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WorldWide Telescope Data Files Reference

This document describes the data file formats used by the WorldWide Telescope. The files are XML files, and have the extension .WTML. Also covered are a few URL based controls that enable the sharing of single images without creating data files.

Data files are used to add to the default data and user experience of WorldWide Telescope. Data files are used to add single or multiple images -- either foreground images (typically single images referred to as *studies*) or background images (typically created from a large number of images, covering all or most of the sky, and referred to as *surveys*), to add tours (animated slide-shows), to create sign up files for communities (public or private groups that can share data), and to add simple or complex sets of data and links for those communities.

Collections Files

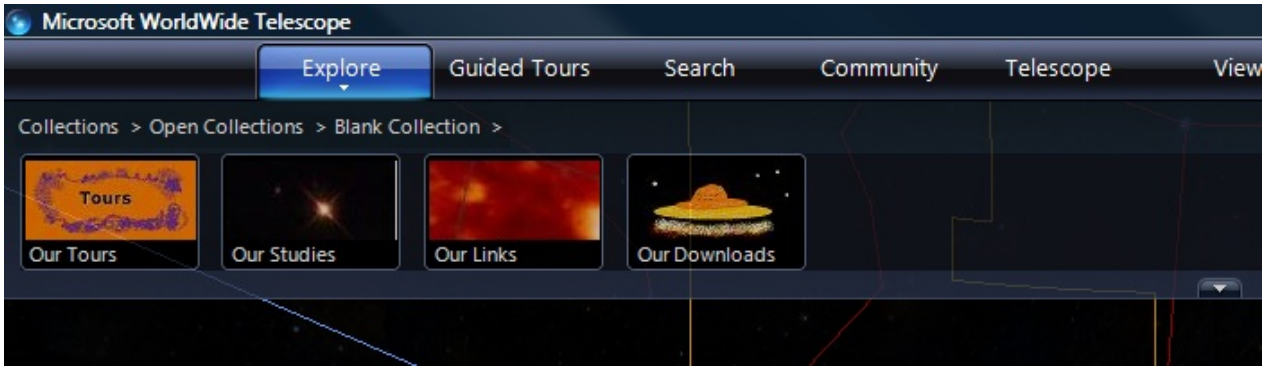
A collection is a friendly name given to a WTML file. WTML is the user-editable file format designed specifically for WorldWide Telescope. The **Explore** menu entry that WorldWide Telescope users will be very familiar with, is essentially a WTML browser.

Fairly simple examples of WTML files are those that contain only one type of object entry, for example a list of tours, or a list of studies. Potentially one of the most complex is a community payload file, which will often contain a hierarchy of folders, each folder containing a collection of sub-folders and objects. Objects can be tours, studies, panoramas, planets, all-sky surveys, and links. Examples of the most common types of WTML file are listed in the samples section.

Structure of a Collection File

A collection file is coded in xml, and is a hierarchical collection of **Folder** entries. The following example can be loaded into WorldWide Telescope and will appear as the image below, even though all the folders are empty. The example is based on a community payload file, though a very similar structure would apply to a hierarchical selection of tours or studies.

Note that the **Name** entries appear in the upper panel of WorldWide Telescope, and that one unique thumbnail image for each **Folder** is helpful (though not required, a default thumbnail will be used if none is provided), and more thumbnail images will be helpful for each entry within each **Folder**. A substantial number of thumbnail images can be necessary if the collection file is large.



Blank Collection.WTML

```
<?xml version="1.0"?>
<Folder
    Name="Blank Collection"
    Group="Explorer"
    Searchable="True"
```

```
    Type="Earth"
    Thumbnail="http://...../Images/T_Earth.jpg">

    <Folder
        Name="Our Tours"
        Group="Tour"
        Thumbnail="http://...../Images/T_Tours.jpg">

        <!-- Tour entries go in here -->

    </Folder>

     <Folder
        Name="Our Studies"
        Group="Explorer"
        Searchable="True"
        Type="Sky"
        Thumbnail="http://...../Images/T_Star.jpg">

        <!-- Studies go in here -->

     </Folder>

    <Folder
        Name="Context"
        Group="Search"
        Searchable="True"
        Browseable="False"
        Type="Sky">

        <!-- Context only entries go in here -->

    </Folder>

    <Folder
        Name="Our Links"
        Group="Explorer"
        Searchable="True"
        Type="Sky"
        Thumbnail="http://...../Images/T_Red.jpg">

        <!-- Link entries go in here -->

    </Folder>

    <Folder
        Name="Our Downloads"
        Thumbnail="http://...../Images/T_Saucer.jpg">

        <!-- Catalogs (pdf files, Word documents) go in here -->

    </Folder>
```

```
    <!-- Some top level place entries go in here -->

</Folder>
```

Places

A place is simply a location for the view. **Place** entries are used within Studies to contain imagery, but can be present in a collection file as viewing points without any additional images. **Place** entries can also be used to hold links to web pages (articles, supporting documents, community website, and so on).

The following shows an example of a **Place** entry in **Sky** mode (a view of the southern star Canopus).

XML	Description
`<Place`	
`Name = "Canopus"`	The name of the star.
`Thumbnail = "http://...../Images/T_star.jpg"`	A URL to a thumbnail image for use in the top panel.
`DataSetType = "Sky"`	Set this to Sky in order to use RA and Dec.
`RA = "6.3991667"`	Right ascension of the star, in decimal hours.
`Dec = "-52.6952778"`	Declination of the star, in decimal degrees.
`ZoomLevel = "60.0"`	The Zoom Level when viewing the feature. Zoom Level is six times the Field of View, so a Zoom Level of 60 will give a Field of View of 10.
`Constellation = "CAR"`	Determines the constellation to be shown in the Properties panel. Set to the three or four letter code specified in the Constellations table, CAR for Carina in this case.
`Classification="Star"`	One of a range of Classifications.
`Magnitude="-0.72"`	The *Apparent Magnitude* of the star. This field does not affect the view, but is simply information that is displayed in the Properties for the place.
`Distance="19604298.227"`	The distance to the star in astronomical units (AU). Multiply light years by 63239.6717 to get the distance in AU. This field does not affect the view, but is simply information that is displayed in the Properties for the place.
`</Place>`	

The following shows an example of a **Place** entry in **Planet** mode (the location of Olympus Mons on Mars).

XML	Description
`<Place`	
`Name = "Olympus Mons"`	The name of the feature.
`Thumbnail = "http://...../Images/T_mountain.jpg"`	A URL to a thumbnail image for use in the top panel.
`DataSetType = "Planet"`	Set this to Planet in order to use latitude and longitude.
`Lat = "18.0"`	The latitude of the feature, in the range -90 to 90 degrees.
`Lng = "133.0"`	The longitude of the feature, in the range -360 to 360 degrees.
`ZoomLevel = "60.0"`	The Zoom Level when viewing the feature. Zoom Level is six times the Field of View, so a Zoom Level of 60 will give a Field of View of 10.
`Angle = "45">`	The angle for the view. Zero, the default, will give a view vertically down to the planet surface. An angle of 45 degrees will angle the view up by 45 degrees.
`</Place>`	

The following shows an example of a **Place** entry containing a link (to a high definition image of a gully on Mars):

XML	Description
`<Place`	
`Url="http://hirise.lpl.arizona.edu/PSP_005957_1435"`	Link to the web page. This could be to an html web page, or to a document such as `.pdf` file.
`Thumbnail="http://...../Images/T_mars.jpg"`	Link to the thumbnail image.
`DataSetType = "Planet"`	This entry is optional, but should be present if the default of **Sky** is not correct for the data. If the user double-clicks the place thumbnail, then the mode will change to that set in this field before the web page is displayed. This mode change does not happen if the user single-clicks the thumbnail.
`Name = "Gully on Mars">`	Descriptive name of the web page.
`</Place>`	

Thumbnail Images

Thumbnail images are used frequently throughout WorldWide Telescope to provide an image to go along with a link, either in the top pane under Collections or Tours, or in the lower pane as part of a context search. Typically if you prepare your own data you may well create a thumbnail image for it - usually be taking a screen shot then capturing a rectangle of interest to match the fixed sizes of the thumbnails given in this document. Note that URL entries for thumbnails should always reference the full path, and not a relative path.

An alternative is to request a thumbnail image from the thumbnail server. This is done by entering appropriate text at the end of the following query (the example requests a thumbnail where the title contains the word "Mars"):

```
http://www.worldwidetelescope.org/wwtweb/thumbnail.aspx?name=Mars
```

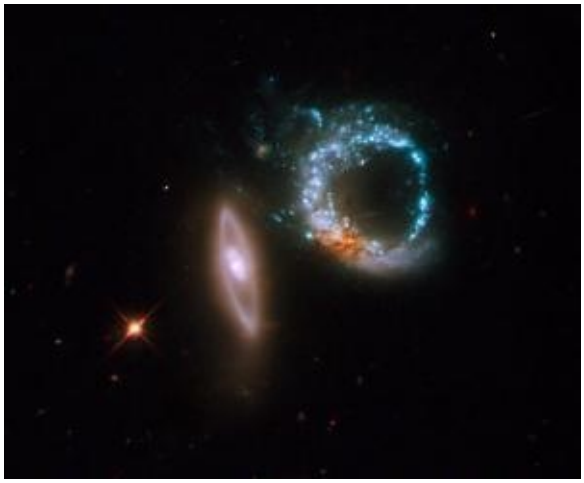
If a thumbnail image is not found containing the supplied text, as suitable default is used.

Studies

Study images are stored in image pyramids. Given an W x H pixel study, it is represented as an N x N pixel image where N is the smallest power of 2 that is at least as big as W and H. In mathematical terms, N = 2^ceiling(log_2(max(W,H))). In simpler terms, if a study image is 958 by 768 pixels, it will be embedded in a 1024 x 1024 square bitmap. The extra area not covered by the W x H photograph is occupied by transparent pixels. This forms the lowest level of the pyramid, with each level up containing a lower-resolution version of the original image with half the height and half the width of the image at the previous level. At each level, the image is further divided up into 256 x 256 tiles.

The process of dividing up an image into this pyramid of tiles can be done using the Study Chopper tool. This tool not only creates the correct tiles, but places them in the required directory structure, and outputs sample WTML files to load them into WorldWide Telescope. The Study Chopper tool is included with the WorldWide Telescope May 2009 ADK.

