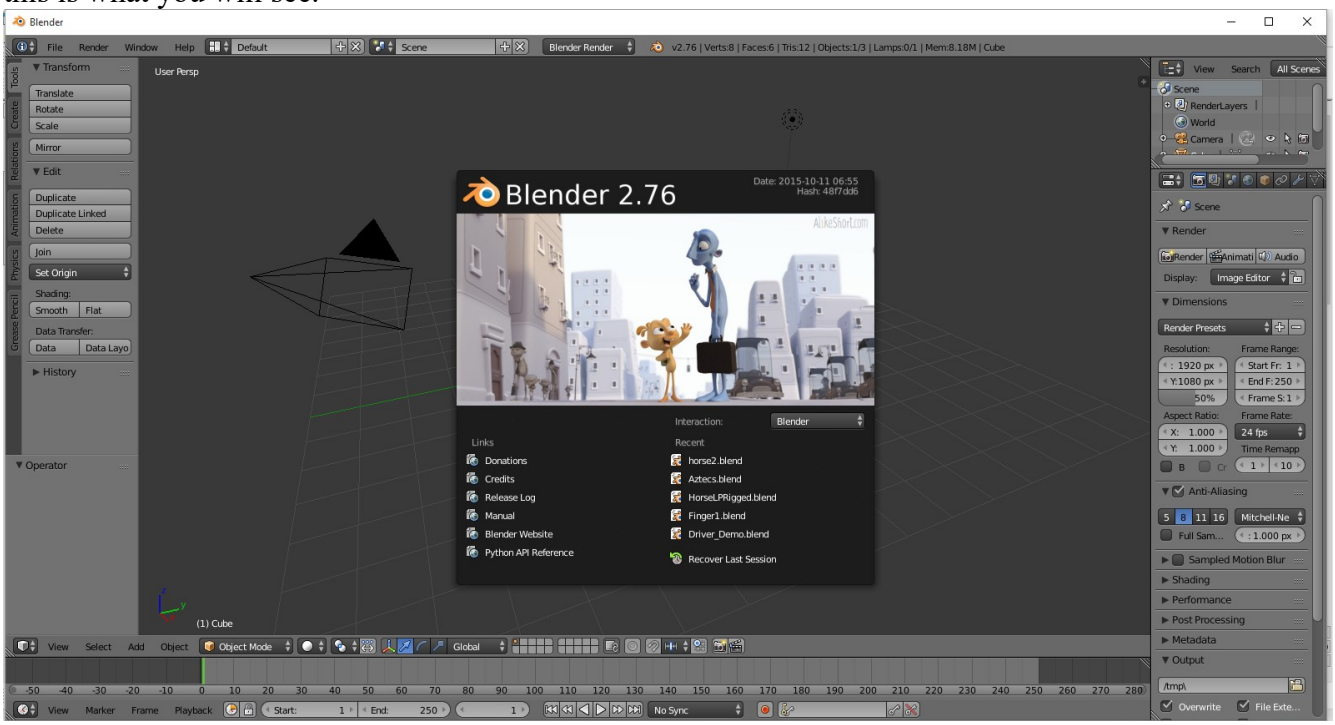
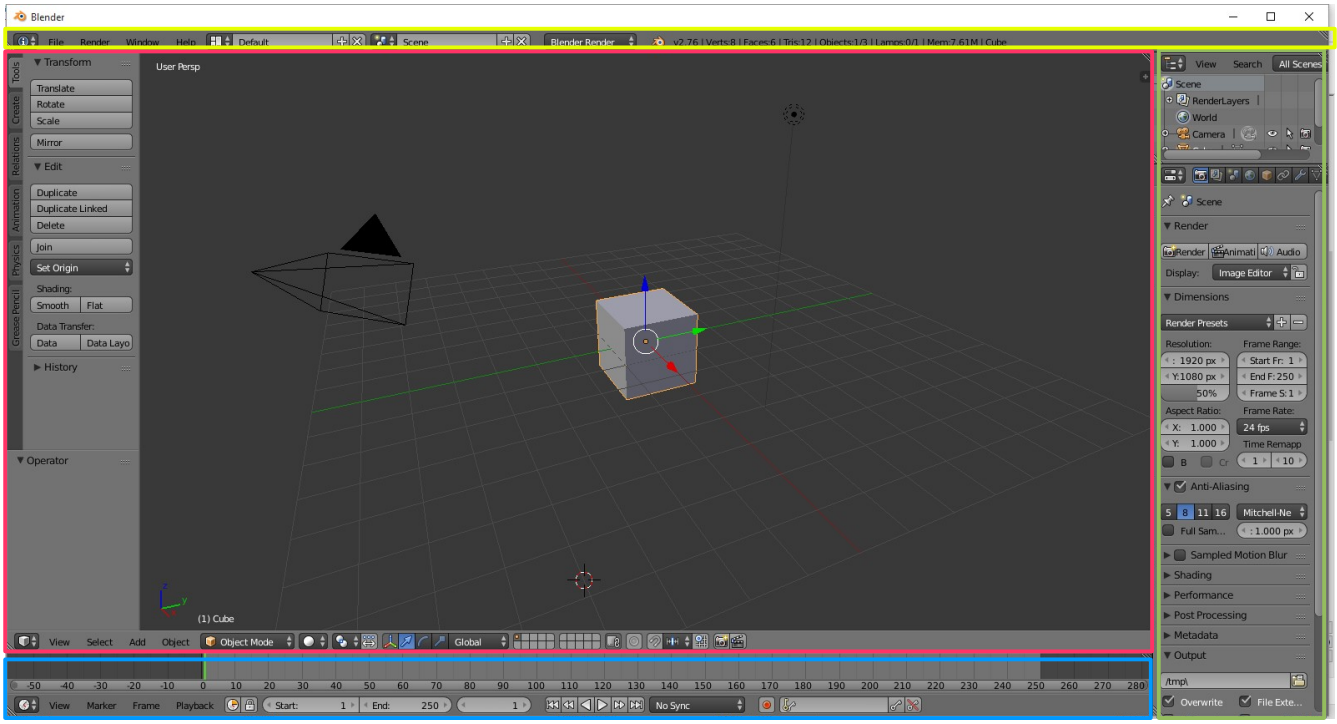
Astromomy Club Blender Demo

NASA has provided us with all sorts of wonderful maps and data on the planets in our solar system that can be download from the internet. Some show the color of the planets, some show elevations, and some show reflectivity. These can be combined with a free 3-D graphics program called Blender that can be downloaded at www.blender.org. This evening you will learn how to use Blender and these maps to create 3-D, CGI models of the planets.

You can start by downloading Blender and installing it on your computer. (Again, that can be found at www.blender.org .) Open Blender by double clicking on its icon as you would any other program and this is what you will see.

