

# 3D Digital Content Production

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**Solar System**

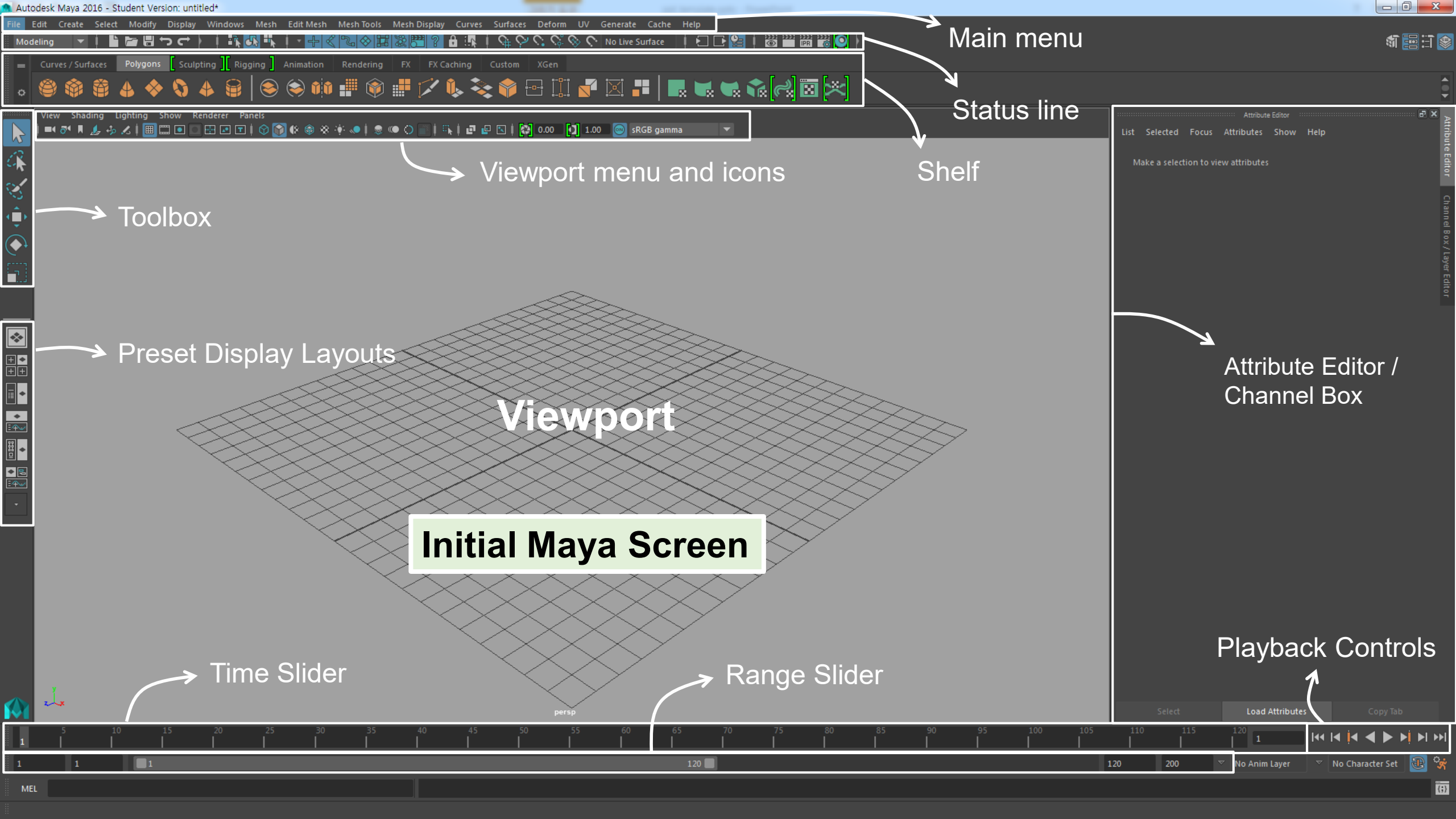
**Global Entrepreneurship and ICT**  
*Creation beyond technology*