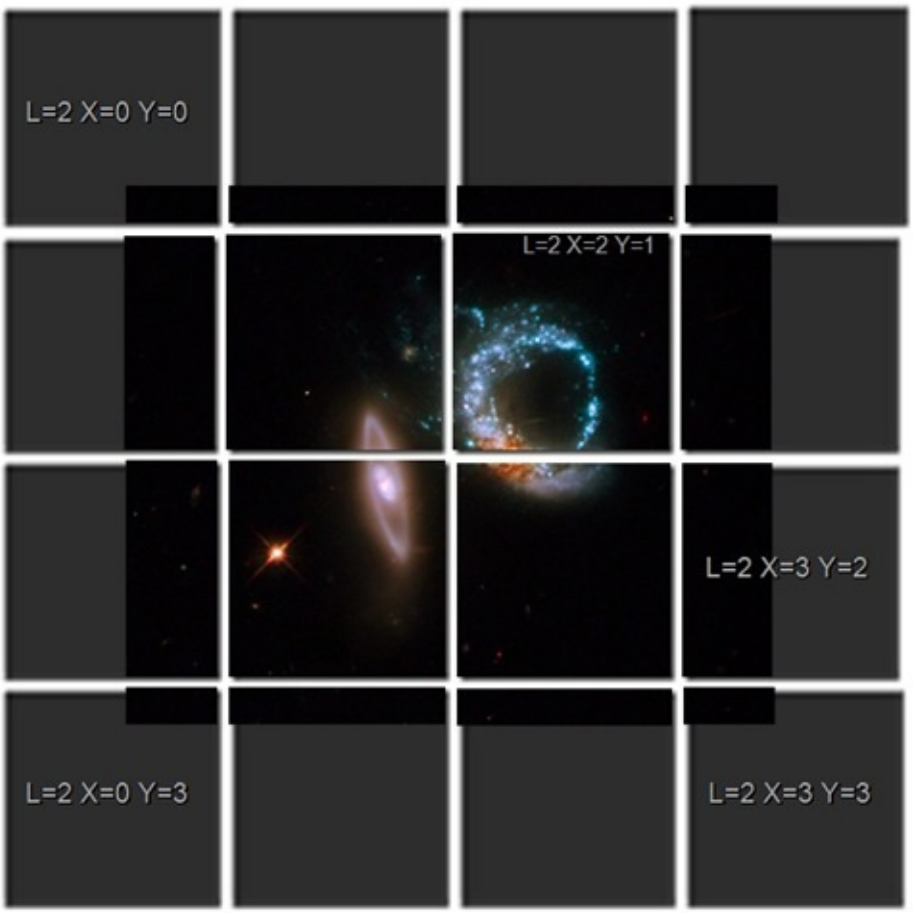
For example, suppose we had a 1457 x 1201 study image, such as this Spitzer image of Galaxy NGC 4579.



This image should be embedded in a 2048 x 2048 image and stored in a pyramid with four levels 0, 1, 2, 3.

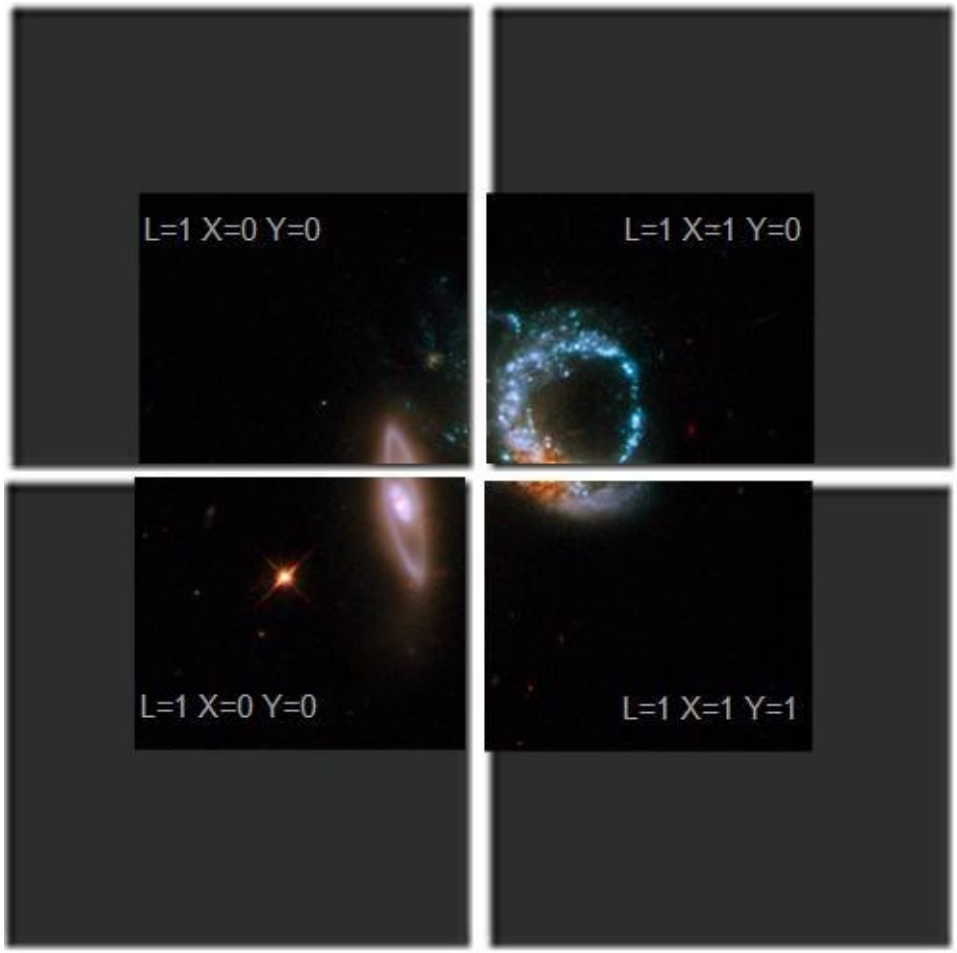
At level 3 there would be 64 256 x 256 tiles containing the entire image (no image is shown here for this level). The location is about Right Ascension 47.83 degrees (3h 11m 19s) and Declination 1.32 degrees (1d 18m 53s) in J2000 coordinates, and it is about 20 arc seconds wide.

Level 2



At level 2 there are 16 256x256 tiles representing a down-sampled 1024 x 1024 version of the image. The grey shadows show the transparent regions. Some of the tiles have been labeled with X and Y coordinates between 0 and 3 -- which is how individual tiles of the pyramid are addressed at each level.

Level 1



At level 1 there are 4 256x256 tiles representing a further down-sampled 512 x 512 version of the image.

Level 0

At level 0 there is a single down-sampled 256x256 version of the image.

The following table describes how the Galaxy NGC 4579 image might be entered into a date file. The **Place** entry should be considered the position of the view, and the **ImageSet** entry the position of the image itself.

XML	Description
`<?xml version="1.0"?>`	
`<Folder`	The **Folder** tags determine the structure of the hierarchy
`Name="Galaxies"`	Enter a suitable project name.
`Group="Explorer"`	Usually set to **Explorer**.
`Searchable="True"`	Set to **True** if the study should be located by the WorldW Telescope search feature. This feature is not currently im
`Type="Sky">`	One of:**Sky**, **Planet**, **Earth**, **Panorama**, **Survey**
`<Place`	
`Name="Spitzer image of Galaxy NGC 4579"`	The name that will be used as a title for the thumbnail in panel of WorldWide Telescope, and the string that will be recognized by a JScript web control.
`DataSetType="Sky"`	One of: **Sky**, **Planet**, **Earth**, **Panorama**, **Survey**
`RA="3.1885833 "`	Right ascension, in decimal hours, of the center of the vi the study. To be the center of the image divide the RA of (**CenterX**) in the **ImageSet** tag (which is in degrees) by
`Dec="1.31471944444444 "`	Declination, in degrees, of the viewpoint for the study. Th often equals **CenterY** from the **ImageSet**.
`Constellation="CET"`	Determines the constellation to be shown in the Study Pr panel. Set to the three or four letter code specified in the Constellations table.
`Classification="Galaxy"`	One of a range of Classifications.
`Magnitude="0"`	This field does not affect the view, but is simply informati the original picture that can be displayed in the Propertie image.
`Distance="0"`	This field does not affect the view, but is simply informati the original picture that can be displayed in the Propertie image.
`ZoomLevel="0.2"`	Distance away from the image of the view. Note **ZoomL Field of View** refer to the same thing. The higher the zoo greater distance the viewpoint is away from the image. M field of view is 60 degrees, the minimum is just below 0.0
`Rotation="0"`	Rotation of the view camera in degrees. Refer to the ima how rotating the view camera, and rotating the image, co
`Opacity="100"`	Set to 100 for full opacity (no transparency). An entry of example, would mean 50% transparency.
`Angle="0"`	Up and down angle of the view camera if relative to the s planet. Has no effect on a sky view Negative angles are
`AngularSize="0">`	

`<Target>Undefined</Target>`	The default is **Undefined**, but can be one of: **Sun**, **Merc** **Mars**, **Jupiter**, **Saturn**, **Uranus**, **Neptune**, **Pluto**, **Moon**, **Europa**, **Ganymede**, **Callisto**, **IoShadow**, **EuropaShad** **GanymedeShadow**, **CallistoShadow**, **SunEclipsed**, **Ea** **Custom**, **Undefined**
`<ForegroundImageSet>`	Contains one or more **ImageSet** entries, describing the f image.
`<ImageSet`	Description of a single image.
`Generic="False"`	For foreground images this should be set to **False**.
`DataSetType="Sky"`	One of:**Sky**, **Planet**, **Earth**, **Panorama**, **Survey**. Note that images are currently only rendered in **Sky** mod
`BandPass="Visible"`	The primary wavelength. One of: **Gamma**, **XRay**, **Ultrav** **Visible**, **HydrogenAlpha**, **IR**, **Microwave**, **Radio**. Note that only one entry can be made, even if the image composite of several wavelengths.
`Url="_path._png"`	A URL that contains a link to the 256 x 256 tile pyramid c image. In this case, it is a path to an image on the web, b any URL (for example, a local path or a SQL query) that the size of the pyramid coded in the {} parameters. This path similar to: `http://research.microsoft.com/...../530919080/{2}/{3}/{`
`TileLevels="3"`	The maximum level of the image pyramid used to store t The example study uses 4 levels numbered 0 to 3, so **Ti** 3.
`WidthFactor="2"`	Legacy entry. Set to **2**.
`Sparse="True"`	This is a hint to the rendering system, **True** indicates tha is a study and will only appear on a section of the sky.
`Rotation="-5.0799999999867"`	Angle in degrees at which image is inclined. A positive nu rotate the image to the left, negative to the right (refer to example images below).
`QuadTreeMap=""`	If the tiling of the image is processed using the LX, LY co system, this entry should be ignored or left as an empty s tiling is processed using a quad tree then this entry shou coding of how the quad tree is organized (for example, **QuadTreeMap="0123"**). Note that the Study Chopper to LX,LY system.
`Projection="Tangent"`	For studies this should always be set to **Tangent**, as stu tangentially projected. One of: **Mercator**, **Equirectangul** **Tangent**, **Tan**, **Toast**, **Spherical**, **SkyImage**, **Plotted**.
`Name="Galaxy;Galaxy NGC 4579;NGC 5479"`	Semicolon separated list of words or phrases that can be a search.
`FileType=".png"`	One of ".jpg" or ".png". The period is optional.
`CenterX="1.3146065774006597"`	Right ascension of the center of the image, in decimal de