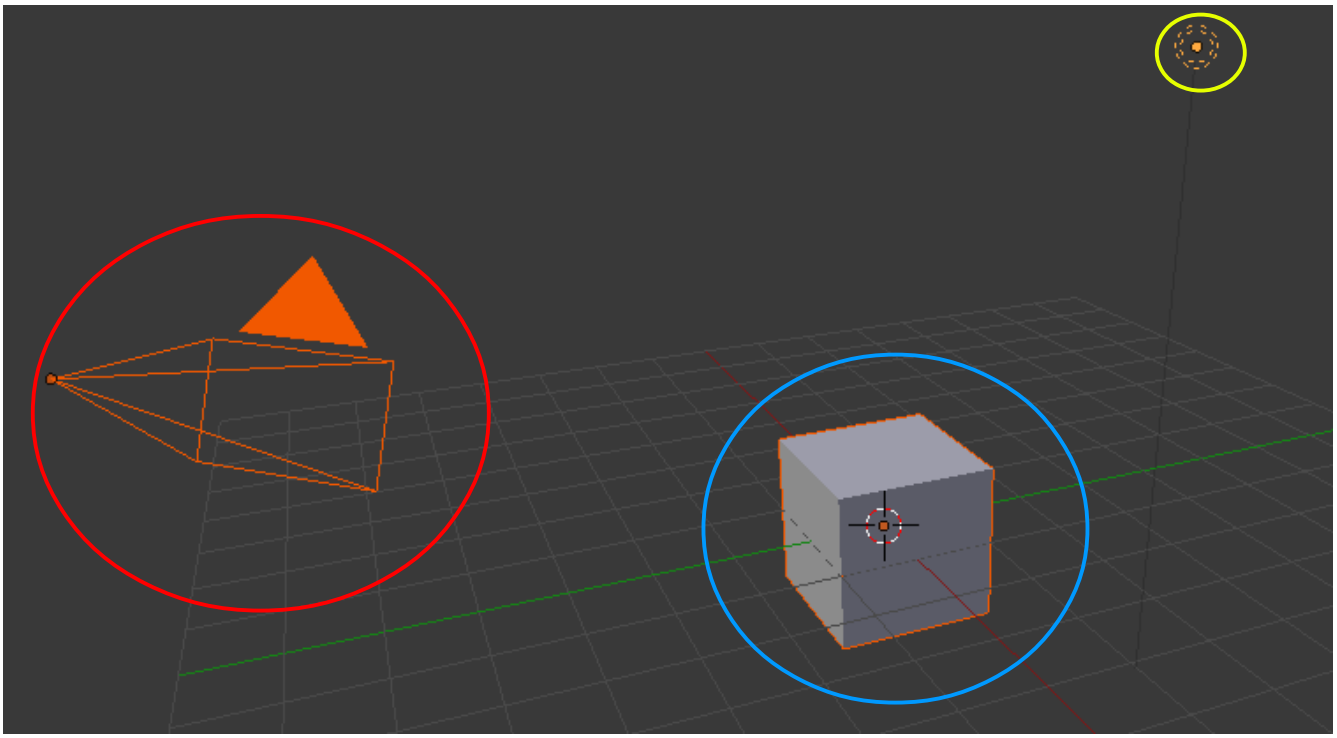


If you click any where on the screen, the splash screen will go away and you will see this.



The large window, (outlined in red in the image above,) is called the 3-D View Port. This is where we will see our 3-D view. The window at the bottom outlined in blue is the timeline for animations, the 2 windows at the right, outlined in green are the Outliner on top 15%, and the Properties window in the bottom 85%.

The objects in the 3-D View Port highlighted orange in the following image are the camera, (circled in red,) the cube, (circled in blue,) and a lamp, (circled in yellow,).



If we middle mouse button click and drag within the 3-D View Port, we can rotate around the scene. If we hold down the Shift key while middle mouse button click and drag within the 3-D View Port we can pan. If we scroll middle mouse button, we can zoom in and out of our scene.

We can also change the view with the numeric keys to view the top with 7 the side with 3 and the front with 1. If we hold down the Ctrl key while pressing the 7, 3, and 1 keys, we can switch to the bottom, other side, and back views.

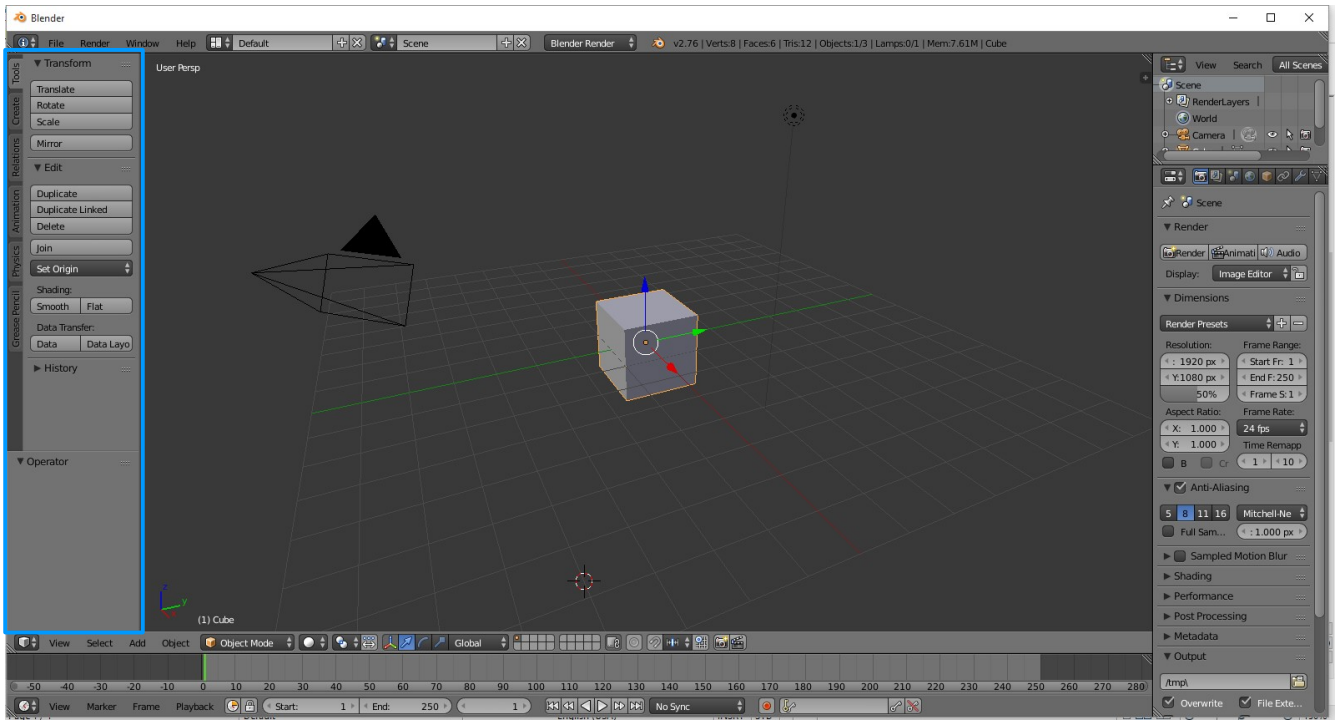
The numeric keypad 0 key gives us a view from the camera. 5 on the numeric key pad toggles between viewing our scene in perspective and ortho mode.

