

**Groups** are gravitationally bound clumps of galaxies. Membership can range from a few to a few thousand galaxies. Large groups are also known as *clusters*.

**Filaments** - or their kin walls, clouds, and arcs - are formations of galaxies in expanding space, which are not necessarily gravitationally bound. These formations can be string-like or sheet-like. They can have curvature like a bow or like a sail. Filaments can be grouped together into even larger structures called *filament families*.

Groups and filaments are intimately connected. Clusters - big groups - tend to lie at nodes where filaments meet. The filaments form a three-dimensional roadway connecting the urban centers of

the clusters and are dotted with village groups. Some walls and arcs are wide expressways. Some filaments degenerate into lanes or paths. Essentially all filaments do connect to other filaments so it is false to say that 'you can't get there from here'. Between the filaments lie great *voids*, regions of space millions of light years across that are empty of galaxies.

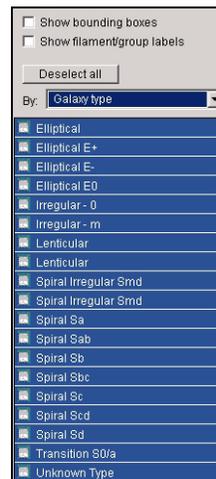
A galaxy can belong to at most one group and at most one filament. You can examine the group or filament to which any galaxy belongs by right-clicking on the galaxy and choosing **Highlight "xxx" group** or **Highlight "xxx" filament**. This will highlight all galaxies belonging to that group or filament.

*Note: if a galaxy does not belong to a group or filament, these options will not appear in its contextual menu.*

The next section explains how we can use groups and filaments to explore the large-scale structure of the Tully Collection.

## Extragalactic Structure

There are many filaments, walls, groups, clusters, and voids to be explored in the Tully Collection. The principal tool for exploring these structural elements is the **Highlight** pane in the navigation bar. The pull-down menu lets you examine the database by one of five methods: filament family, filament name, filament ID, group ID and galaxy type.



Choosing any of these categories will display a list of all objects in the category. You can click on any object in the list to highlight that object. If you have "Show bounding box" checked, all highlighted groups, filaments or families, will be surrounded by a 3-dimensional box,

letting you see the spatial area occupied by the group or filament. If you have "Show filament/group labels" checked, all highlighted objects will be labelled. The **Deselect all** button quickly turns off all highlighted objects.

You will probably find that the most useful object category is "filament family". Highlighting a family automatically highlights all the connected filaments in that family. Over a dozen filament families can be highlighted in Deep Space Explorer. When examining the large-scale structure of the Tully Collection, it is best

to begin about 800 MLY from Earth, with a view similar to [“Viewing the Tully Collection”](#) on page 31, so that you can see the position of the family you are examining in relation to the entire database. You can then zoom in to examine the structure of the filament in more detail.

***Tip:** You may wish to play with some of the options in the **Settings** pane (described in [“Galaxy Drawing Options”](#) on page 37) to produce the clearest view of the Tully Collection. This will make it easier to examine the structure of filament families.*

Three gigantic structures dominate the cube that encloses the Tully Collection, and you can view any of these structures by highlighting the appropriate filament families.

We belong to the structure known as the Local Supercluster complex. The part of the complex closest to home, centred on the Virgo Cluster, has been known for many decades and is called the Local Supercluster. Two orthogonal structures can be seen by highlighting alternatively the ‘Supergalactic Equatorial Plane’ family and the ‘Local Supercluster Layered Wall’ family. The ‘Virgo Flower Petal’ family shows how filaments connect into the nodal Virgo Cluster in 3-dimensions.

About two decades ago astronomers began to realize that the Local Supercluster is just an appendage on a much larger structure centered on the Centaurus Cluster. Everything in our local supercluster is moving towards this structure at a speed of 600 km/s. The name ‘Great Attractor’ was coined to identify

this region and it can be identified by highlighting the ‘Great Attractor’ family.

There are great arcs of galaxies appended to the Great Attractor region. The most impressive is highlighted as the ‘Pavo-Indus Arc’, which arises out of the Centaurus Cluster region and the Norma Cluster, the latter buried in the zone that is obscured by the Milky Way. The ‘Hydra-Cancer Arc’ arises out of the Hydra I Cluster. The ‘Milky Way Arc’ emanates from the Centaurus and Norma clusters vicinity and arches half way across the sky in close proximity to the plane of the Milky Way.

The combination of the Great Attractor, Pavo-Indus Arc, Hydra-Coma Arc, and Milky Way Arc families constitute the Local Supercluster Complex.

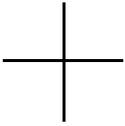
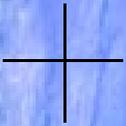
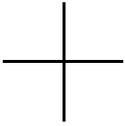
The second gigantic structure in the Tully Collection is known as the ‘Great Wall’ family, and it is even more spectacular than our Local Supercluster Complex. The Coma Cluster lies near the center of the wall as we see it and the Hercules Cluster lies near the edge. The Great Wall extends beyond the boundaries of the Tully Collection, so we can only view part of it in Deep Space Explorer.