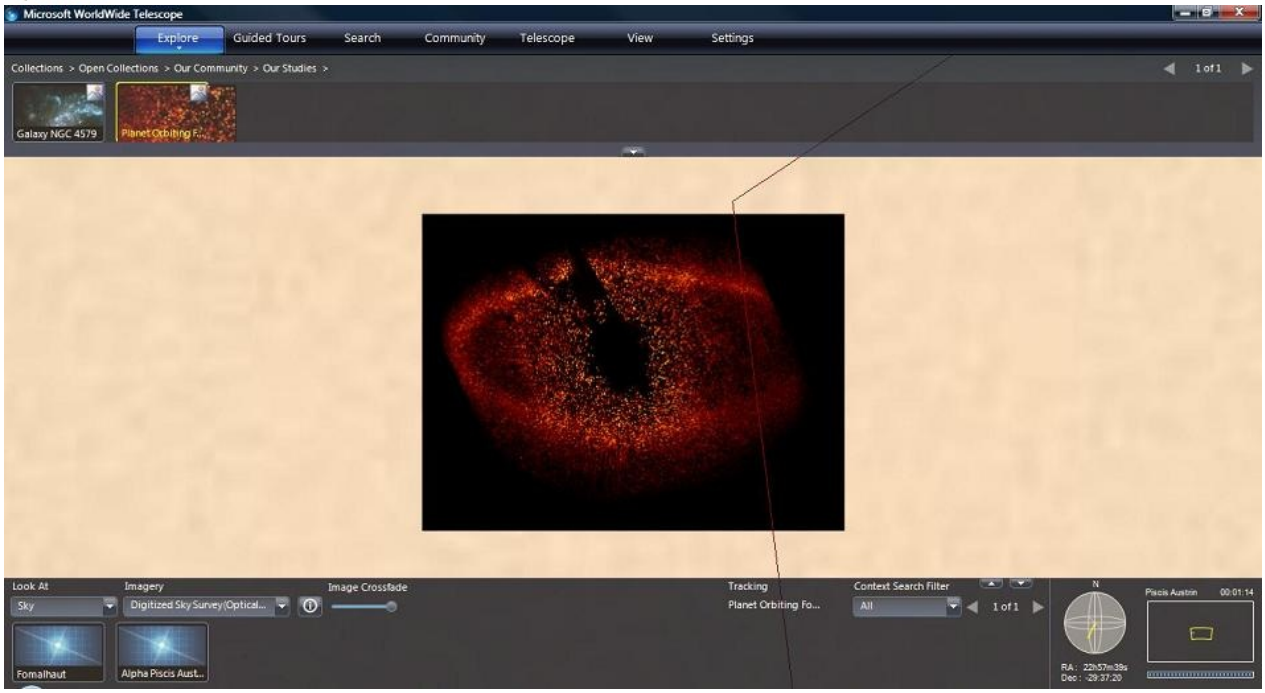
`CenterY="47.828862896748753"`	Declination of the center of the image, in decimal degree
`BottomsUp="False"`	Set to "True" if the image should be inverted.
`OffsetX="-0.00277778"`	**OffsetX** and **OffsetY** will normally both be zero, indicatir **CenterX** and **CenterY** position applies to the very center image. The image can be offset from the center by enter zero value for either of these entries, which are then add **CenterX** or **CenterY** to place the image in the view. Refe example image below.
`OffsetY="-0.00277778"`	
`BaseTileLevel="0"`	Usually 0, for the index of the first level of tiling. Refer to structure output from the Image Chopper tool (explained WorldWide Telescope Data Tools Guide).
`BaseDegreesPerTile= "0.02842076047738">`	This is the number of degrees of declination that the top pyramid occupies on the sky. Each Study is embedded ir 2^n x 2^n image. This is also the number of degrees of d that that larger image occupies on the sky. Use the formu *(Height of image in arc minutes * largest image size)/(60 height) = degrees*. For example, an image 1200 pixels high set in a 2048 sc that occupies one arc minute of the sky: (1 * 2048)/(60 * 0.0284 degrees.
`<Credits>"NASA, ESA, and M. Livio (STScI) /Line2/Line3 Data were taken 2009." </Credits>`	Brief description of where the image came from, who ma date it was taken, and so on. Add "/" characters to show credits should appear on different lines.
`<CreditsUrl>"path.html" </CreditsUrl>`	URL to a site that might give more information on the ima
`<ThumbnailUrl>"path.jpg" </ThumbnailUrl>`	A link to an image (96 wide x 45 in height) for use as a th
`</ImageSet>`	
`</ForegroundImageSet>`	
`</Place>`	
`</Folder>`	

The following images give examples of how the appearance of an image can be changed by varying some of the parameters.

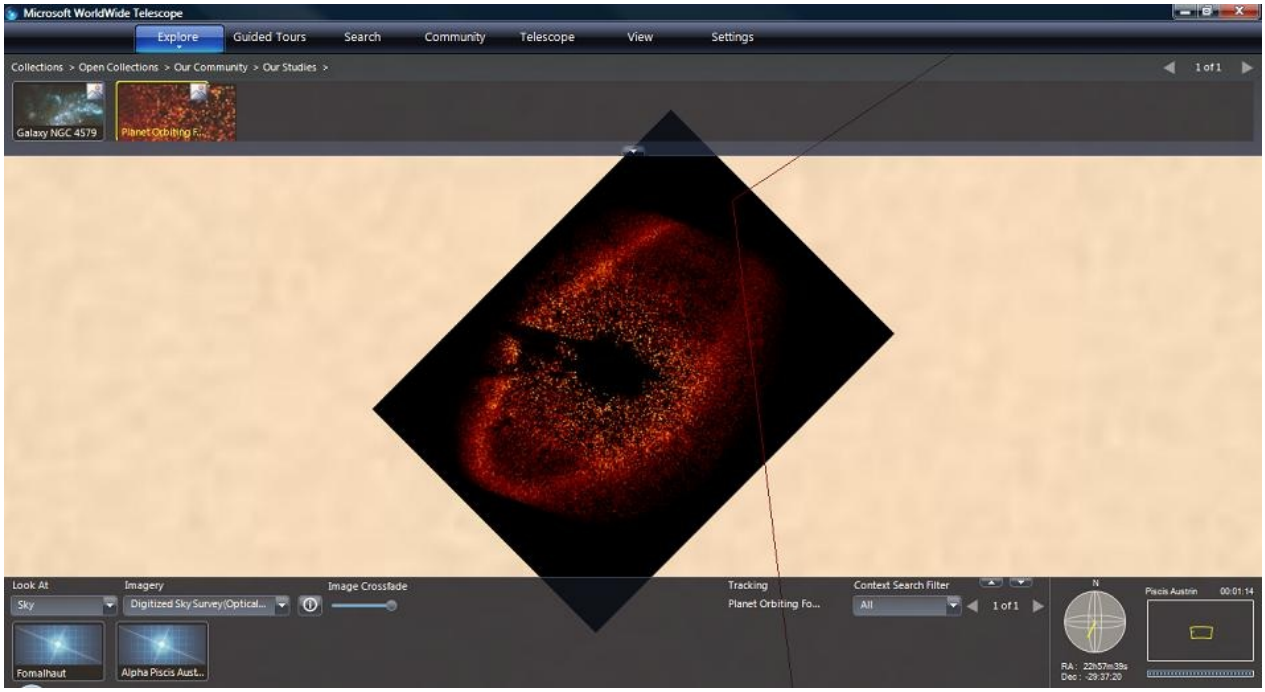
Image Manipulation

The following text shows the starting point, with the resulting image shown below.