If you get lost you can bring everything into the view with the home key.

> *Note: the number keys at the top of the keyboard change layers not views. If you have pressed one of those keys, other than the 1 key, all objects will disappear. This is because all our objects so far are on layer 1. You can of course switch back to layer 1 by pressing the 1 key on the top of your key board.*

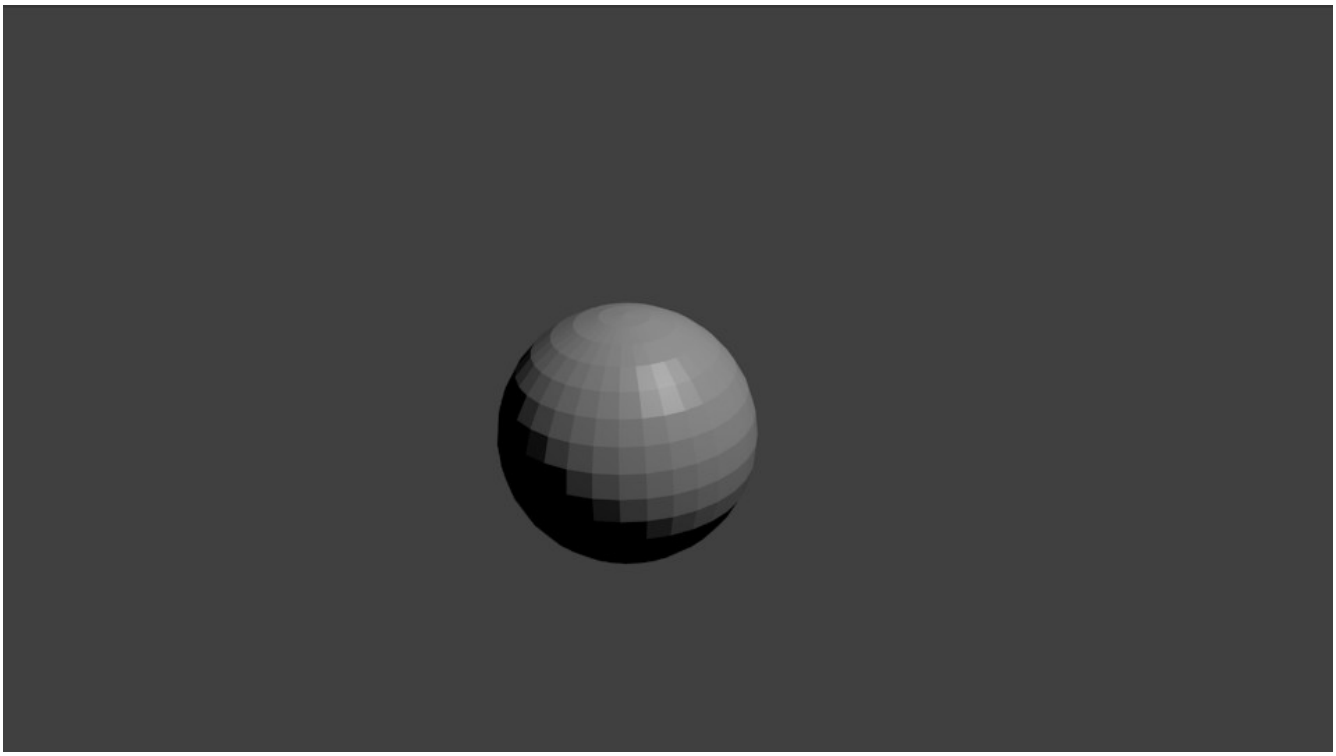
We will need a camera in our scene and a lamp, but we do not need the cube. To get rid of it we can select it by right mouse button clicking on it. It will be highlighted in orange to let us know that it is selected. Once selected we can press the X key and confirm that we want the selected object to be deleted.

We can add a new object to our scene at the location of the 3-D cursor. This is the white and red dashed circle surrounded by "cross hairs." This can be repositioned by left clicking in the 3-D View Port. It can be moved back to the center by pressing the key combination Shift S and picking the option "Cursor to Center"

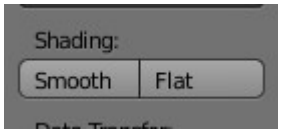


Along the left edge of the 3-D View Port is a pane called the Tool Shelf. Click the “Create” tab. You will see all the objects that can be added to your scene. Click on the one that says “UV Sphere” under the Mesh heading.

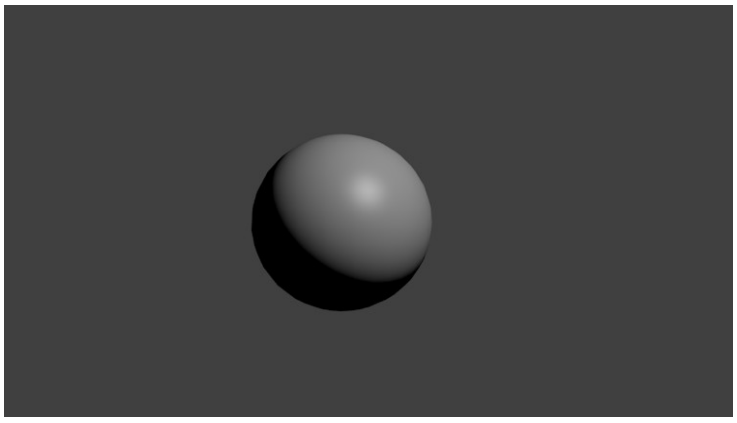
This will be our planet. We can render the image with the F12 key to see what it looks like at this point.



You can see that we have some work to do. First the UVSphere looks faceted. Go back to the unrendered view by pressing the ESC key and in the Tool Shelf, click the Tools tab. Under Shading, click the Smooth button.