# Autodesk Maya

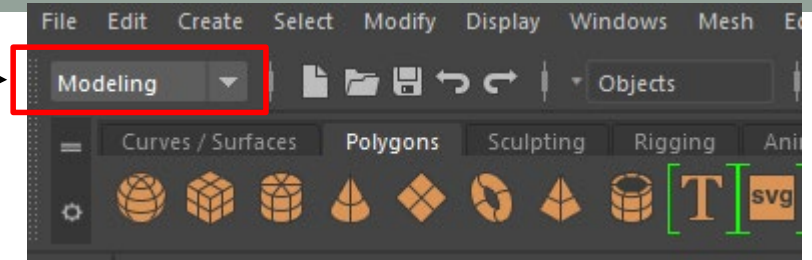
- *3D computer graphics software* to produce 3D contents including *video games*, *animated films*, *TV series*, or *visual effects*
- First released in 1998 by Alias Systems Corporation, and acquired by Autodesk, Inc. in early 2006
- *Used by top feature film animation studios*



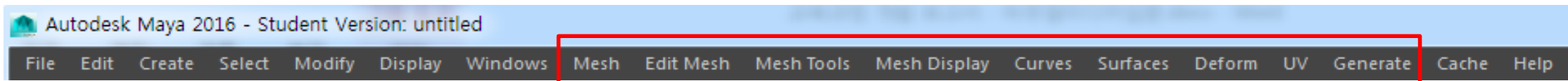


# Main Menu Bar

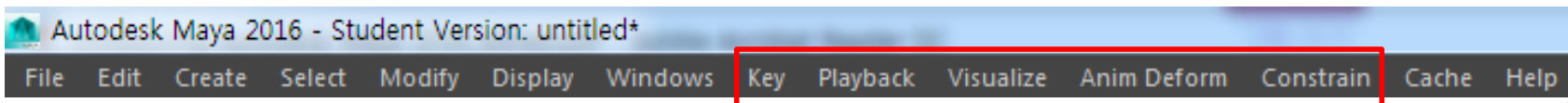
Menu set button →



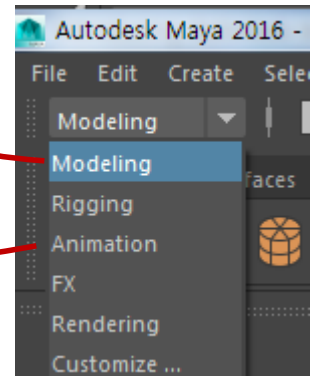
- In Maya, menu choices can be changed by switching *menu sets*, which are *Modeling*, *Rigging*, *Animation*, *FX* (Special Effects), and *Rendering*.



(Menu set of *Modeling*)



(Menu set of *Animation*)

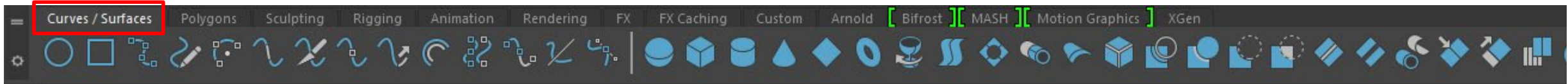
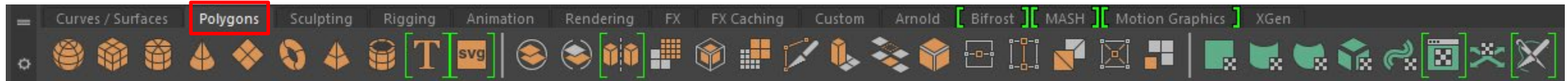


# Status Line / Shelf

- *Frequently-used menu items* and *tools* are located.