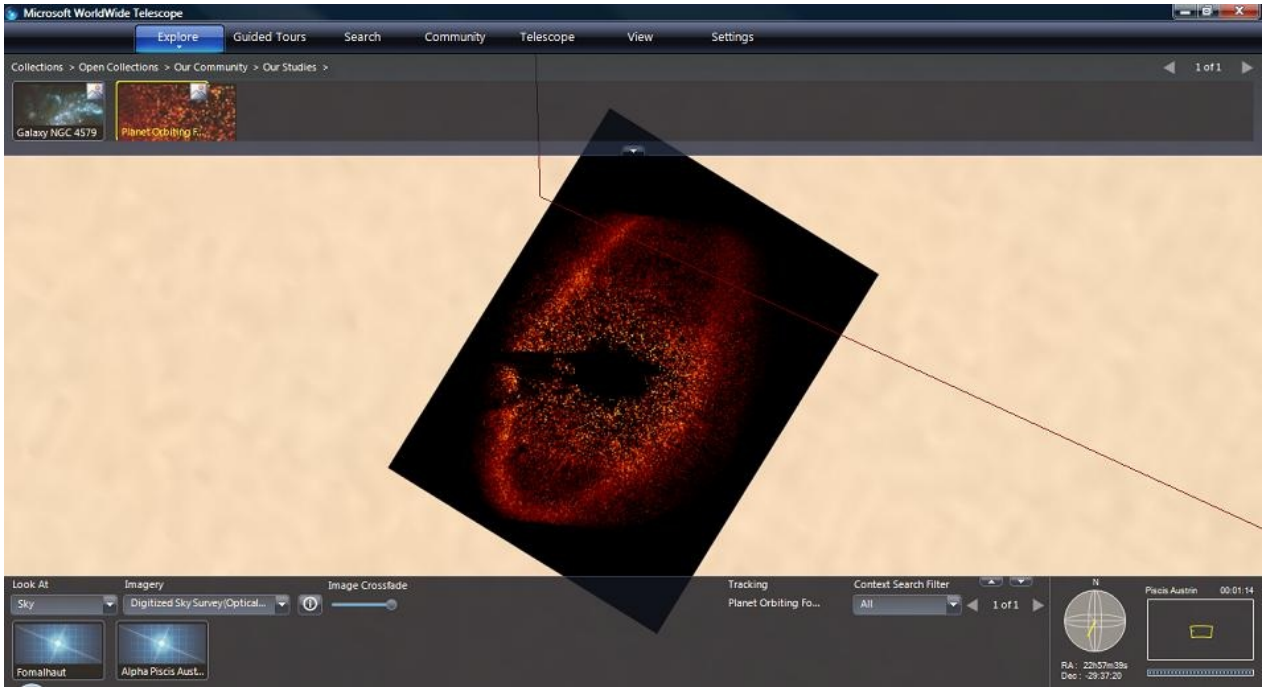
```
<Place
        Name="Planet Orbiting Fomalhaut"
        DataSetType="Sky"
        RA="22.9608472222222"
        Dec="-29.6222361111111"
        ZoomLevel = "0.123333333333333"
        Opacity="100"
        Constellation="PSA"
        Classification="Unfiltered"
        Magnitude="0"
        Distance="0"
        Rotation="0"
        Angle="0"
        AngularSize="1"
        Thumbnail="G:\Peter\Images\T_Fomalhaut.jpg">
          <ForegroundImageSet>
                  <ImageSet
                        DataSetType="Sky"
                        BandPass="Visible"
                        TileLevels="4"
                        Url="http://research.microsoft.com/~dinos/wwtexp/934203617/{1}/{3}/{3}_{2}.png"
                        CenterX="344.412708333333"
                        CenterY="-29.6222361111111"
                        Rotation="0"
                        BaseDegreesPerTile="0.0220985710119568"
                        BaseTileLevel="0"
                        FileType=".png"
                        WidthFactor="2"
                        Sparse="True"
                        QuadTreeMap=""
                        Projection="Tangent"
                        Name=""
                        BottomsUp="False"
                        OffsetX="0"
                        OffsetY="0">
                        <Credits>"NASA, ESA, P. Kalas (UC Berkeley) et. al."</Credits>
                        <CreditsUrl>"http://hubblesite.org/newscenter/archive/releases/2008/39"</CreditsUrl>
                  </ImageSet>
          </ForegroundImageSet>
</Place>
```



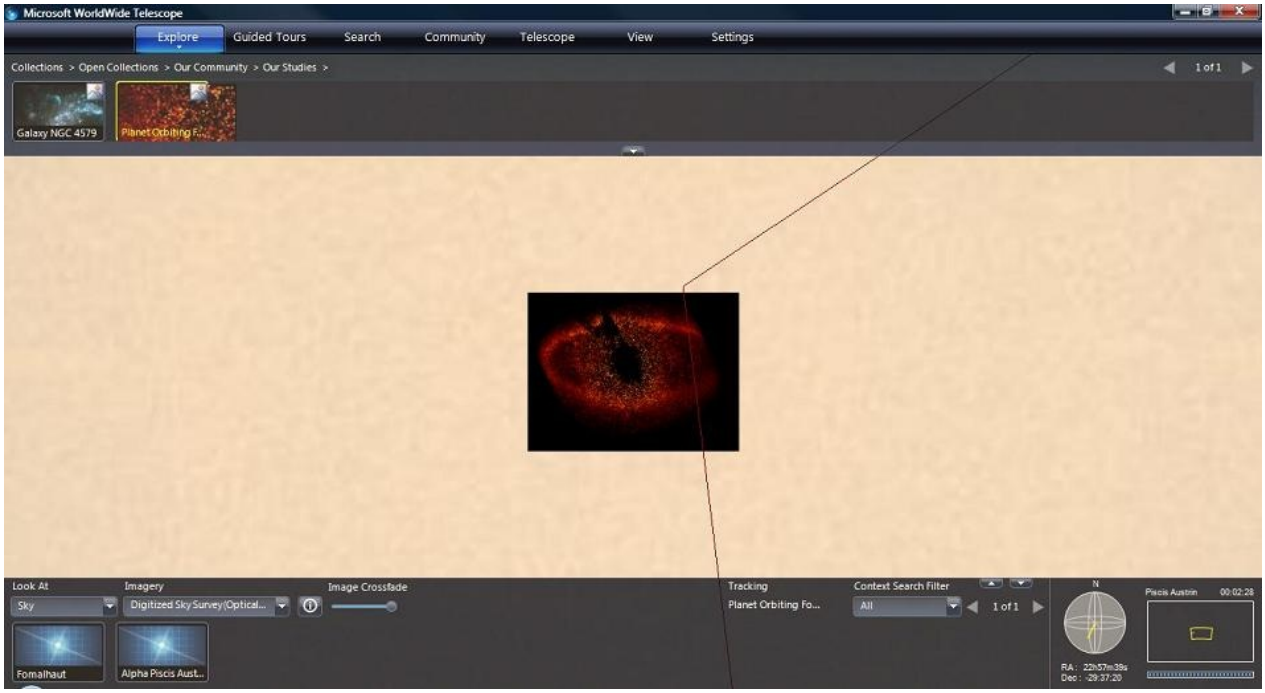
Changing the **Rotation** entry of the **ImageSet** to 45 will result in a 45 degree left rotation. If the **Rotation** was set at -45, the rotation would be to the right.



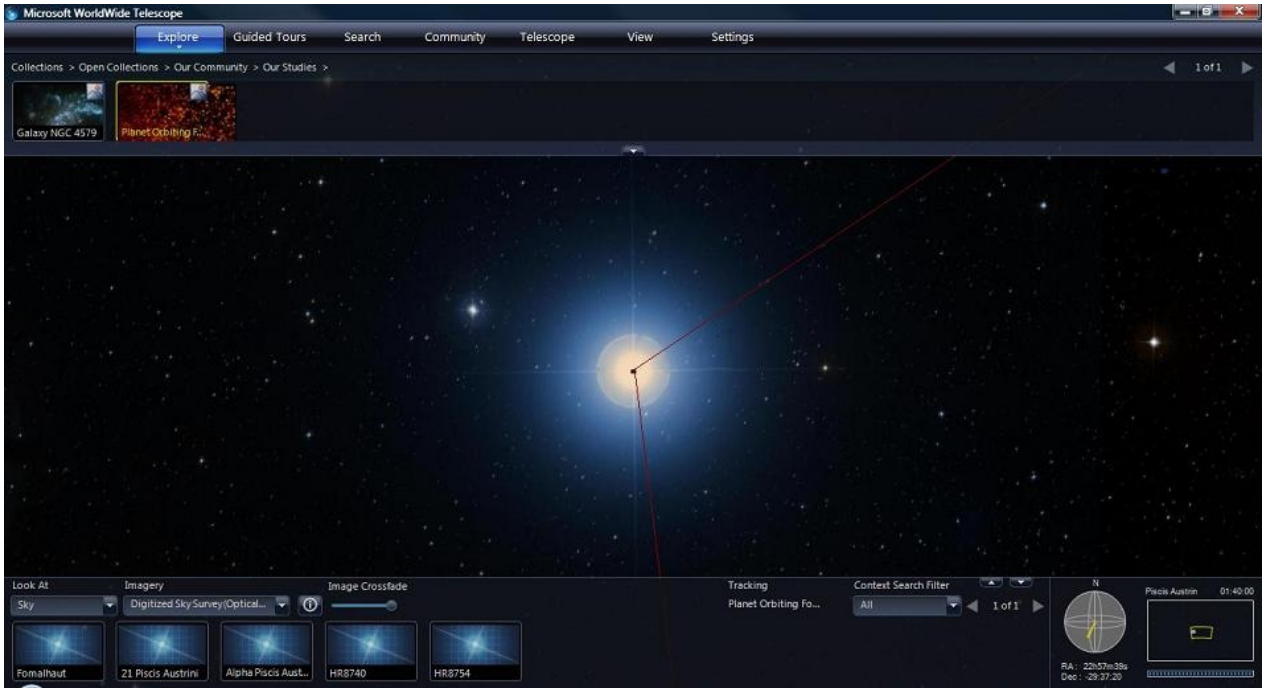
Leaving the **ImageSet Rotation** at zero, and changing the **Place Rotation** to -45 degrees, results in the following image. Note the apparent variation in the angle of the image, as the view is not perfectly aligned with the center of the image.



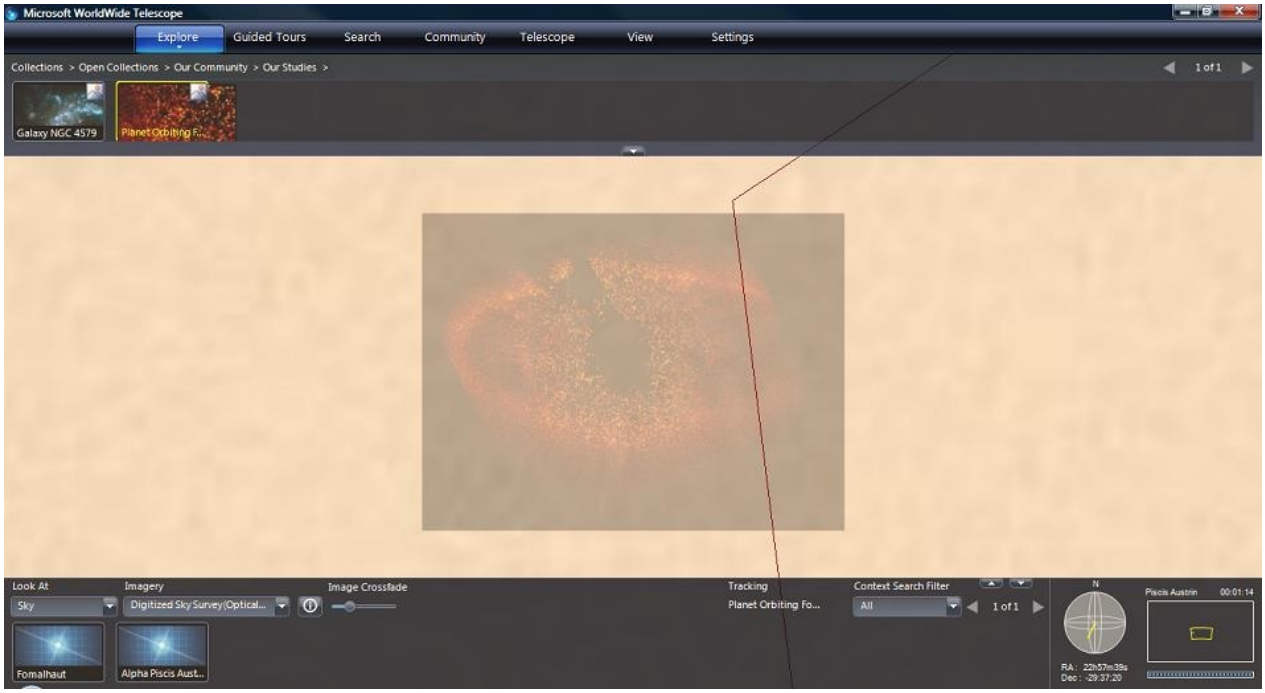
Leaving both rotation values at zero, and doubling the **ZoomLevel** to 0.246666:



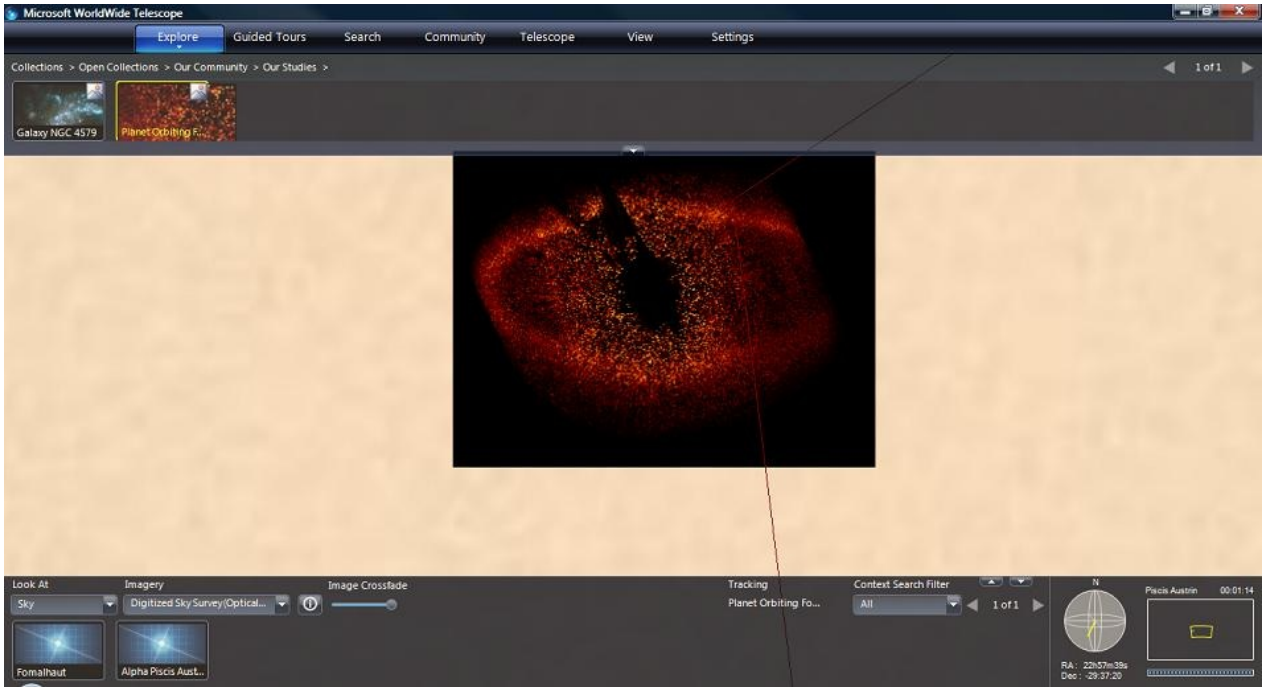
Changing the **ZoomLevel** to 10 results in a much more distant image:



Changing the **Opacity** setting for the view to 25 (percent):



Applying an offset to the image (**OffsetX** = 0.001, **OffsetY** == 0.002), results in a slight displacement of the image up and to the right.



Surveys

Surveys typically contain image data for the entire sky. The most popular surveys are inevitably at the visual wavelengths, however there are many other options at non-visible wavelengths -- such as radio, x-ray, gamma, and so on. Comparing the visual appearance of an object with a graphical representation of one of the non-visible wavelengths is an important feature of WorldWide Telescope.

This section describes the WTML file format used to contain survey data.

Survey Data

Preparing a full sky survey involves a huge amount of data collection and preparation, and a comparatively simple WTML collection file to render it. The Toast projection system for survey data is described in the WorldWide Telescope Projection Reference, and the Sphere Toaster tool used to prepare data is described in the WorldWide Telescope Data Tools Guide.

Similar to studies, the source image data is converted into an image pyramid for ease of rendering.

The WTML collection file used to render a survey is simpler than that for a study, as no positional data is needed. The orientation of the survey is determined using the Sphere Toaster tool.

There are few differences between the contents of a WTML file containing a study or a survey. In particular note that the **Projection** entry is set to **Toast** rather than **Tangent.**

```
<?xml version='1.0' encoding='UTF-8'?>
<Folder Name="TestSurvey">
   <ImageSet
     Generic="False"
     DataSetType="Sky"
     BandPass="Visible"
     Name="A Test Survey"
     Url="path to ..... \TestSurvey\{1}\{3}\{3}_{2}.png"
     BaseTileLevel="0"
     TileLevels="2"
     BaseDegreesPerTile="180"
     FileType=".png"
     BottomsUp="False"
     Projection="Toast">
     <Credits>Microsoft</Credits>
     <CreditsUrl>www.microsoft.com</CreditsUrl>
     <ThumbnailUrl>path to ..... \testsurvey.jpg</ThumbnailUrl>
     <Description />
   </ImageSet>
</Folder>
```

Tours

The actual content of a tour is stored in a .WTT file. These files include a lot of binary information and are not designed to be human-readable. However, WTML files can contain references to tours. These references can be used in conjunction with a set of images, so

that an appropriate tour or range of tours is available for the new image data (the references to the new images are embedded in the WTT file). Alternatively of course tour collections can be put together for existing image data.

All but two of the parameters in a **Tour** entry are optional, and are identified in the table.

XML	Description
`<?xml version='1.0' encoding='UTF-8'?>`	
`<Folder`	Top level Folder
`Name ="Samples">`	**Open Collections > Samples```
`<Folder`	Tour Folder
`Name="Our Tours"`	This name will appear as part of the location string in the UI of WorldWide Telescope. For example: `Open Collections > Samples > Our Tours`
`Group="Tour">`	Enter **Tour**.
`<Tour`	
`Title="Apollo Missions"`	Name of this tour. Not required but very helpful.
`ID="8939B405-9261-49d4-A7C4-52847A51A08A"`	**Required**. Enter a Guid to uniquely identify the tour. The Visual Studio Tools/Create Guid utility is a good way of generating Guids.
`Description="Brief history of Apollo missions"`	Brief description of the tour. If the description is longer than one line in the properties dialog, it will be wrapped and justified appropriately.
`Author="A.N. Author"`	Author's name.
`OrganizationName="Microsoft Research"`	Name of the organization, can be left empty.
`AverageRating="4"`	Rating, out of five, for the tour.
`AuthorImageUrl ="http://research.microsoft.com/....jpg"`	A link to a thumbnail image, 72 pixels wide by 96 in height, of the author.
`ThumbnailUrl =”http://research.microsoft.com/....jpg”`	A link to a thumbnail image, 96 pixels wide by 45 in height, for the tour. The bold "T" (for *tour*) in the top right hand corner is added by WorldWide Telescope, so should not be included in the thumbnail.
`TourUrl ="http://research.microsoft.com/....WTT"`	**Required**. Link to the .WTT file containing the tour.
	The approximate length of the tour in

`LengthInSecs=”243”`	seconds. This entry is only used in the tour properties dialog, as information for users.
`RelatedTours="26BB4C2E-52F1-4fdf-8C99-31556E791FC6;26BB4C2E-52F1-4fdf-8C99-31556E791FC7"`	List of related tours identified by their ID entry. This feature is currently only implemented for the default tours.
`</Folder>`	
`</Folder>`	

The following example shows the minimal meaningful information necessary to add a **Tour** entry.

```
<Tour
      Title="A Wild Ride"
      ID="AD143D7D-38DC-4dd5-A6E0-3AFC81E72E07"
      Description="A race through the galaxies."
      Author="A.N. Author"
      TourUrl="http://...../GalaxyRace.wtt"  />
```

Default Tours

The default tours used by the Windows version of WorldWide Telescope are held in the *tours.WTML* file, in the following locations:

Windows Vista: **C:\Users\\AppData\Local\Microsoft\WorldWideTelescope\data**

Windows XP: **C:\Documents and Settings\\Local Settings\Application Data\Microsoft\WorldWideTelescope**

Currently there is not a supported process to add your own tours to this file.

Communities

Communities are the primary way in which WorldWide Telescope users can share data and tours with each other. Communities can be made by any user, but typically are individuals or organizations, such as planetariums, science centers, astronomy clubs, magazines, bloggers, schools, classes, and for class projects. There is no limit to the number of communities that can be set up.

Setting up a Community

You can set up your own community using your own servers and without any contact with Microsoft. However, you may prefer to have your community listed it on the WorldWide Telescope Community Directory (a subset of which is shown on the WWT Support page). To do this, send an email to **WWTCommunity@microsoft.com**, requesting that your

community be listed. To be considered for inclusion in the community directory, community sites must maintain standards in terms of quality, scalability, and content appropriateness. These standards include:

- Sign-up membership can be required by your community, but community access must remain free for all users.
- Community content must be well moderated, free of hate speech, and reflect currently accepted astronomical information/theory. The installation must have sufficient capacity for handling projected traffic.
- The community must make use of integrated WorldWide Telescope features such as tours, sky-aligned images, and so on. Not just simple HTML links to existing web content.

To set up a community go through the following steps:

Step 1: Set the Mime Types

To set up a community, you should first add the WorldWide Telescope file extensions to the mime types on your server.

File type	File extension	Mime-Type
WWT Collections (and Communities)	.WTML	application/x-wtml
WWT Tours	.WTT	application/x-wtt
WWT Constellation Figures	.WWTFIG	application/x-wwtfig

Step 2: Create a Thumbnail Image

Create a thumbnail image for the community. This should be 176 wide by 45 pixels in height.