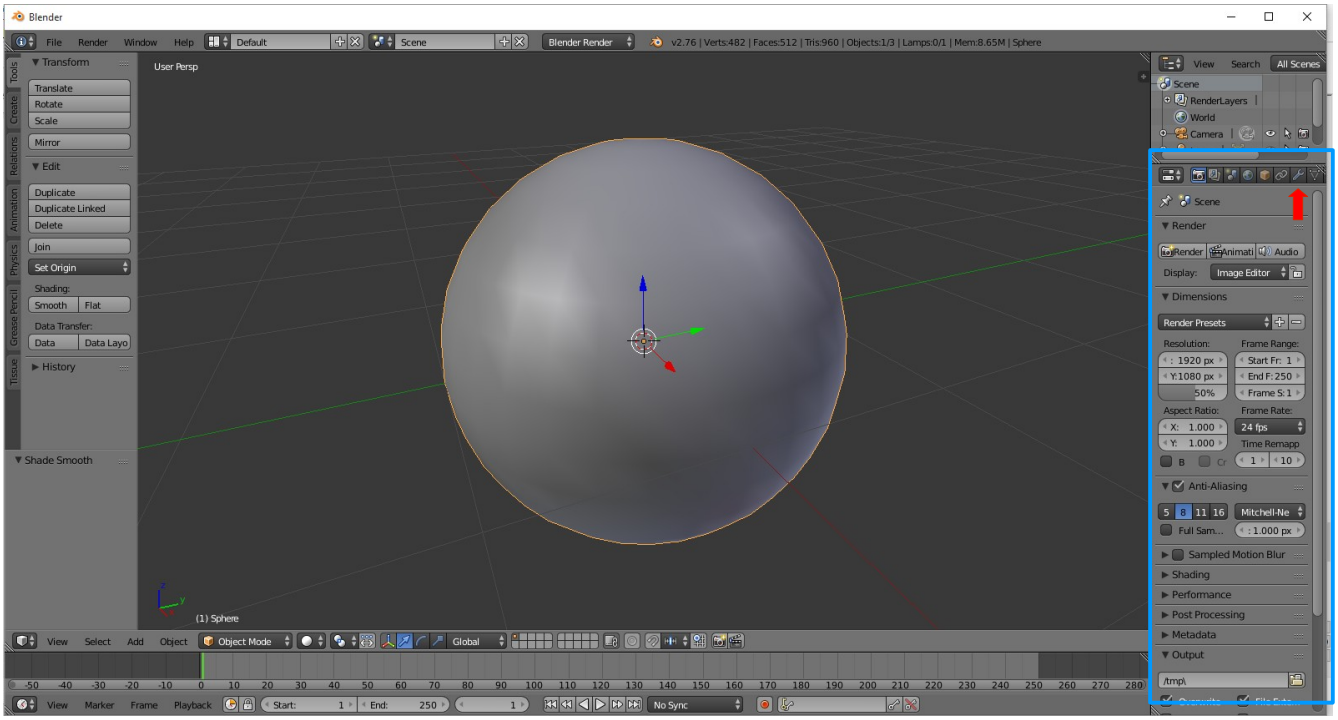
Render again with F12.



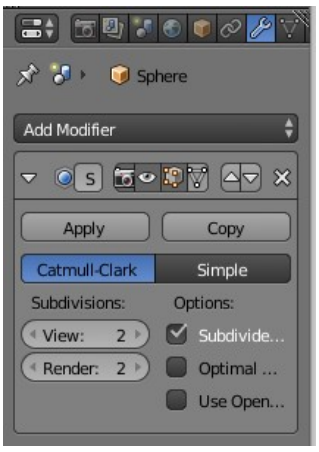
That looks better. Now close the render window with the ESC key.

If we zoom in by scrolling the mouse wheel we will see that the outline against the background is still noticeably facited even though the surface appears smooth. This is because we have just changed the way the light reflects off the facets. By turning on "Smooth Shading" we have told Blender to average the angle of reflectivity over the adjacent faces. To make the sphere actually smoother, we can use a Subdivision Surface modifier.

Subidivision Surface Modifier.



To add a Subdivision Surface modifier we must go to the Properties window outlined in light blue in the screen shot above. Click on the Contextual button that looks like a wrench. In the image above, the red arrow is pointing to it. Click the Add Modifier button and a menu will open with all the modifiers available for the selected object (our sphere.) In the second column with the heading Generated, third from the bottom is the modifier we want. Click the Subdivision Surface option to select it. In the new panel that opens up change the View field to 2. This is how much the Subdivision Surface modifier will smooth our mesh in the view. It already is set to 2 for the render. We could go higher, but 2 is high enough and the higher we go the more processor time it will take.

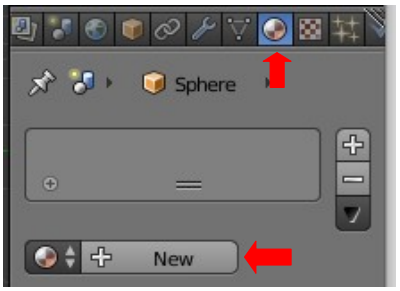


Render again with F12 and see how much smoother it looks. When finished, press ESC to return to your Blender screen.

At this point it could be any planet, but lets make it Mars. It needs to have some surface features and some color. We can give it a Mars material to make it look more recognizable as Mars.

Adding a Material to the Sphere

So far our planet only has the default gray material. We will now add a real material to our planet to give it a color and a place to add our textures from NASA. With our material we will have lots of options but don't worry, we will only be using a few of them.



In the Properties window, where we found the Modifier contextual button that looks like a wrench, there are many other buttons, these change depending on what is selected in our scene. With the planet still selected, click on the icon with the sphere on it to the right of the button with the wrench icon. (It will be just before the checker board icon button.) This will open the Materials options. Click on the New button to add a new material to the Sphere. It will be named "Material.001". Double click the name to select it and type the new name "Mars" and press Enter to change the name. In the Diffuse panel click the white rectangle to open a color picker and choose a more Mars like color. Don't worry about making this exact as we will be changing it when we add a color texture map. Down below the Diffuse panel is the Specular panel. This is where we can control the highlights of the material. It is a little strong so change the intensity to .050, and the Hardness value to 25. The higher the hardness value the more like glass or plastic the material will look.