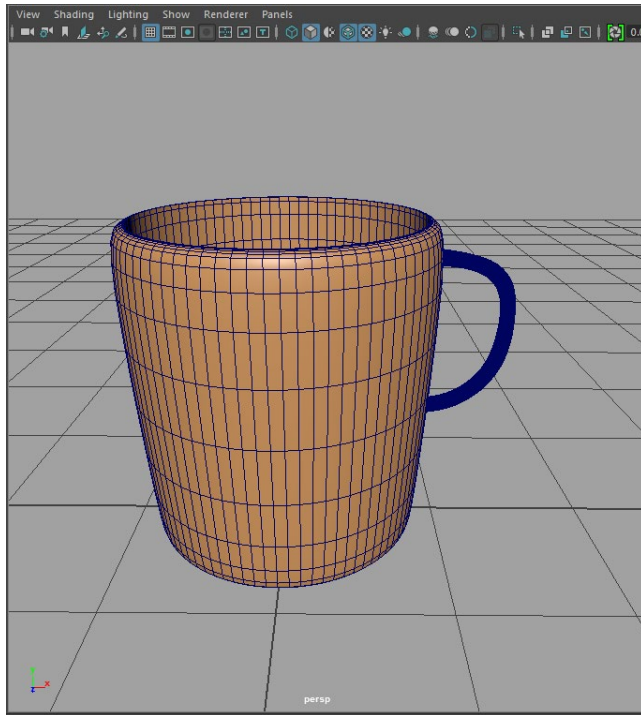
## Tools for polygonal modeling



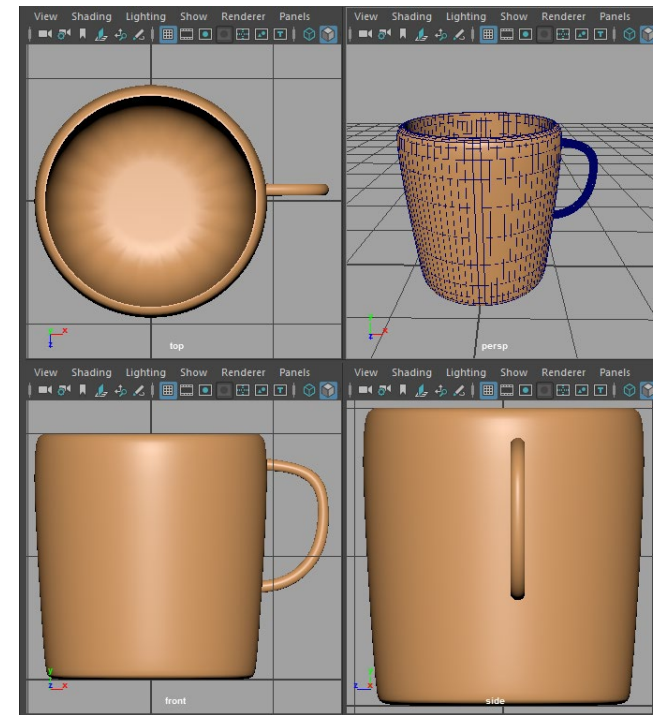
## Tools for making/editing curves and surfaces