The third major structure is seen by highlighting the combination of the ‘Perseus-Pisces Arteries’ and the ‘Southern Wall’. The Perseus-Pisces Arteries are prominent twisted string-like features. The Southern Wall is a huge sheet-like arc.

You should use the structures mentioned above as a starting point for your explorations, not a complete guide. Many of the regions in the Tully Collection have not been studied in depth and there are plenty of structures remaining to be discovered!

**Example 2: Examining the Local Supercluster Complex**

- 1 Press the **Home** button to reset your view.
  - 2 Use the Increase Elevation button to increase your elevation until you are about 800 MLY from the sun. You should now be able to see the entire Tully Collection.
  - 3 Press the **Highlight** pane in the Navigation bar. Make sure that “Show bounding boxes” and “Show filament/group labels” are unchecked.
  - 4 Check the boxes for “Supergalactic Eq Plane” and “Local SC Layered Wall”. These are the two structures of the local supercluster complex that are closest to home.
  - 5 Use the Location Scroller to rotate your view of the Tully Collection. Note that all galaxies in these filaments are near the center of the dataset.
  - 6 Use the Decrease Elevation buttons until you are about 300 MLY from the sun.
  - 7 Practice alternately checking and unchecking the boxes for “Supergalactic EqPlane” and “Local SC Layered Wall”. Use the Location Scroller to frequently rotate your view.
- This should help you visualize the 3-D structure of these two families. You will notice that these structures are at right angles to one other.
- 8 Check the box for “Great Attractor” to turn on this major family.
  - 9 Much of the Great Attractor will not be visible in your current view, so use the Increase Elevation button until you are again 800 MLY from the sun. Check and uncheck the “Great Attractor” box to see that it is a much larger filament than the “Supergalactic Eq Plane” and the “Local SC Layered Wall”.
  - 10 Check the boxes for the “Pavo-Indus Arc”, the “Hydra-Cancer Arc”, and the “Milky Way Arc”. You have now turned on all the filaments that comprise the Local Supercluster Complex. Use the Location Scroller to rotate your view of this massive structure.



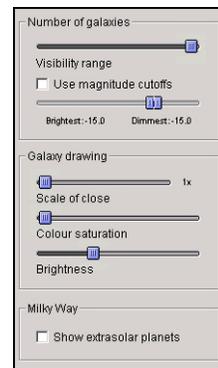
## Chapter 5

# Altering the Look

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This chapter describes how you can customize Deep Space Explorer to look exactly how you want. Most of the tools discussed in this chapter are in the **Settings** pane and the **Labels** pane in the Navigation bar.

### Galaxy Drawing Options



The 28 000 galaxy database was discussed in “[The Tully Collection](#)” on page 29. You have great control over how this database is displayed onscreen, in the **Settings** pane.

**Number of galaxies:** This slider controls the number of galaxies drawn onscreen. The criteria for determining which galaxies to draw is their distance from your current position and their inherent brightness. When the slider is near the left edge, only the brighter galaxies are displayed. This is useful if you are simulating a flight through the universe, because the distant background galaxies are eliminated and it is easier to see the apparent motion of the nearby galaxies. Moving the slider all the way to the

right edge displays all 28 000 galaxies in the database. This is useful if you are examining filament families or other large-scale structure in the database.

**Use magnitude cutoffs:** If you check this box, only those galaxies whose absolute magnitude lies within a certain range are displayed. Remember that absolute magnitude is a measure of a galaxy's inherent brightness, and therefore its size and mass. Lower magnitudes correspond to brighter (and bigger) galaxies. You can set both an upper and a lower limiting magnitude. For example, to quickly find just the largest galaxies in the database, you could set the magnitude range from -21.0 to -30.0. This would display only those galaxies brighter than magnitude -21.0 (the brightness of approximately 20 billion suns!). The Milky Way has a magnitude of -21.12, so it would be shown, but the Large Magellanic Cloud has a magnitude of -18.82, so it would not.

**Example 1: Finding Dwarf Galaxies**

- 1 Press the **Home** button
- 2 Click the **Settings** pane.
- 3 Check "Use magnitude cutoffs" and set the "Brightest" value to around -15, and the "Dimmest" value to -10. Most of the galaxies will disappear from your screen.
- 4 Click the **Labels** pane and check the "Galaxy Labels" checkbox. All of the galaxies that are visible will be dwarf galaxies, including the Sculptor Dwarf and the Pisces Dwarf.

**Scale of close galaxies:** When a galaxy is very close, it is represented by a full-colour image instead of a dot. This slider lets you enlarge these galaxy images. The "correct" position of the slider is all the way to the left-this will draw galaxies the proper size, and you will rarely see more than one or two galaxy images onscreen at the same time. Moving the slider to the right allows you to see many galaxy images at the same time, producing some spectacular views.