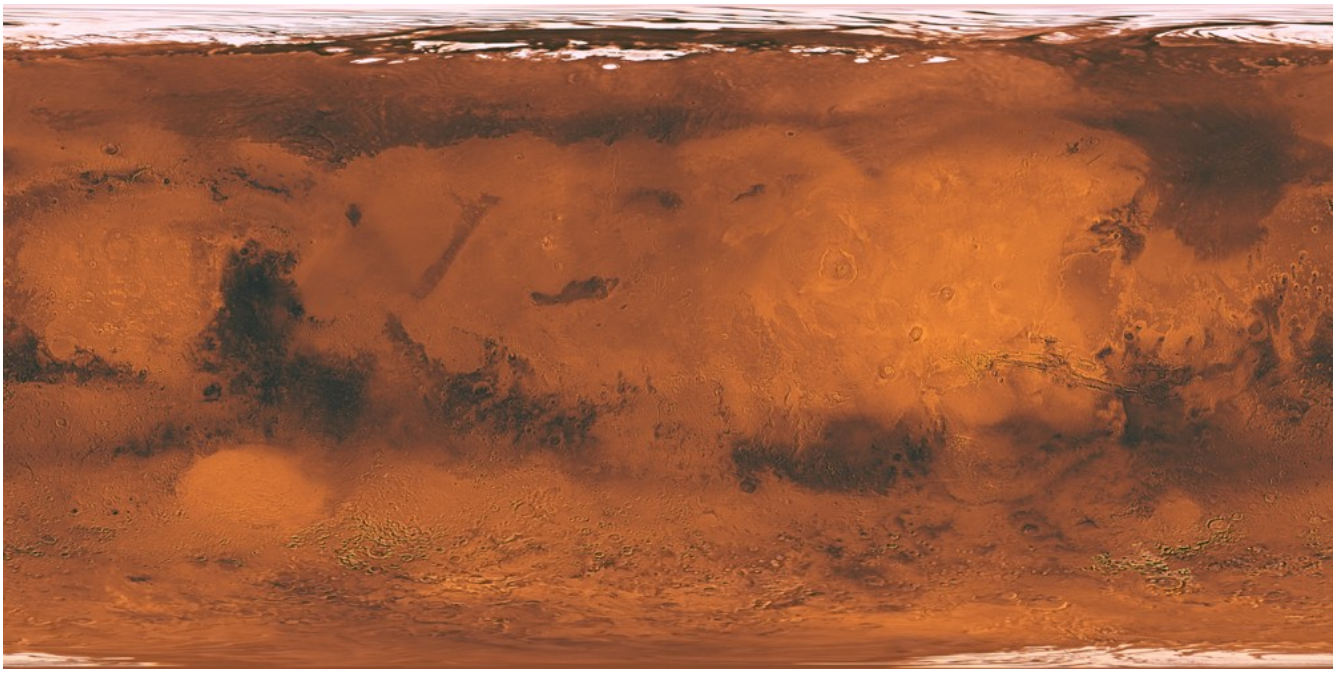
Below these panels are many more including "Transparency" and "Mirror" settings but these are not anything we will need for this project. All these properties can be controlled by Textures assigned to the materials and these textures can be mapped in different ways.

Objects in Blender can have up to 16 different materials, but we will only need one for our model of Mars.

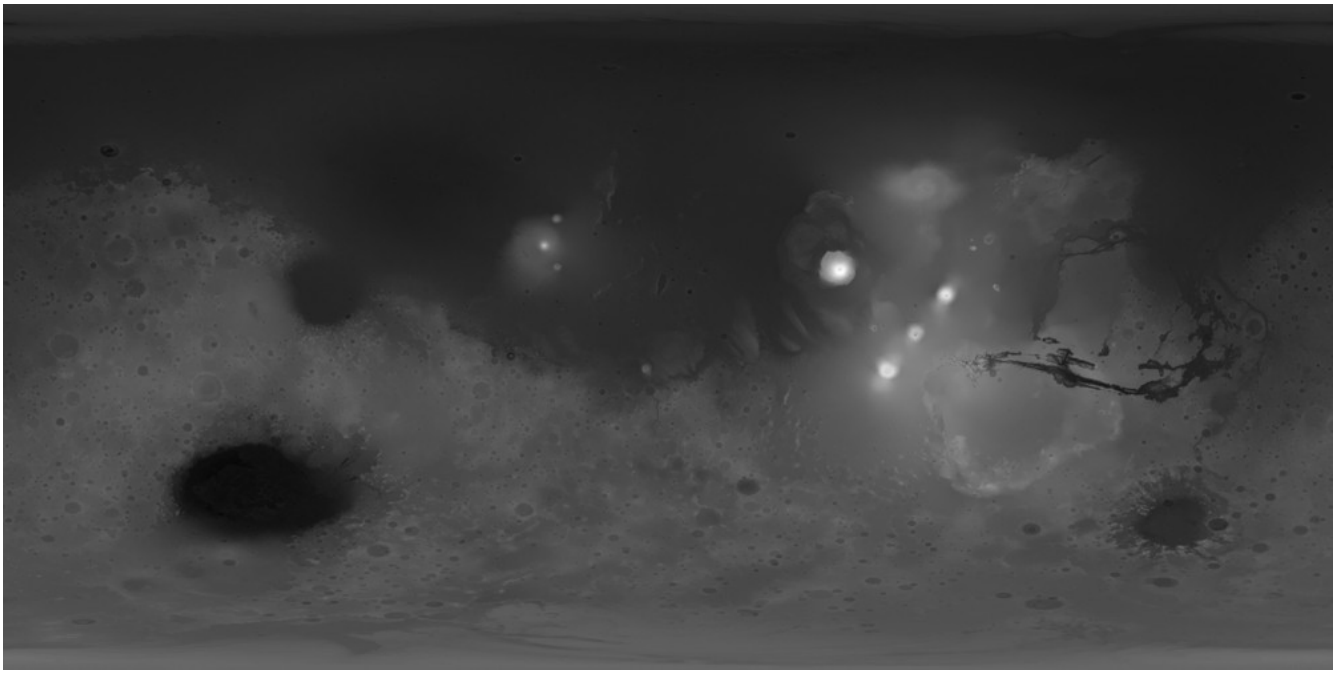
Adding a Color Texture to the Material

The images we are using for our maps are from James Hasting's site, http://planetpixelemporium.com/mars.html . The images are retouched to remove lighting artifacts caused by shadows and such. The website sells high resolutions maps for a minimal cost, but gives the 1K images away for free.

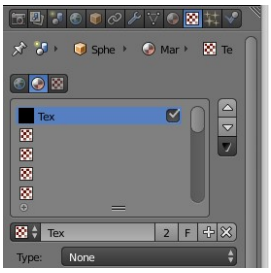
We will be using a color map for our color texture, and a gray scale map for elevation, or our "Bump map" texture. The color map looks like this.



The Bump Map looks like this.



These images will be wrapped about our sphere. One to color our planet, and the other to change the way light bounces and cast shadows by the same method that our "Smooth" shader makes the faceted planet look like a smooth sphere.



To add these images to our material, click the next Contextual button to the right of the Materials button in the Properties window. It is the one that looks like a checker board. One texture named "Tex" of type "None" already

exists. Rename it. “Mars color” by double clicking the name and typing “Mars color” then pressing Enter.

Change the Type field to “Image or Movie” and down in the Image panel, click the File Folder icon to navigate to the color image map to where ever you have saved it on your computer. Mine is in a folder on my desktop.

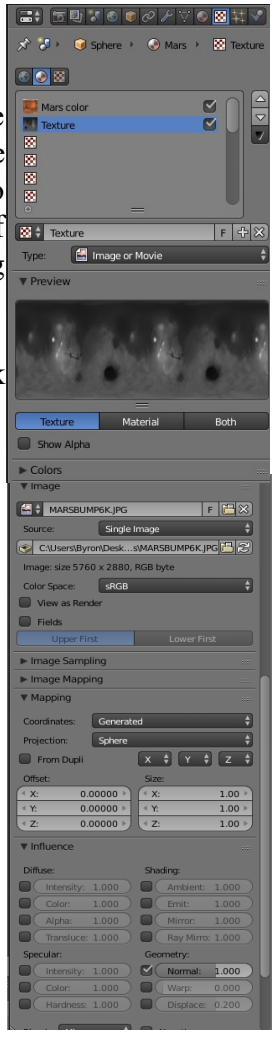
In the Mapping panel (not the Image Mapping panel) change the Coordinates field to Generated, and the Projection field to Sphere.