# Viewport Navigation

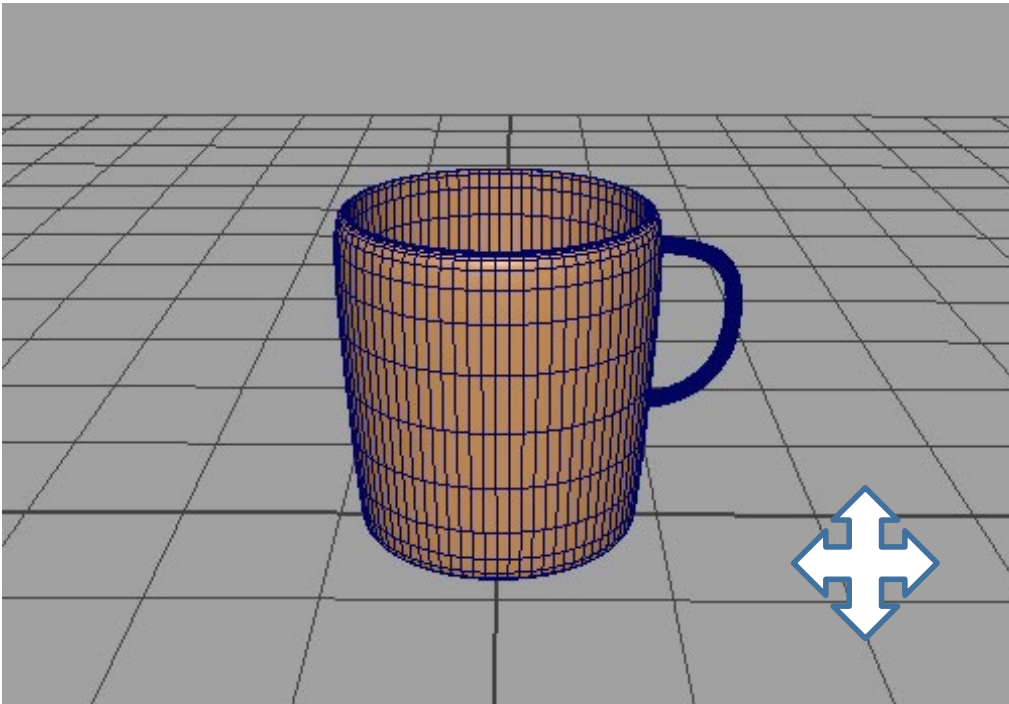
- **Spacebar**: toggle between a **four-panel layout** and a **single view panel**.



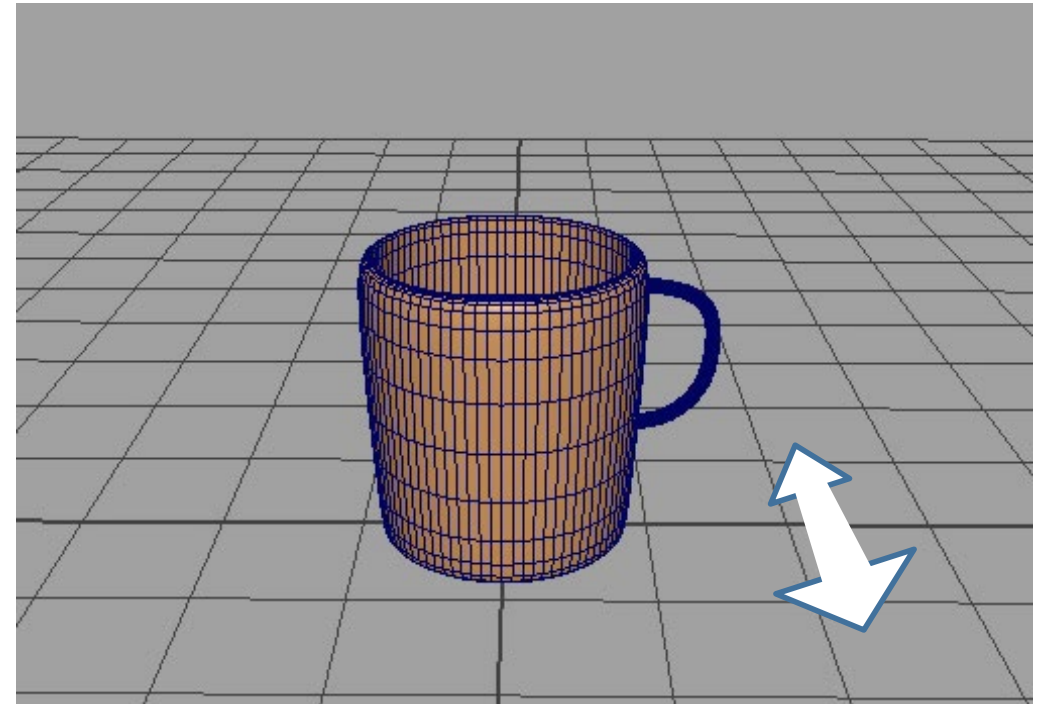
Press  
spacebar.