**Colour Saturation:** Each different type of galaxy is represented in Deep Space Explorer with its own colour image. The dots used to represent a distant galaxy are the same colour as the full-size image. Moving this slider to the right makes the colour of the dots closer to that of the galaxy image, while moving the slider to the left strips away all colour distinctions until all galaxies are represented by white dots. The advantage of having the slider far to the right is that you can quickly identify the galaxy type, for example, a cluster of blue dots indicates a group of elliptical galaxies. The disadvantage is that the sky becomes gaudy and unrealistic-looking.

**Brightness:** When a galaxy is too far away for its image to be visible, Deep Space Explorer will represent its position in space with a dot. This slider controls the brightness of these dots. The ideal position of this slider will depend on the brightness of your monitor and the lighting conditions in your computer room. Moving this slider to the right makes the dots larger and brighter, while moving it to the left makes the dots smaller and dimmer.

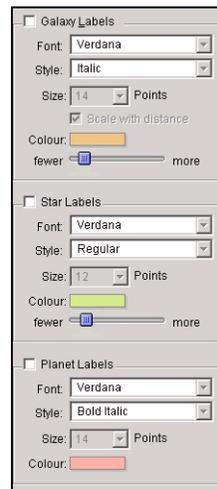
**Example 2: Creating a “Hubble Deep Field” view**

- 1 Choose **Edit->Find** and type in “M87”, then hit the **Find** button. M87 is a giant elliptical galaxy that lies at the heart of the Virgo cluster, which is a dense collection of 2000 galaxies located 60 million light years from Earth.
- 2 Use the Decrease Elevation or Increase Elevation buttons to change your elevation to about 6 MLY above M87.
- 3 Move the “Close galaxies” slider all the way to the right. You should see images of many nearby galaxies pop into view.
- 4 Use the Location Scroller tool to rotate your view around M87. Images of many galaxies will move in and out of view. You should be able to see several dozen images onscreen at the same time.
- 5 Check out this website for links to Hubble Deep Field photos and note the similarities with the scene you just created using Deep Space Explorer:

<http://www.stsci.edu/ftp/science/hdf/hdf.html>

**Show Extrasolar planets:** This is the only control in the **Settings** pane which does not involve galaxies. Instead it involves stars in our own Milky Way known to have planetary systems. At the time of writing, over 60 extrasolar planets had been discovered, and these are all included in Deep Space Explorer. When you are positioned inside the Milky Way and you have “Show Extrasolar Planets” checked, stars with planetary systems are marked with a special icon. See

“[Onscreen Info \(Extrasolar Planets\)](#)” on page 27 to learn how to get information on these extrasolar planets.

**Labels**

The **Labels** pane lets you customize the appearance of labels for stars, planets and galaxies. You can control the number of objects to label, and the label font, style, size and colour.

**Turning labels on/off:** Check the box marked “Galaxy Labels” to turn on labels for galaxies, or uncheck the box to turn them off. Ditto for stars and planets.

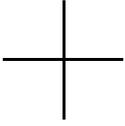
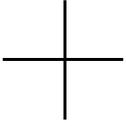
**Font:** Choose from any of the fonts in the pull-down list.

**Style:** Choose from regular, bold, italic, or bold italic.

**Size:** Set the size of your labels.

**Colour:** Click on the coloured rectangle to open a window that allows you to choose a new label colour.

**Number of Labels:** Move the slider to the right to draw labels for more objects, or to the left to draw fewer labels. This is only an option for stars and galaxies. For

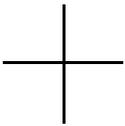
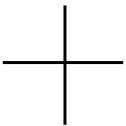


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planets, either all or none of the planets are labelled.

**Scale With Distance:** An option for galaxies only, this connects label size with object distance. The closer a galaxy is to you, the larger its label will appear. This makes it easy to identify the nearest galaxies.





## Chapter 6

# Creating Multimedia

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In this chapter you will learn how Deep Space Explorer looks at files, and how to create your own files. You will also learn how to make movies and images of your flights through the cosmos.

### Files

A Deep Space Explorer file allows you to recreate all the conditions which you used in the program to create a particular view. When you open a file again, it will restore you to the same viewing location and viewing direction as you had when you saved the file. All your label, guide and sky settings will also be restored.

What is a Deep Space Explorer file **not**? It is not a premade animation sequence showing a flight to the Andromeda galaxy, for example. All a Deep Space Explorer file does is establish the initial screen conditions- from then on you have complete control over how the program will evolve. If you want to make replayable animation sequences, read the section on “[Making Movies](#)” on page 43.

To create a file, just choose **File->Save As** from the menu and name your file. You can then open this file again by starting Deep Space Explorer, choosing **File->Open** from the menu, and selecting your file.

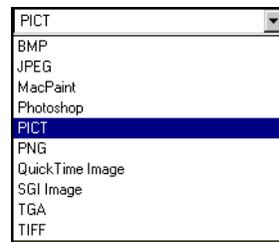
**Example: Saving a File Of Our Solar System**

- 1 Press the **Home** button.
- 2 Press the Decrease Elevation button repeatedly to reduce your elevation. At an elevation of about 3000 AU, the orbits of the outer-most planets should come into view.
- 3 Continue pressing the Decrease Elevation button until you have reached an elevation of about 60 AU. At this elevation, the orbits of Jupiter, Saturn, Uranus, Neptune and Pluto should all be visible, with the orbits of Mars, Earth, Venus and Mercury all close together at the center of the screen.
- 4 Choose **File->Save** from the menu and name your file "OuterSolarSystem".
- 5 Exit Deep Space Explorer.
- 6 Start Deep Space Explorer. The program opens with your standard view, looking down at the Milky Way.
- 7 Choose **File->Open** and select the file "OuterSolarSystem". You will be returned to your view that shows the orbits of the outer planets.