If you scroll down to the Influence you will see that in the diffuse section, Color is the only parameter checked.

Go ahead and press F12 to render to see how the color you set earlier is replaced with the color map of Mars. It is looking better but still looks featureless. This is where the Bump Map comes in. Press the ESC key to return to your Blender screen.

Save your file by clicking File in the top Info window and choosing Save As. Name the file and tell Blender where you want it saved. You can update this file by pressing Ctrl and S.

Adding a Bump Map Texture to the Material



Add a new texture, by first clicking the next checker board icon down below the first texture “Mars color” and name it Mars bump. Click the New button, of Type Image or Movie. In the Image panel, click the File Folder icon and navigate to where you have stored your second image. The one of the gray scale map of elevations. Scroll down and make sure that the Coordinates field in the Mapping panel is set to Generated, and that the Projection field is set to Sphere.

In the Influence panel uncheck the color box in the Diffuse section and check Normal in the Geometry section.

Render again with F12. Note that the topological features now reflect light in the manor that we would expect for the mountains and craters of Mars. We can even go back to the top and uncheck the color texture, to see just the effect of the bump map, and render again.

We are finished with our material and its textures at this point, but need to work on the lighting a bit. We can also make our background black as space itself.

Moving the Lamp

If you cannot see your lamp in the 3-D view port, press the Home key on your keyboard to bring all objects in your scene into view. Select the lamp by right clicking your mouse on it. Click and drag the blue arrow on the lamp to bring it down to closer to the grid that represents the floor plan of the scene.

Changing the Lamp Type

In the Properties window, notice that the Materials button has changed its appearance. It now is a Data Object Data button. This is because the buttons' context is determined by what is selected and now you have a Lamp object selected instead of the Mesh object that was selected when you were working with the Sphere. Change the lamp type to Sun from Point. This will insure that the rays are parallel that hit the surface of our planet. With the lamp still selected, and the mouse pointer in the 3-D View Port, go to the front view with the numeric key pad 1 key and rotate the direction of those parallel rays by pressing the R key and moving the mouse to where the dashed line from the lamp is pointing to the planet. Do the same from the Top view by pressing the numeric key pad 7 key.

Render again with F12 to see how this looks. Use ESC to return to the Blender screen.

The planet seems a little small lets make it larger. Making something larger or smaller in Blender is called scaling. Make sure the planet is selected then press the S key and then the 2 key followed by the Enter key. This makes it 2 times its original size.

Render again with F12 to see how this looks. Use ESC to return to the Blender screen.

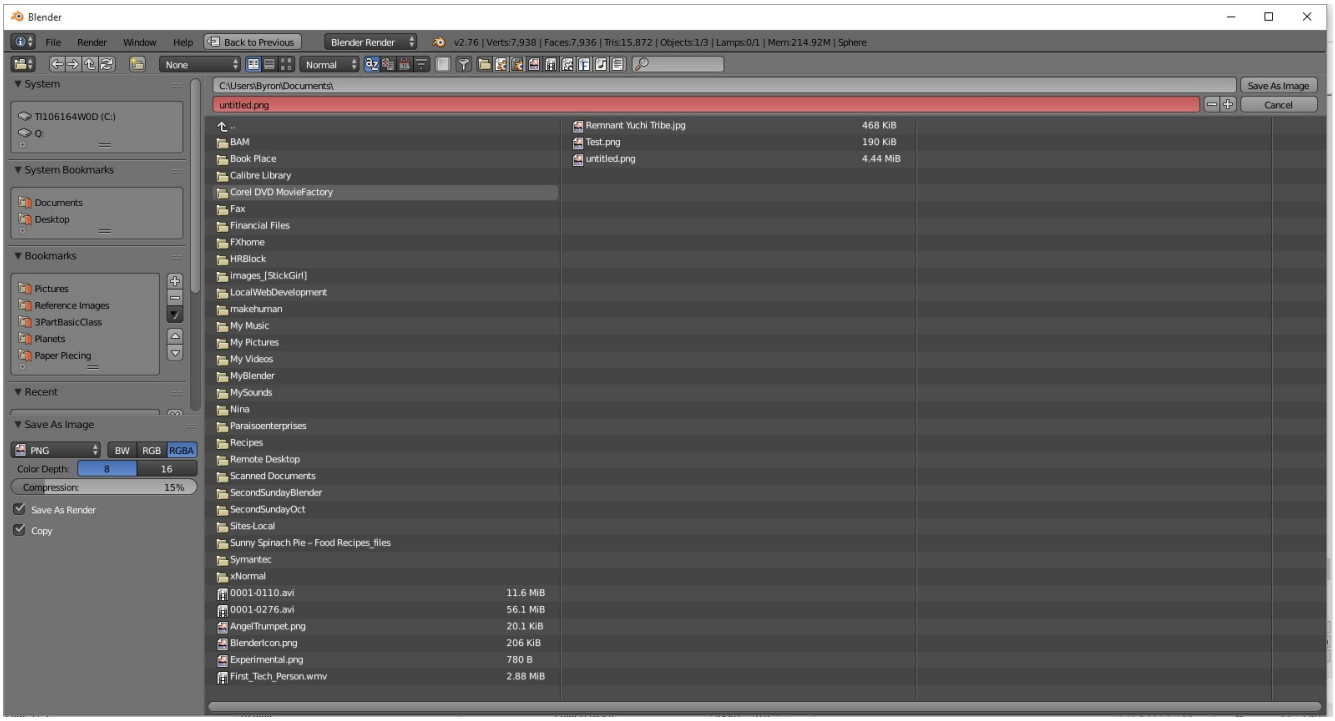
Setting the World

In Blender the World settings refer to the setting for the environment of our scene so this might be a little confusing for a scene set in space. We can however use these setting so set our background to black with the sky settings. In the Properties window, click the 4th contextual button from the left. It also looks like a sphere but is bluish, not a gray. The only change we will make is to change the Horizon color to black using the color picker button that we used earlier when we set the base color of Mars. Click the gray Horizon rectangle and when the color picker comes up, slide the value slider down all the way.

Saving the Image

So far we have rendered lots of images, but now that we are happy with what we have we might want to save the image so that we can send it to our friends. Render the image as you did before, but instead of closing the Render window with ESC, press F3.

This will open the following screen.