 Sample community thumbnail.

Step 3: Create a Payload File

The payload file contains the main content for a community. This file determines the folder structure, images, tours, community metadata, and so on. In its simplest form, a payload file can be a static WTML file that is hand-edited on the server side. Alternatively it can be generated from a database, and so might be much easier to update regularly.

Typically payload files contain the following:

- Tours
- Study Images
- Surveys
- Panoramas
- Places: lists of locations (**Place** entries without an **ImageSet**)
- Catalogs
- Constellation figures (files with the WWTFIG extension)
- Links to articles or the organization's website
- Links to Blog entries, forums, conversation threads, discussion boards

A sample community payload file is Community Payload.html.

Step 4: Create a Signup File

A signup file is a short WTML file that points to the thumbnail and payload files, and gives the title of the community. The following table shows a sample signup file, based on the signup file for the WWT Data Community.

XML	Description
`<?xml version="1.0" encoding="UTF-8"?>`	
`<Folder`	One Folder entry.
`Name= "WWT Data Community"`	Name of the community.
`Group="Community"`	Set to **Community**.
`Thumbnail= "http://research.microsoft.com/..../wwtdatacommunitylogo.jpg"`	Full URL of the community thumbnail.
`Url= "http://research.microsoft.com/..../wwtdata_payload.wtml"/>`	Full URL of the payload file.

A sample community signup file is also listed at Join Our Community.html.

Step 5: Accessing the Community

The signup file should be placed in a web-accessible location, and appropriately linked to from your institution/organization/club website.

Including Other WTML Files

A WTML file can include references to other WTML files, which can then be used to build up collections of collections, or add studies and surveys to a community payload file, for example. To include another WTML file in a collection, add the following entry:

XML	Description
`<?xml version="1.0" encoding="UTF-8"?>`	
`<Folder`	
`Name="Name of collection"`	A friendly name for the file to be included.
`Group="Explorer"`	For most included files this should be set to **Explorer**.
`Url="http:/..../filename.wtml"`	Path to the file to be included. This can be a local path or http address.
`Thumbnail="http:/...../thumbnail.jpg" />`	Thumbnail image to use in the top pane. Note the closing bracket for the folder entry.

WTML Samples

The following table lists the samples that can be used as a starting point for WorldWide Telescope WTML file development.

Click on the **Sample Name** to view the source. Note that paths may need to be changed for the samples to work, these paths are highlighted by comments in the sample code.

Sample Name	Description
WTML Blank Collection	Shows the hierarchy of a collection, without any content.
WTML Sample Study	Shows a collection of two studies. One image at the center of Pisces and one at the center of Aquarius.
WTML Sample Tour Collection	Shows a collection of two tours.
WTML Sample Panorama Survey	Shows a collection containing a single panorama.
WTML Join Our Community	Shows a community signup file.
WTML Community Payload	Shows a community payload file that can be used as a starting point for a new community. The community includes tours, studies, downloads and links.

Sharing Views

There are two single URL based controls, **Goto** and **ShowImage** that enable the sharing of views by simply providing recipients with the URL. **Goto** is the simpler of the two, and enables a link to a particular point in space (RA, Dec and Zoom) to be captured, and then sent, for example, by email. **ShowImage** is similar, but includes more information (including a link to an image) that enables the sharing of that single image, without the need to write a WTML data file or create a community. If a valid data file does exist, a command line parameter can be used to initiate the Windows Client version.

Goto

To capture a link from WorldWide Telescope, right click to bring up the **Finder Scope**, select **Research** then **Copy Shortcut** from the menu. This will encode the current view into a URL.

The base of the URL is as follows:

```
http://www.worldwidetelescope.org/wwtweb/goto.aspx?
```

Following this there are four required parameters, separated by the ampersand (&) symbol:

Required Parameter	Description
`object=string`	Name to appear on the thumbnail, under **Collections > Open Collections > Link Collection**.
`ra=double`	Right ascension (RA) of the view center.
`dec=double`	Declination (Dec) of the view center.
`zoom=double`	Zoom factor (6 x Field of View).

Optional Parameter	Description
`wtml=true`	The default behavior is that this will open the image in the Windows Client version of WorldWide Telescope, rather than the Web Client version. This assumes that the mime-type for WTML files is set to the Windows Client.

For example:

```
http://www.worldwidetelescope.org/wwtweb/goto.aspx?
object=NGC117&ra=0.453&dec=1.333888889&zoom=0.157005192359341
```

If the receiver of the email clicks on this link, it should open up the Web client version of WorldWide Telescope, and provide a thumbnail that can be selected for the specified view to be rendered:

Note that the shortcut can be captured from either the Windows Client or Web Client versions of WorldWide Telescope. Clicking on the link will open up the Web Client version unless the **wtml=true** parameter is set.

Show Image

The **ShowImage** control enables an image to be shared, by embedding information about the image in a URL. The URL could then, for example, be emailed to colleagues who could then view the image in WorldWide Telescope simply by clicking on the link. Unlike **Goto**, there is no automated way of creating the URL from within WorldWide Telescope.

Of course the image, and optionally a thumbnail of it, must be web accessible for this to work. The image should also have a maximum size of 2048 x 2048 pixels. If larger sized images are required, then WTML data files should be set up to tile the image correctly (refer to the WorldWide Telescope Data Tools Guide).

The base of the URL is as follows:

```
http://www.worldwidetelescope.org/wwtweb/ShowImage.aspx?
```

Add to this base the following parameters, with an ampersand (&) between each parameter.

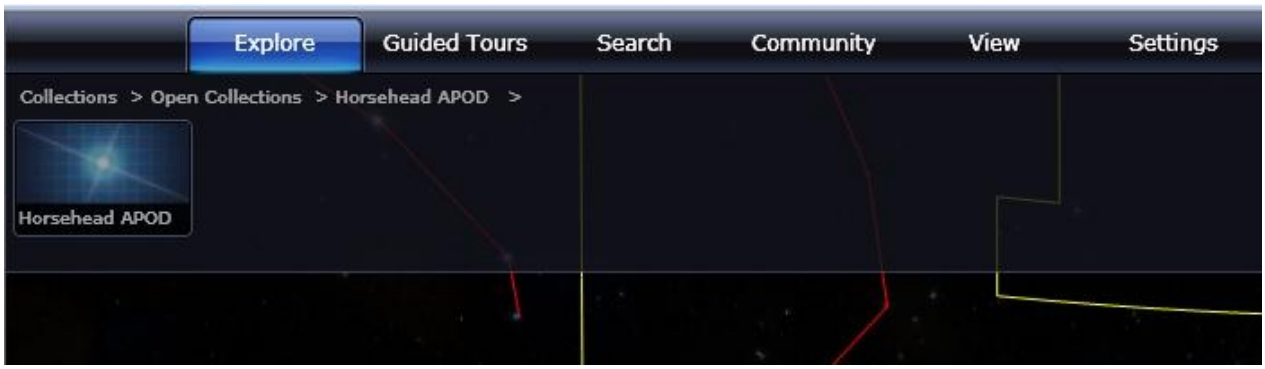
Required Parameter	Description
`name=string`	User friendly, but relatively unique name.
`ra=double`	Right ascension (RA) of the image center (or tangent point) from the plate solution.
`x=double`	Pixel position corresponding to the RA.
`dec=double`	Declination (Dec) of the image center (or tangent point) from the plate solution.
`y=double`	Pixel position corresponding to the Dec.
`scale=double`	Arc seconds per pixel from the plate solution.
`rotation=double`	Rotation east of north.
`imageurl=string`	URL encoded link to the original image at the scale and size of the image described in the rest of the URL.

Optional Parameter	Description
`wtml=true`	The default behavior is that this will open the image in the Windows Client version of WorldWide Telescope, rather than the Web Client version. This assumes that the mime-type for WTML files is set to the Windows Client.
`thumb=string`	Link to the thumbnail image. The thumbnail should be 96x45 pixels.
`credits=string`	Appropriate credit text.
`creditsUrl=string`	Link to the credit information or image page.
`reverseparity=Bool`	True inverts the image, False is the default.
`goto=Bool`	True indicates that WorldWide Telescope will slew and zoom on the image only. False (the default) indicates that the image thumbnail will appear under **Open Collections** and the user must select this to slew and zoom to the image. False also indicates that the user can save the image to their own collections.
`debug=Bool`	True indicates that the WTML file will be shown, rather than launched. False is the default.

Examples

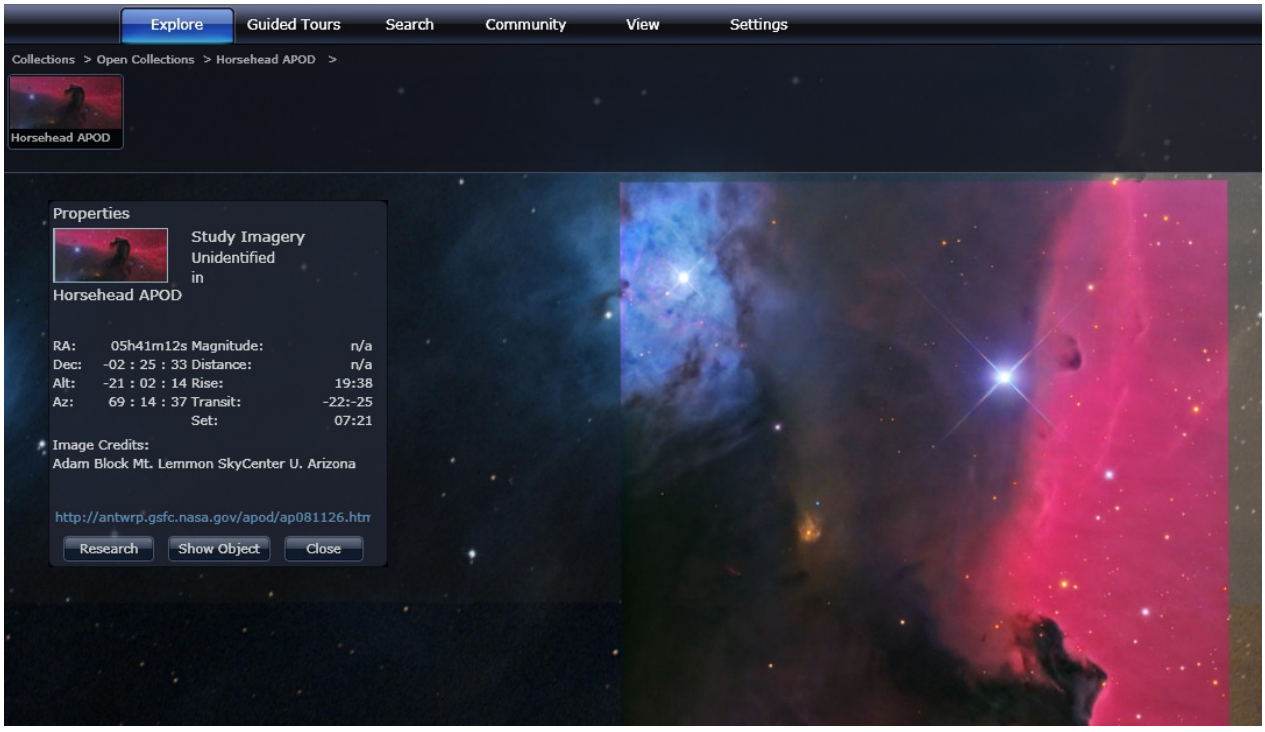
The example URL shown below will only result in a default thumbnail and the name being added to the **Open Collections**. For the user receiving the URL to view the image, they will need to click on the thumbnail.

```
http://www.worldwidetelescope.org/wwtweb/ShowImage.aspx?name=Horsehead+APOD%20&ra=85.2983&dec=-2.42589&x=450&y=300&scale=1.69&rotation=90.21&imageurl=http://antwrp.gsfc.nasa.gov/apod/image/0811/horsehead_caelum.jpg
```