**Images**

If you don't want to recreate a view inside Deep Space Explorer, but want to capture a colour image from the program, then the **File->Save** command is not for you.

Instead you want to choose **File->Export as Image**. This will bring up a familiar Save dialog box. One of the fields in this dialog box allows you to choose the format for your new image. You can choose from JPEG, bitmap, PICT, and many other popular formats.



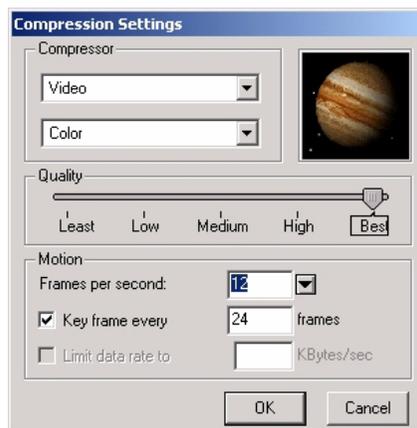
The picture which is saved is an exact duplicate of what you see on your screen. You can use images from Deep Space Explorer for many purposes: to post on your web site, to create images for teaching purposes, or perhaps even to make a birthday card for an astronomy buff!

***Tip:** You can also use the **Export as Image** command to print colour images. Save the image you wish to print using the **Export as Image** command, and then open this image in a program such as Internet Explorer. Choose **File->Print** from the menu to print your image.*

### Making Movies

You can make spectacular movies of any of your Deep Space Explorer voyages. Movies are played back using the QuickTime viewer, so you can send movies to your friends and colleagues. They do not need to have Deep Space Explorer to watch the movies.

To make a movie, select **File->Make Movie**. A window will open that asks you to name your movie and pick a folder to save it in. The default name is "Space Movie" and the default location is the "Deep Space Explorer" folder. You can change the movie name and/or the directory where it will be saved. If you are making a movie for the first time, the Compression Settings window then comes up.



If you have ever tried to download a video file from the Internet, you know how large these files can be. The same thing can happen with QuickTime movies because they are also composed of a series of still images. If you are using 30 frames per

second (the standard rate for television images), this means 900 images for a 30 second video! It is easy to understand how even a short movie can easily be a few megabytes in size. The compression settings offer different ways to keep your movie files down to a manageable size.

**Compressor:** This popup lets you choose from several different compression formats. Depending on the compression format chosen, a second popup menu may allow you to choose from several colour options.

*Tip: The best compressor for Deep Space Explorer movies is usually "Sorenson Video". This compressor can create relatively high-quality movies that are not too large.*

**Quality:** The slider lets you adjust the quality of the recording. The better the quality, the larger the file size.

**Motion:** Within this box you can adjust how many frames per second are displayed when the movie is played back and how often to draw a key frame, and limit the amount of data stored per second to a maximum value.

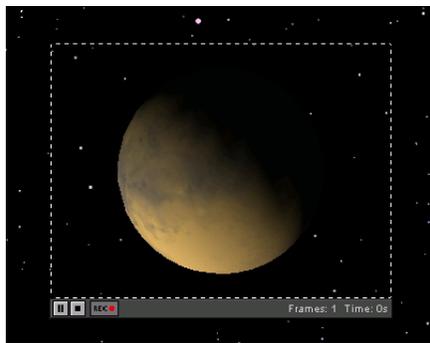
*Tip: After you have set your compression settings once, the Compression Settings window will not open automatically when you make subsequent movies. To change your movie preferences, you can select **File->Preferences** from the main menu and press the **QuickTime movie preferences** button.*

Once you have closed the Compression Settings Window, a rectangular outline will appear in the center of the screen. The

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area inside the rectangle will be recorded in your movie.

***Note:** You cannot change the size of the movie window in Deep Space Explorer. Use the elevation buttons to move in or out to get the right scale for your movie.*



The left side of the movie window will have three buttons, corresponding to the three modes of the movie window. The Movie window will automatically be in Record mode when it opens.

■ The **Pause** button pauses the recording of the movie. This enables you to adjust your view between frames, for quick cuts from one view to the next.

■ The **Stop** button completes the recording process, and closes the QuickTime window.

■ The **Record** button resumes the recording of a movie after it has been paused.

While in Record mode, a new frame is added to the movie every time the screen is redrawn. Most changes you make in

Deep Space Explorer will cause the screen to be redrawn and a new frame added to your movie. Increasing or decreasing elevation, changing the labels, and highlighting groups or filaments are just a few of the changes which will cause a new frame to be recorded.