- **Alt+MMB<sup>1</sup>+Click**: Translates the viewport as it is done in two dimensions.



- **Alt+RMB<sup>2</sup>+Click (= scrolling the mouse wheel)**: This zooms the view in and out.

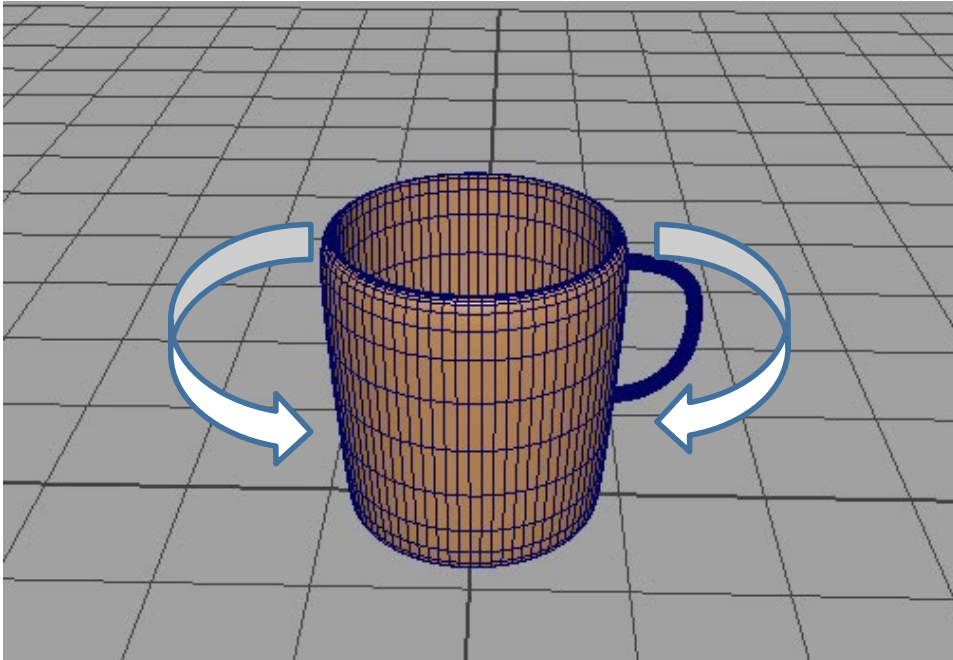