The pink field is where you can type whatever name you want to give to your image. The field above it is the location where you want to store the image. On the bottom left side of the screen is a "Save As Image" panel where you can choose the type of image to save. By default it is set to a .png file extension with RGBA channels. The panels above that are additional navigation tools for where you want to save your image.

Making a Movie

So far we have been working with making an image of the planet Mars. A movie is just a series of still images displayed in rapid succession. This series of images are called frames. If we change the rotation of our planet slightly on each successive frame of the movie it appears as a smooth movement.

We only need to set a starting location, rotation or scale on the beginning key frame and an ending location, rotation or scale for the ending key frame and Blender will calculate all the frames in between.

We will be working in the Time Line window at the bottom of our screen to make an animation.

Notice that the Start of the animation is set to frame 1 and the end is set to frame 250. At a frame rate of 24 frames per second this will give us about 10 seconds of animation. The next field to the right of the End frame field shows the current frame of the animation. Lets change the End field to give us 5 seconds of animation instead. Click in the End field to select it and then type "5*24" and press Enter. Blender will calculate this value to be 120. This built in calculator works in any numeric field in Blender.

Note also the green line in the time line. This marks the current frame. If you left click anywhere in the time line you can change the current frame. This will be reflected in the current frame field below the time line. You can also change the current frame number field and the green line's position will reflect this change, to a new location on the time line above.

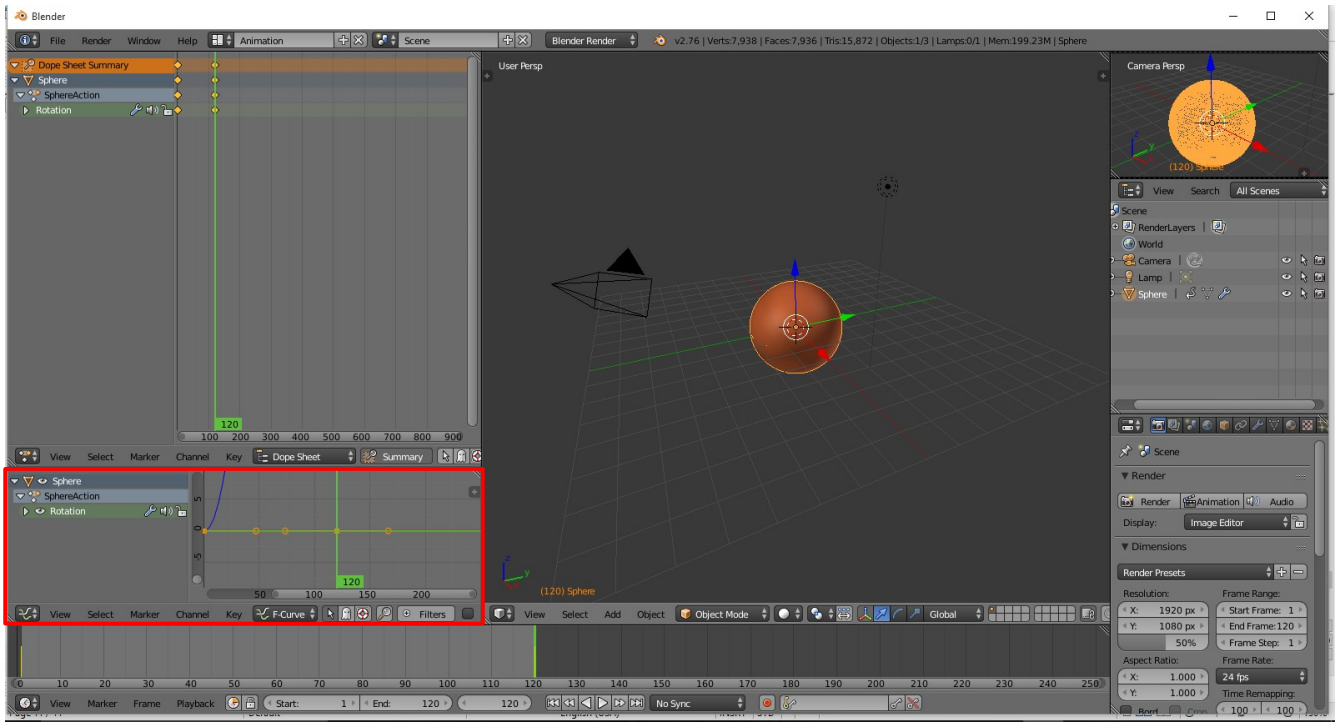
Setting a Key Frame

We will be animating the planet by rotating it on its polar axis. In Blender this is the Z axis. Be sure the planet is selected by right clicking on it and see that it is highlighted in orange.

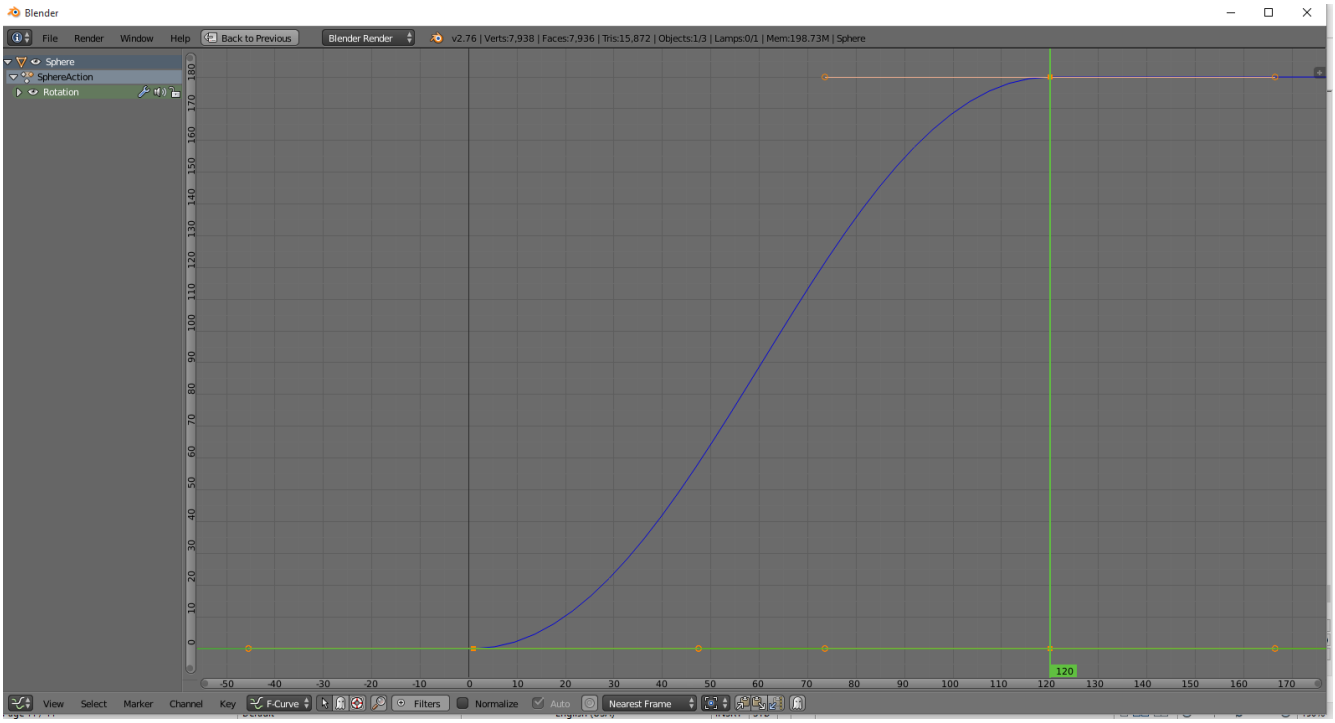
If you have moved the current frame, reset it to one. Move the mouse to the 3-D View Port and press the I key to Insert a key frame. From the menu choose "Rotation" as we will be changing the rotation of Mars on its axis. Move to the last frame on the time line.