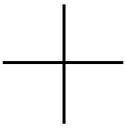
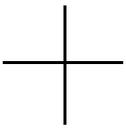
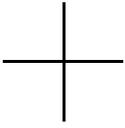
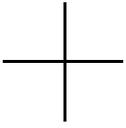
Once you are ready to start filming, just change the screen in any way you want. The number of frames currently recorded is shown in the bottom right corner of the window, along with the total running time of the movie. When you are finished recording, hit the Stop button along the bottom of the movie window.

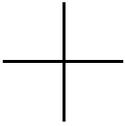
***Tip:** To change viewing angles in the middle of a movie, press the Pause button in the Movie Window and change your location. The movie will not resume recording until you press the Record button again.*

**Playing Back Movies:** You can use the QuickTime movie player to play back your movies. To play back a movie, double-click the file in the folder where you saved it. The QuickTime player will open and begin playing your movie.

**Example: Recording a Voyage to the Triangulum and Southern Pinwheel galaxies**

- 1 Press the **Home** button
- 2 Choose **File->Make Movie** from the menu. If the Compression Settings window opens, choose Sorenson Video from the drop-down list of compressors and leave all other compression settings unchanged. Hit the **OK** button to close the Compression Settings window.
- 3 Name your movie “GalaxyVisit”. The Movie window should then appear, overlaying your current view.
- 4 Choose **Edit->Find** and type in “Triangulum”, then press the **Find** button. This will center and zoom in on the Triangulum Galaxy, also known as the Pinwheel Galaxy. This is a spiral galaxy in our own Local Group. Note that at every step in the zoom sequence, a new frame is added to your movie.
- 5 Repeat step 4, but this time type “Southern Pinwheel” into the Find dialog. This centers and zooms in on the Southern Pinwheel Galaxy, a more distant spiral galaxy 25 million light years from Earth.
- 6 Press the Stop button in the movie controls to stop recording.
- 7 Close Deep Space Explorer, locate the file “GalaxyVisit” on your hard drive and double-click on this file. QuickTime will open and begin playing back your movie. You can imagine creating a longer movie which showed closeups of many more galaxies.





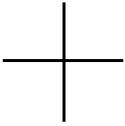
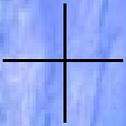
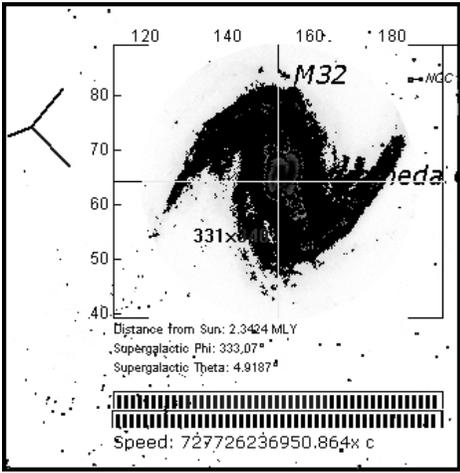
# Chapter 7

## Spaceship Mode

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The spaceship mode lets you change your location in a completely different way, by simulating the motion of an intergalactic spaceship! Pressing the **Spaceship** button brings up various gauges and displays, described below. The area inside the red rectangle is known as the *viewport*. The motion of the spaceship is always towards the area of sky at the center of the viewport. To turn off spaceship mode, just press the **Spaceship** button again.



**Speed:** Two gauges beneath the main display measure the motion of your spaceship. The top gauge measures your velocity or speed. In order of increasing speed, the markers are green, yellow, orange and red. If you are in the green range, you are travelling beneath the speed of light, while yellow, orange and red are all greater than the speed of light. Your speed is also shown in a numerical format beneath the two gauges. It is given in units of 'c', which is the speed of light, so values less than 1 are beneath the speed of light, while values greater than 1 are greater than the speed of light.

The lower gauge indicates how fast you are accelerating or decelerating (i.e. changing your speed). If your speed is increasing, this gauge will be green, while if your speed is decreasing, the gauge will be red.

**Closest Object:** The position of the closest object inside the viewport is marked by cross-hairs on the display screen. The name, brightness and distance to the object are shown just to the right of the display. You may also see a second object marked by cross-hairs, which is outside the viewport. If so, then this object is even closer than the object marked inside the viewport. If no second object is marked by cross-hairs, then the object inside the viewport is the absolute closest object.

**Direction of Spaceship:** Two display features indicate the direction in which your spaceship is pointing. The numbers along the top and left sides of the viewport indicate your direction relative to the sun. If you use the pitch and yaw keys (see the next section for information on these keys) so that these numbers are both equal to 0,

then your spaceship will be travelling directly towards the sun. If the number along the left side is 0 but the number along the top is 180, then you are moving directly away from the sun. The red, green and yellow axes to the left of the viewport show your direction relative to the supergalactic co-ordinate system. This system is described in "[Supergalactic Co-ordinates](#)" on page 31.

### Piloting the Spaceship

1	Decelerate
2	Accelerate
P	Pause
F1	Legend
Z	Roll +
A	Roll -
↑	Pitch +
↓	Pitch -
→	Yaw +
←	Yaw -

You control the spaceship using different keys.