In this second example the optional parameters **thumb=** and **credits=** and **creditsUrl=** have been added, to improve the experience for the user receiving the URL. When the image appears, note the better looking thumbnail image, and the credits text and link in the **Properties** panel.

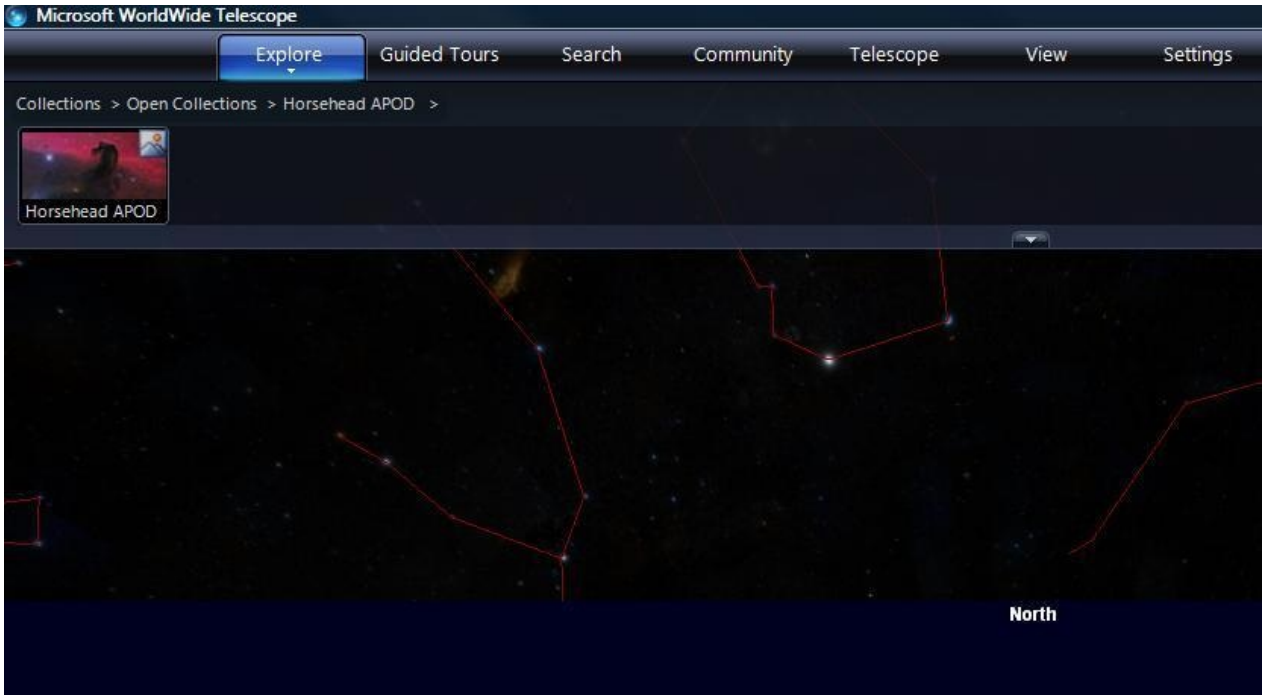
```
http://www.worldwidetelescope.org/wwtweb/ShowImage.aspx?name=Horsehead+APOD%20&ra=85.2983&dec=-2.42589&x=450&y=300&scale=1.69&rotation=90.21&imageurl=http://antwrp.gsfc.nasa.gov/apod/image/0811/horsehead_caelum.jpg&thumb=http://research.microsoft.com/~dinos/wwtimages/tn_horsehead_caelum.jpg&credits=Adam+Block+Mt.+Lemmon+SkyCenter+U.+Arizona&creditsUrl=http://antwrp.gsfc.nasa.gov/apod/ap081126.html
```



|

In this third example, the collection file is opened in the Windows Client, rather then Web Client, version:

http://www.worldwidetelescope.org/wwtweb/ShowImage.aspx?name=Horsehead+APOD%20&ra=85.2983&dec=-2.42589&x=450&y=300&scale=1.69&rotation=90.21&imageurl=http://antwrp.gsfc.nasa.gov/apod/image/0811/horsehead_caelum.jpg&thumb=http://research.microsoft.com/~dinos/wwtimages/tn_horsehead_caelum.jpg&wtml=true



Command Line

To initiate the Windows Client version of WorldWide Telescope, with either a WTML data file, or WTT tour file, go through the following steps:

1. Open up a Command Prompt window.
2. Navigate to the folder containing the **WWTExplorer.exe** file. By default this is:

   ```
   C:\Program Files (x86)\Microsoft Research\Microsoft WorldWide Telescope\
   ```

3. Type a command such as:

   ```
   wwtexplorer path\datafile.wtml
   or
   wwtexplorer path\tourfile.wtt
   ```

   ensuring of course that the full path and filenames are correct.
4. This should open up WorldWide Telescope with either the collection thumbnail from a wtml file displayed under **Collections > Open Collections**, or will startup a tour if a valid tour file is used as the command line parameter.

Appendices

Classifications

Classification entries in WTML files can take one of the following values. The default classification is **Unfiltered**.

```
Star
Supernova
BlackHole
NeutronStar
DoubleStar
MultipleStars
Asterism
Constellation
OpenCluster
GlobularCluster
NebulousCluster
Nebula
EmissionNebula
PlanetaryNebula
ReflectionNebula
DarkNebula
GiantMolecularCloud
SupernovaRemnant
InterstellarDust
Quasar
Galaxy
SpiralGalaxy
IrregularGalaxy
EllipticalGalaxy
Knot
PlateDefect
ClusterOfGalaxies
OtherNGC
Unidentified
SolarSystem
Unfiltered
Stellar
StellarGroupings
Nebulae
Galactic
Other
```

Constellations

The following table lists the constellation codes and the center of each constellation. If a correct code is entered in a WTML file, such as **Constellation="CET"**, then there can be an improvement in the systems performance. If **Constellation** is left blank, or is wrong, then the **RA** and **Dec** entries are used. There are 89 entries in the table, as the discontiguous Serpens constellation is treated as two.

Name	Code	RA (decimal hours)	RA (decimal degrees)	Dec (decimal degrees)
`Andromeda`	AND	0.80766667	12.115	37.431833
`Antlia`	ANT	10.273833	154.1075	-31.5165
`Apus`	APS	16.144167	242.1625	-74.7
`Aquarius`	AQR	22.289667	334.345	-9.210833
`Aquila`	AQL	19.667	295.005	3.410833
`Ara`	ARA	17.374833	260.6225	-55.411667
`Aries`	ARI	2.636	39.54	20.79233
`Auriga`	AUR	6.0736667	91.105	42.028
`Bootes`	BOO	14.710667	220.66	31.202667
`Caelum`	CAE	4.7045	70.5675	-36.11833
`Camelopardalis`	CAM	6.000	90.0	72.000
`Cancer`	CNC	8.649333	129.74	19.805833
`Canes Venatici`	CVN	13.116	196.74	40.101833
`Canis Major`	CMA	6.829	102.435	-21.859667
`Canis Minor`	CMI	7.652833	114.7925	6.4271667
`Capricornus`	CAP	21.048833	315.7325	-17.976833
`Carina`	CAR	8.695	130.425	-62.780667
`Cassiopeia`	CAS	1.319333	19.79	62.184
`Centaurus`	CEN	13.071167	196.0675	-46.654667
`Cepheus`	CEP	22.0	330.0	71.0085
`Cetus`	CET	1.668333	25.025	-6.8206667
`Chamaeleon`	CHA	10.692167	160.3825	-78.795
`Circinus`	CIR	15.0	225.0	-64.0
`Columba`	COL	5.8626667	87.94	-34.9055
`Coma Berenices`	COM	12.787833	191.8175	23.305667
`Corona`				

Australis				
Corona Borealis	CRB	15.843167	237.6475	32.624833
Corvus	CRV	12.442	186.63	-17.56333
Crater	CRT	11.395833	170.9375	-14.071
Crux	CRU	12.449833	186.7475	-59.8135
Cygnus	CYG	20.588	308.82	44.545
Delphinus	DEL	20.6935	310.4025	11.671
Dorado	DOR	5.241833	78.6275	-58.613
Draco	DRA	15.0	225.0	62.0
Equuleus	EQU	21.187667	317.815	7.7581667
Eridanus	ERI	4.0	60.0	-27.243833
Fornax	FOR	2.798	41.97	-30.3655
Gemini	GEM	7.0706667	106.06	22.600167
Grus	GRU	22.4565	336.8475	-45.648167
Hercules	HER	17.386	260.79	27.498833
Horologium	HOR	3.276	49.14	-52.663667
Hydra	HYA	11.612167	174.1825	-26.0
Hydrus	HYI	2.3441667	35.1625	-68.0435
Indus	IND	21.972167	329.5825	-58.29333
Lacerta	LAC	22.46133	336.92	46.041833
Leo	LEO	10.667167	160.0075	13.138667
Leo Minor	LMI	10.24533	153.68	32.134667
Lepus	LEP	5.565833	83.4875	-18.953667
Libra	LIB	15.19933	227.99	-14.76533
Lupus	LUP	15.220167	228.3025	-41.291167
Lynx	LYN	7.9921667	119.8825	47.466667
Lyra	LYR	18.852833	282.7925	36.68933
Mensa	MEN	5.415	81.225	-76.496
Microscopium	MIC	20.964667	314.47	-35.725167
Monoceros	MON	7.0605	105.9075	0.28216667
Musca	MUS	12.588	188.82	-69.839