To rotate the planet on its Z axis, 180 degrees,press the R key then the Z key then 180 followed by pressing the Enter key. Press the I key to set a new key frame and again choose "Rotation" from the menu.

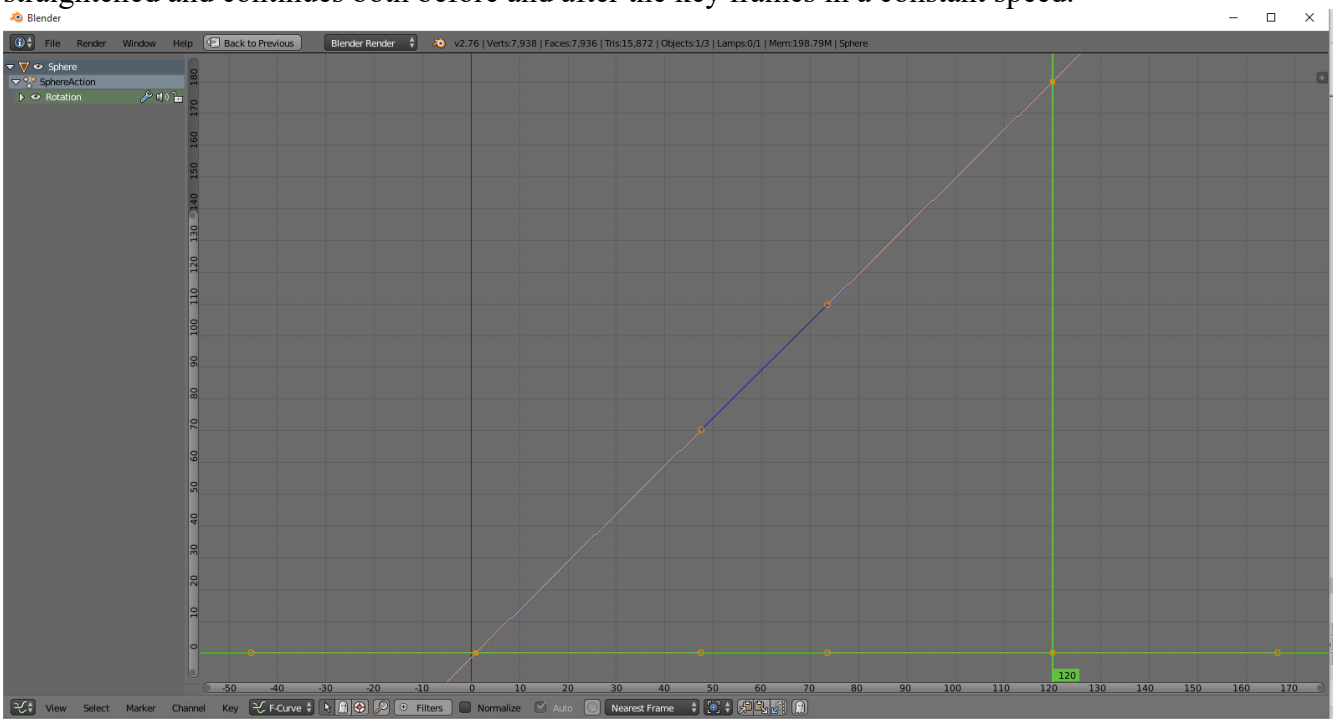
By default, the beginnings and endings between key frames start and end slow, like a car accelerating to a cruising speed and then decelerating before coming to a full stop. This is not what we want with the planet rotation as it has been and will be spinning for a while so the rate of rotation should be constant. At the top of our screen, is a small narrow window called the Info window. Near its center is a screen selection field. By default it is the Default screen set up. Click the UP/DOWN arrow icon to open the menu and select Animation screen setup. It should now look like this.



Move your mouse into the Curves Editor window highlighted in red in the image above. Press the Home key to bring the entire curve into view. Press Ctrl plus the Up arrow keys on your key board to make this window full screen. It will now look like this.



The blue curve represents the animation of the rotation of Mars on the Z axis. Note that it starts and ends slow, but is at a fairly constant speed in the middle. In the footer click Channel and then from the resulting menu, Extrapolation Mode and then Linear Extrapolation. Now see that the curve has been straightened and continues both before and after the key frames in a constant speed.

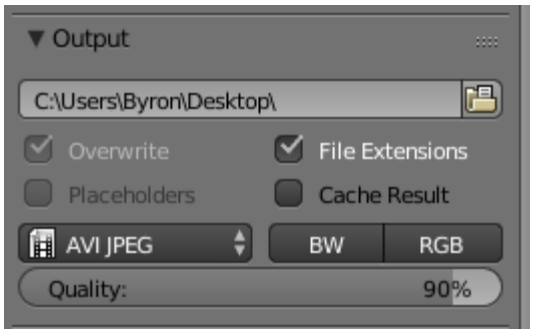


Press Ctrl and the Up arrow again to bring back the full screen set of windows, and change back to the Default screen set.

All we have to do now is rendering our movie. Here we will be working with our Properties window again. This time click on the first Contextual button. The one that looks like a 35 mm camera. Here we have the the controls over how we render the movie.

In the Dimentions panel, we have the default setting for 1080 HD, but only set to 50%. Change this to 100%. Down to the Output panel, set location that you want to save the movie file to by clicking the file folder icon. I am setting this to the Desktop.

Change the file type from .PNG to what ever movie you want. I am using AVI JPEG.



Now all we have to do is press Ctrl F12, set back and let the movie render. This will take a while, depending on your computer's capabilities. When it is done, you should have a movie on your desktop.

You can now play this video by double clicking it, or email it to your friends or upload it to social media. You can also go back to your .blend file and set some key frames for your camera or the angle of the suns rays.

I hope that you have been inspired to learn more. Google Blender tutorials and you will find all sorts of great tutorials on ways of using Blender.