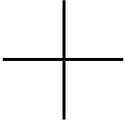
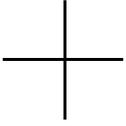
These keys and their functions are listed in the legend at the top left corner of the screen. Once you become familiar with the keys, you can hide the legend

by pressing the F1 key.

**Accelerate/Decelerate:** Speed up/slow down the spaceship.

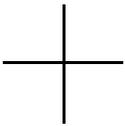
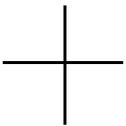
**Pause:** Instantly stop the spaceship. You might need to do this if you are flying towards an interesting object and are moving so fast that the object will disappear from view before you can slow down using the deceleration key. If the spaceship is already paused, pressing this key again will unpause the spaceship.

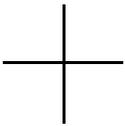
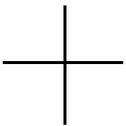
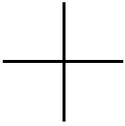
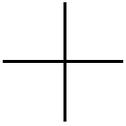
**Roll, Pitch, Yaw:** All of these keys change the direction of your spaceship. Roll rotates the spaceship, pitch shifts the spaceship up or down, and yaw shifts the spaceship left or right.



### Spaceship Tips & Tricks

- 1** If you want to fly towards a specific object, first use the **Find** command (described in [“Finding Objects”](#) on page 22) to center on that object. You can then turn spaceship mode on and fly directly towards the object.
- 2** Slow down! As soon as an interesting object comes into view which you want to look at, begin decelerating. Otherwise, the object will quickly pass you by.
- 3** Point your spaceship towards areas that are densely populated. As you move closer, each of these points will become galaxies, and you will be moving through a crowded region of space.







## Appendix A

# Glossary

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**Apparent magnitude:** A measure of a celestial object's brightness, as seen from a certain location. Lower magnitudes correspond with brighter objects. Apparent magnitude depends on your location, distinguishing it from *absolute magnitude*.

**Absolute magnitude:** A measure of an object's intrinsic brightness, which does not depend on the observer's position. Lower magnitudes correspond with intrinsically brighter objects.

**Astronomical Unit (AU):** One astronomical unit is the average distance between the earth and sun—approximately 150 000 000 km (93 000 000 miles). Distances between objects in our solar system are usually given in astronomical units.

**Doppler Shift:** The change in colour of an object due to its motion. Objects moving towards us will appear bluer than they really are (blueshifted), and objects moving away from us will appear redder (redshifted). The Doppler shift of a galaxy can be used to determine its distance from the earth.

**Elliptical Galaxy:** An old galaxy with no star formation regions that takes the shape of an ellipse.

**Family:** The largest structures in the Tully Collection, families are collections of many

*filaments*. Examples include the Great Attractor and the Great Wall.

**Filament:** A 3-dimensional structure, composed of many galaxies. The galaxies in a filament are not necessarily gravitationally bound.

**Group:** A gravitationally bound collection of galaxies.

**Heads-Up Display (HUD):** The Heads-Up Display is the information that pops up onscreen automatically when you point the cursor at an object.

**Irregular Galaxy:** A galaxy with very little or no spiral or elliptical structure.

**Lenticular Galaxy:** An intermediate class of galaxy between spirals and ellipticals. Lenticular galaxies have a faint disk but otherwise resemble elliptical galaxies.

**Light Year (ly):** The distance that light travels in one year- 9.46 trillion km (6 trillion miles). The distances to stars within our Milky Way and very close galaxies are usually given in light years.

**Location Scroller:** The tool in Deep Space Explorer that rotates your view around the object you are centred on. Hold down the left mouse button and move the mouse in any direction to use the location scroller.

**Media Player:** The special player which Deep Space Explorer uses to play the multimedia videos in the **Views** pane.

**Mega Light Year (MLY):** One mega light year (MLY) is equal to one million light years. Distances to galaxies are usually given in units of mega light years.

**Navigation Bar:** The bar on the left side of Deep Space Explorer with five panes:

**Views, Labels, Guides, Settings, Highlight.**

Click any of these panes to expand the Navigation Bar, and click the same pane again to collapse the bar.

**QuickTime:** The multimedia software program that needs to be on your computer for Deep Space Explorer to run. QuickTime is included on the Deep Space Explorer CD.

**Spaceship mode:** The special mode that is activated when you press the **Spaceship** button. Spaceship mode has different displays and controls and can be used to fly through the universe.

**Spiral galaxy:** A galaxy composed of a flattened disk surrounding a central bulge. The disk has well-defined spiral arms where star formation is occurring.

**Spiral irregular galaxy:** Classification for smaller galaxies that show hints of spiral structure but are not as symmetrical as true spirals.

**Supergalactic Co-ordinates:** A co-ordinate system used to describe the 3-dimensional position of galaxies within our universe. The system is centred on the sun and uses a dense band of nearby galaxies as its supergalactic equator.