Norma	NOR	15.903	238.545	-50.6485
Octans	OCT	23.0	345.0	-81.848
Ophiuchus	OPH	17.394833	260.9225	-6.0876667
Orion	ORI	5.5765	83.6475	5.949
Pavo	PAV	19.611833	294.1775	-64.2185
Pegasus	PEG	22.69733	340.46	19.46633
Perseus	PER	3.175	47.625	45.013167
Phoenix	PHE	0.9318333	13.9775	-47.41933
Pictor	PIC	5.7076667	85.615	-52.525833
Pisces	PSC	0.4828333	7.2425	13.687167
Piscis Austrinus	PSA	22.2845	334.2675	-29.357833
Puppis	PUP	7.5	112.5	-33.0
Pyxis	PYX	8.9526667	134.29	-26.64833
Reticulum	RET	3.9211667	58.8175	-58.0025
Sagitta	SGE	19.650833	294.7625	18.86133
Sagittarius	SGR	19.099	286.485	-27.523167
Scorpius	SCO	16.30	244.5	-30.0
Sculptor	SCL	0.438	6.57	-31.911667
Scutum	SCT	18.673167	280.0975	-8.111333
Serpens Caput	SER1	15.69	235.35	10
Serpens Cauda	SER2	18.25	273.75	-6.0
Sextans	SEX	10.2715	154.0725	-1.385333
Taurus	TAU	4.7021667	70.5325	14.877167
Telescopium	TEL	19.325667	289.885	-50.963167
Triangulum	TRI	2.1845	32.7675	31.476
Triangulum Australe	TRA	16.0825	241.2375	-64.612
Tucana	TUC	23.77733	356.66	-64.17
Ursa Major	UMA	11.312667	169.69	50.721167
Ursa Minor	UMI	15.0	225.0	77.699833
Vela	VEL	9.577333	143.66	-46.832833
Virgo	VIR	13.4065	201.0975	-3.8415

`Volans`	VOL	7.7955	116.9325	-68.198833
`Vulpecula`	VUL	20.23133	303.47	24.442667

Taxonomy

The following table lists the taxonomy codes that can be used to classify images. WorldWide Telescope has adopted the image hierarchy taxonomy proposed by the International Virtual Observatory Alliance and the Virtual Astronomy Multimedia Project's (VAMP) Astronomy Visualization Metadata (AVM) Standard. Refer to the International Virtual Observatory Alliance (IVOA) and Virtual Astronomy Multimedia Project (VAMP) websites.As an example, a tour of the Sea of Tranquility on the Moon could be classified as *Planet>Feature>Surface>Impact.*

Code	Description
`1`	Planet
`1.1`	[Type]
`1.1.1`	Terrestrial
`1.1.2`	Gas Giant
`1.2`	[Feature]
`1.2.1`	Surface
`1.2.1.1`	Mountain
`1.2.1.2`	Canyon
`1.2.1.3`	Volcanic
`1.2.1.4`	Impact
`1.2.1.5`	Erosion
`1.2.1.6`	Liquid
`1.2.1.7`	Ice
`1.2.2`	Atmosphere
`1.2.2.1`	Cloud
`1.2.2.2`	Storm
`1.2.2.3`	Belt
`1.2.2.4`	Aurora
`1.3`	[Special Cases]
`1.3.1`	Transiting

`1.3.2`	Hot Jupiter
`1.3.3`	Pulsar planet
`1.4`	Satellite
`1.4.1`	[Feature]
`1.4.1.1`	Surface
`1.4.1.1.1`	Mountain
`1.4.1.1.2`	Canyon
`1.4.1.1.3`	Volcanic
`1.4.1.1.4`	Impact
`1.4.1.1.5`	Erosion
`1.4.1.1.6`	Liquid
`1.4.1.1.7`	Ice
`1.4.1.2`	Atmosphere
`1.5`	Ring
`2`	Interplanetary Body
`2.1`	Dwarf planet
`2.2`	Comet
`2.2.1`	Nucleus
`2.2.2`	Coma
`2.2.3`	Tail
`2.2.3.1`	Dust
`2.2.3.2`	Gas
`2.3`	Asteroid
`2.4`	Meteoroid
`3`	Star
`3.1`	[Evolutionary Stage]
`3.1.1`	Protostar
`3.1.2`	Young Stellar Object
`3.1.3`	Main Sequence
`3.1.4`	Red Giant
`3.1.5`	Red Supergiant
`3.1.6`	Blue Supergiant

`3.1.7`	White Dwarf
`3.1.8`	Supernova
`3.1.9`	Neutron Star
`3.1.9.1`	Pulsar
`3.1.9.2`	Magnetar
`3.1.10`	Black Hole
`3.2`	[Type]
`3.2.1`	Variable
`3.2.1.1`	Pulsating
`3.2.1.2`	Irregular
`3.2.1.3`	Eclipsing
`3.2.1.4`	Flare Star
`3.2.1.5`	Nova
`3.2.2`	Carbon
`3.2.3`	Brown Dwarf
`3.2.4`	Wolf-Rayet
`3.2.5`	Blue Straggler
`3.2.6`	Exotic
`3.3`	[Spectral Type]
`3.3.1`	O
`3.3.2`	B
`3.3.3`	A
`3.3.4`	F
`3.3.5`	G
`3.3.6`	K
`3.3.7`	M
`3.3.8`	L
`3.3.9`	T
`3.4`	[Population]
`3.4.1`	I
`3.4.2`	II

`3.4.3`	III
`3.5`	[Feature]
`3.5.1`	Photosphere
`3.5.1.1`	Granulation
`3.5.1.2`	Sunspot
`3.5.2`	Chromosphere
`3.5.2.1`	Flare
`3.5.2.2`	Facula
`3.5.3`	Corona
`3.5.3.1`	Prominence
`3.6`	[Grouping]
`3.6.1`	Binary
`3.6.2`	Triple
`3.6.3`	Multiple
`3.6.4`	Cluster
`3.6.4.1`	Open
`3.6.4.2`	Globular
`3.7`	Circumstellar Material
`3.7.1`	Planetary System
`3.7.2`	Disk
`3.7.2.1`	Protoplanetary
`3.7.2.2`	Accretion
`3.7.2.3`	Debris
`3.7.3`	Outflow
`3.7.3.1`	Solar Wind
`3.7.3.2`	Coronal Mass Ejection
`4`	Nebula
`4.1`	[Type]
`4.1.1`	Interstellar Medium
`4.1.2`	Star Formation
`4.1.3`	Planetary
`4.1.4`	Supernova Remnant

4.1.5	Jet
4.2	[Appearance]
4.2.1	Emission
4.2.1.1	H II Region
4.2.2	Reflection
4.2.2.1	Light Echo
4.2.3	Dark
4.2.3.1	Molecular Cloud
4.2.3.2	Bok Globule
4.2.3.3	Proplyd
5	Galaxy
5.1	[Type]
5.1.1	Spiral
5.1.2	Barred
5.1.3	Lenticular
5.1.4	Elliptical
5.1.5	Ring
5.1.6	Irregular
5.1.7	Interacting
5.1.8	Gravitationally Lensed
5.2	[Size]
5.2.1	Giant
5.2.2	Dwarf
5.3	[Activity]
5.3.1	Normal
5.3.2	AGN
5.3.2.1	Quasar
5.3.2.2	Seyfert
5.3.2.3	Blazar
5.3.2.4	Liner
5.3.3	Starburst

`5.3.4`	Ultraluminous
`5.4`	[Component]
`5.4.1`	Bulge
`5.4.2`	Bar
`5.4.3`	Disk
`5.4.4`	Halo
`5.4.5`	Ring
`5.4.6`	Central lack Hole
`5.4.7`	Spiral Arm
`5.4.8`	Dust Lane
`5.5`	[Grouping]
`5.5.1`	Pair
`5.5.2`	Multiple
`5.5.3`	Cluster
`5.5.4`	Supercluster
`6`	Cosmology
`6.1`	[Morphology]
`6.1.1`	Deep Field
`6.1.2`	Large-Scale Structure
`6.1.3`	Cosmic Background
`6.2`	[Phenomenon]
`6.2.1`	Lensing
`6.2.2`	Gamma Ray Burst
`6.2.3`	Dark Matter
`7`	Sky Phenomenon
`7.1`	Night Sky
`7.1.1`	Constellation
`7.1.2`	Asterism
`7.1.3`	Milky Way
`7.1.4`	Trail
`7.1.4.1`	Meteor
`7.1.4.2`	Star

7.1.4.3	Satellite
7.1.5	Zodiacal Light
7.1.5.1	Gegenschein
7.1.6	Night glow
7.2	Eclipse
7.2.1	Solar
7.2.1.1	Total
7.2.1.2	Partial
7.2.1.3	Annular
7.2.2	Lunar
7.2.2.1	Total
7.2.2.2	Partial
7.2.2.3	Penumbral
7.2.3	Occultation
7.2.4	Transit
7.3	Light Phenomenon
7.3.1	Sunrise-Sunset
7.3.1.1	Green flash
7.3.1.2	Refractive Distortion
7.3.1.3	Sun Pillar
7.3.2	Cloud
7.3.2.1	Iridescent
7.3.2.2	Noctilucent
7.3.2.3	Nacreous
7.3.2.4	Corona
7.3.2.5	Glory
7.3.3	Rainbow
7.3.3.1	Moonbow
7.3.3.2	Fogbow
7.3.4	Halo
7.3.4.1	Circle

7.3.4.2	Parhelia
7.3.4.3	Arc
7.3.5	Ray-Shadow
7.3.5.1	Crepuscular ray
7.3.5.2	Anti-crepuscular ray
7.3.5.3	Earth shadow
7.3.6	Lightning
7.3.7	Aurora
8	Technology
8.1	Observatory
8.1.1	Facility
8.1.2	Telescope
8.1.3	Instrument
8.2	Spacecraft
8.2.1	Orbiter
8.2.2	Probe
8.2.3	Lander
8.2.4	Manned