**Tully Collection:** A colloquial name for the database of 28 000 galaxies in Deep Space Explorer.

**Viewport:** The area onscreen that is inside the orange rectangular display when you are in *spaceship mode*.



## Appendix B

# FAQ

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This section answers the most common questions about Deep Space Explorer. You can access the most up to date version of this FAQ by choosing **Help->On-line Help** from the Deep Space Explorer menu.

This is especially useful for websites mentioned on this page. Their addresses may have changed since this manual was printed, in which case the new links will be in the online FAQ.

If your question still isn't answered, contact us at [support@starrynight.com](mailto:support@starrynight.com)

### **QuickTime**

Information about the multimedia program QuickTime needed to run Deep Space Explorer.

#### **What is QuickTime and why do I need it?**

QuickTime is a tool for manipulating graphics files and constructing and viewing animation sequences. Deep Space Explorer uses it to allow you to make movies and to save screen images as graphics files. Deep Space Explorer will not run at all unless you have version 5.0.2 or later of QuickTime.

**When I install QuickTime, what type of installation should I choose?**

You should choose the "Recommended" option, as the **Make Movie** and **Export as Image** features in Deep Space Explorer will not work properly if you choose the "Minimum Install" option.

**I get an error message when I try to install QuickTime.**

This usually occurs if you have other applications or utilities running at the same time you run the installer. You should close all other applications, including any anti-virus software utilities, and then try to run the installer again. On Windows, type the **Ctrl-Alt-Delete** keys at the same time to bring up a list of tasks running on your computer. End every task in this list except "Systray" and "Explorer" and then then run the installer again. If you still encounter errors, you may wish to visit Apple's QuickTime support page:

<http://www.info.apple.com/usen/quicktime/>

**I am trying to install QuickTime, and it asks me to enter a registration number. Why doesn't my Deep Space Explorer registration number work?**

When you install QuickTime, a window will come up which allows you the option of entering a registration number for QuickTime Pro, which is a more advanced version of QuickTime not included with Deep Space Explorer. You should leave all fields in this window ("Registered to", "Organization", "Number") blank and hit the **Next** button to continue with the

QuickTime installation. When you run Deep Space Explorer itself for the first time, a different window will pop up asking for your name and registration number. You should now enter your Deep Space Explorer registration number from the back of the User's Guide and it will work fine.

**Registration Number**

Questions about the Deep Space Explorer registration number

**Where do I find my registration number for the program?**

Your registration number is on the last inside page of the Deep Space Explorer User's Guide. This page is colored to distinguish it from the rest of the book.

**How do I register my copy of Deep Space Explorer?**

Choose **Help->Registration** from the Deep Space Explorer menu and click the **Register Online** button. This allows us to notify you of any bug fixes, upgrades or new plugins for Deep Space Explorer.

**I want to move my copy of Deep Space Explorer to a new computer. How do I retrieve my registration number?**

Choose **Help->Registration**. Your name and registration number will be displayed.

## Installation Problems

Installing Deep Space Explorer on your computer.

### **I get an error message when I try to install Deep Space Explorer.**

This usually occurs if you have other applications or utilities running at the same time you run the installer. You should close all other applications, including any anti-virus software utilities, and then try to run the installer again. On Windows, type the Ctrl-Alt-Delete keys at the same time to bring up a list of tasks running on your computer. End every task in this list except “Systray” and “Explorer” and then then run the installer again.

### **What are the differences between the “Compact”, “Typical” and “Custom” installation options? (Windows only)**

“Typical” installs everything on your hard drive except for the 19 video clips which run in the Deep Space Explorer media player. These movies will not play unless you have the CD in the drive. This requires about 110 MB of hard disk space.

“Compact” installs everything in the “Typical Install” except for the electronic version of this User’s Guide. This requires about 105 MB of hard disk space.

“Custom” lets you install the 19 video clips on your hard drive, in addition to everything in the “Typical” install. If you choose this option, you will be able to play the video clips even if the CD is not in the drive. This requires about 550 MB of hard disk space.

## Updates/Upgrades

Updating to the latest version of Deep Space Explorer

### **How do I find out if I have the latest version of Deep Space Explorer?**

First determine your current version by choosing **Help->About Deep Space Explorer** from the menu. In the bottom left corner of the window that opens, there will be “Deep Space Explorer” followed by a code. The numeric part of this code is your version number. For example, if it reads “400”, you have version 4.0.0 of Deep Space Explorer. Then choose **Help->Check For Updates**, which will take you to the updates page on our website. The latest version will be listed, and you will be able to download any updates.

## General Run-Time Problems

Problems with the way the program runs

### **I get an error message when I try to run Deep Space Explorer.**

This usually means that your computer doesn't meet the system requirements for Deep Space Explorer. On Windows, the most common problem is a lack of RAM. You need at least 32 MB of RAM, and if you only have 32 MB, you should close all other applications before trying to run Deep Space Explorer. If you have a Macintosh, the most common problem is trying to run Deep Space Explorer on an older operating system. You need to have OS 8.6 or later to run Deep Space Explorer. If you are sure that your computer meets all the system

requirements, there may have been a problem with the installation. You should uninstall Deep Space Explorer and then reinstall from the CD. To uninstall on Windows, click the **Start** button on your desktop and choose

**Programs->Deep Space Explorer->Remove Deep Space Explorer**. On the Mac, you should drag both the "Deep Space Explorer" folder and the "System Folder\Prefs\Deep Space Explorer" folder into the trash.

After you have uninstalled Deep Space Explorer, reinstall it from the CD. You should first close all other applications, including any anti-virus software utilities. On Windows, type the **Ctrl-Alt-Delete** keys at the same time to bring up a list of tasks running on your computer. End every task in this list except "Systray" and "Explorer" and then then run the installer again.

#### **How do I run Deep Space Explorer?**

On Windows, just double-click the "Deep Space Explorer" icon on your desktop. You can also click the **Start** button on your desktop and choose **Programs->Deep Space Explorer->Deep Space Explorer**. On the Mac, just double-click the "Deep Space Explorer" application file that is inside the "Deep Space Explorer" folder.

#### **Deep Space Explorer runs very slow. Is there any way that I can speed it up?**

Upgrading your processor, video card and amount of RAM will all improve the performance of Deep Space Explorer. If you have an older video card, you may

also be able to speed up Deep Space Explorer by changing the number of colours in your display settings from "True Colour (24 bit)" to "High Colour (16 bit)". On Windows, you can change the number of colours by clicking the **Start** button on your desktop and choosing **Settings->Control Panel->Display**. Click the **Settings** tab and modify the "Colours" setting. If it is only the movie clips which are playing slow, you may wish to install these movies on your hard drive. To do this, insert the Deep Space Explorer CD and choose "Install Deep Space Explorer". Choose the "Custom install" option. This requires about 550 MB of hard disk space.

#### **Internet Database**

Deep Space Explorer's interactive Internet features

#### **When I choose Online Info for an object in Deep Space Explorer, it opens using Internet Explorer. How do I get it to use Netscape?**

Deep Space Explorer uses your "default Internet browser" to access our Internet database. If you want to use Netscape, you must make it your default browser. Learn how to do this for Macintosh:

[http://home.netscape.com/download/mac\\_instructions.html](http://home.netscape.com/download/mac_instructions.html)

or Windows:

<http://help.netscape.com/kb/consumer/19971009-21.html>

## Multimedia

Using the media player to view Deep Space Explorer videos, and creating your own images and videos.

### **When I change the size of the media player, the original window does not close.**

You need to adjust your QuickTime Player preferences. Open the QuickTime Player (on Windows, you do this by clicking the **Start** button on your desktop and choosing **Programs->QuickTime->QuickTime Player**). Choose

**Edit->Preferences->Player Preferences** and check the box reading "Open movies in new players".

### **The movies in the media player are a little choppy. Is there any way to make them smoother?**

This probably means that your computer is not reading the movie data from the CD fast enough. If you install the movie files on your hard drive, they should run smoother. To do this, insert the Deep Space Explorer CD and choose "Install Deep Space Explorer". Choose the "Custom install" option. This requires about 550 MB of hard disk space.

### **How do I save colour images from the program?**

Set up the screen so that it shows the image you wish to print out. Choose **File->Export as Image**. This opens a window which allows you to save the screen as a graphical image. The bottom left corner of this window has a dropbox which allows you to save the image in

several popular formats, such as a "jpeg" or a "pict". Once you have saved this image, you can open it with a program such as Internet Explorer and choose **File->Print**.

### **The Export as Image feature doesn't do anything. What's wrong?**

This feature will not work if you chose the "Minimum Install" option when you installed QuickTime. You should reinstall QuickTime and choose the "Recommended Install" option. **Export as Image** should then work properly.

### **Why do the movies I made with Deep Space Explorer have distorted colors when I play them back?**

This is a result of the compression method which you used when saving the movie. From within Deep Space Explorer, choose **File->Preferences->QuickTime movie preferences**. The "Compression Settings" window which opens allows you to modify the compression settings. The top dropbox in this window is the compression method. If you saw distorted colors in the movies you made, try changing the compression method. "Sorenson Video" is a good compressor which usually doesn't distort the original images noticeably. Also make sure that the "Quality" slider in the "Compression Settings" window is all the way to the right.

## Stars

Information on the star data in Deep Space Explorer

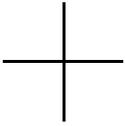
### **Where does the star data in Deep Space Explorer come from?**

The star data comes from the Hipparcos catalogue, which is the result of a recent mission by the European Space Agency. Find out more about this catalog at the Hipparcos Project home page:

<http://astro.estec.esa.nl/SA-general/Projects/Hipparcos/hipparcos.html>

### **When I zoom far away from the earth, the stars all appear to group together in a ball around the sun. Is this the Milky Way?**

No, this is a limitation of our star catalog. Deep Space Explorer has distances to about 30 000 stars from the Hipparcos catalogue. Most of the stars in this catalog are within a few hundred light years of the sun, so as you zoom out farther than this, they appear to cluster around the sun.



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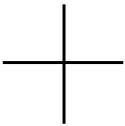
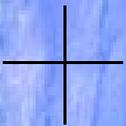
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