<sup>1</sup>MMB: Middle Mouse Button

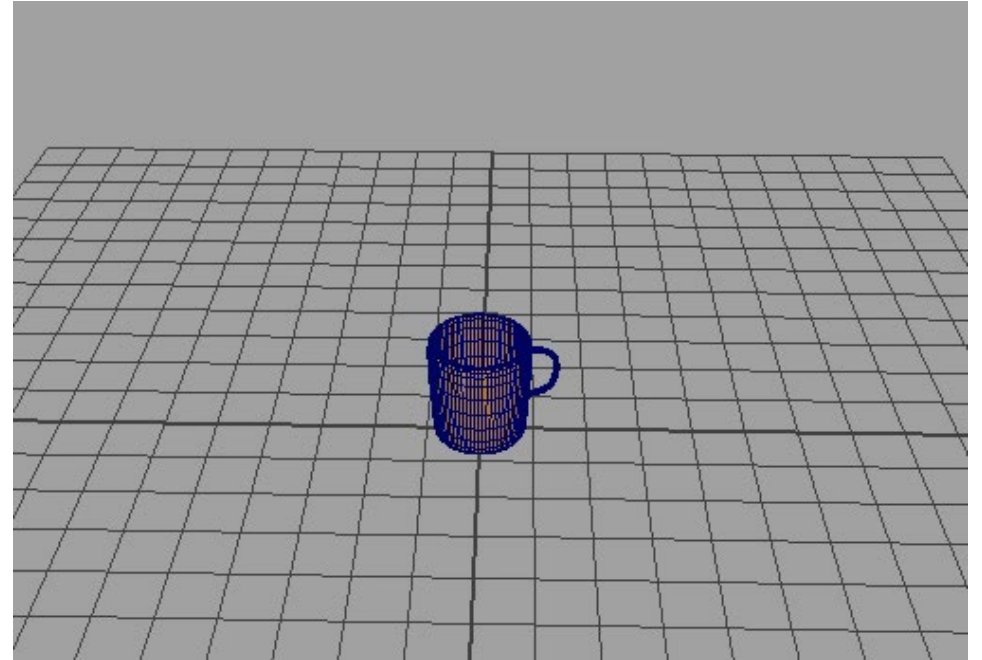
<sup>2</sup>RMB: Right Mouse Button



- **Alt+Click**: This rotates or orbits the camera around the center of the viewport.

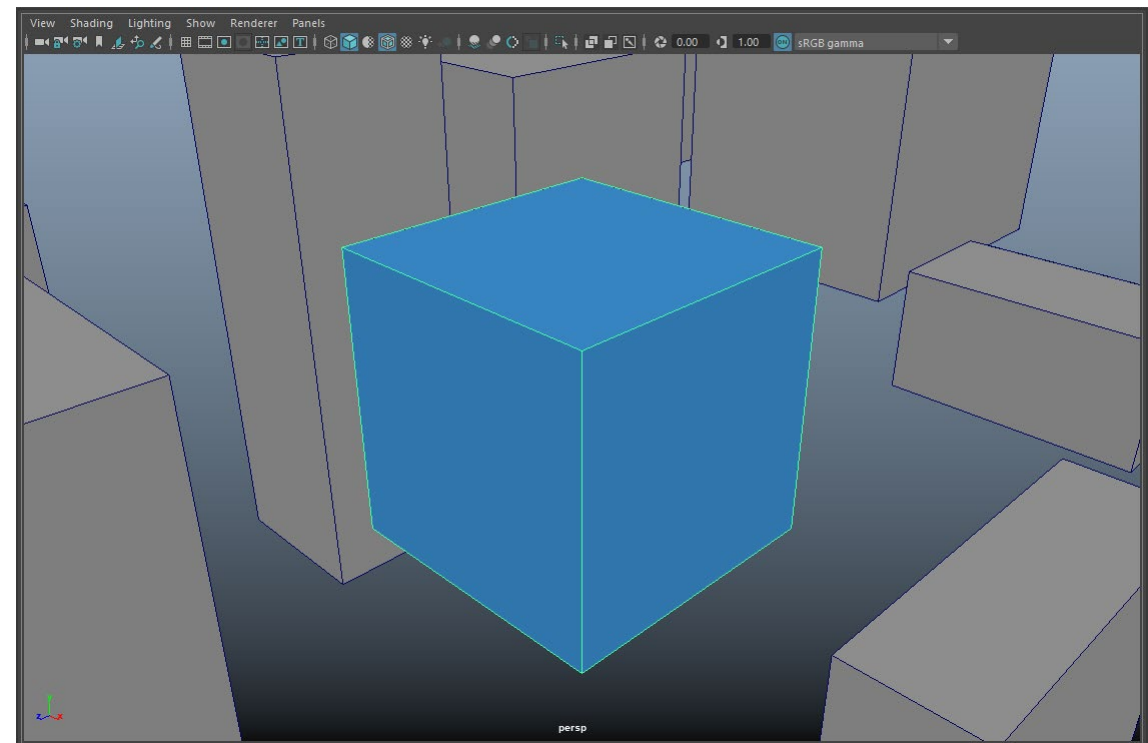
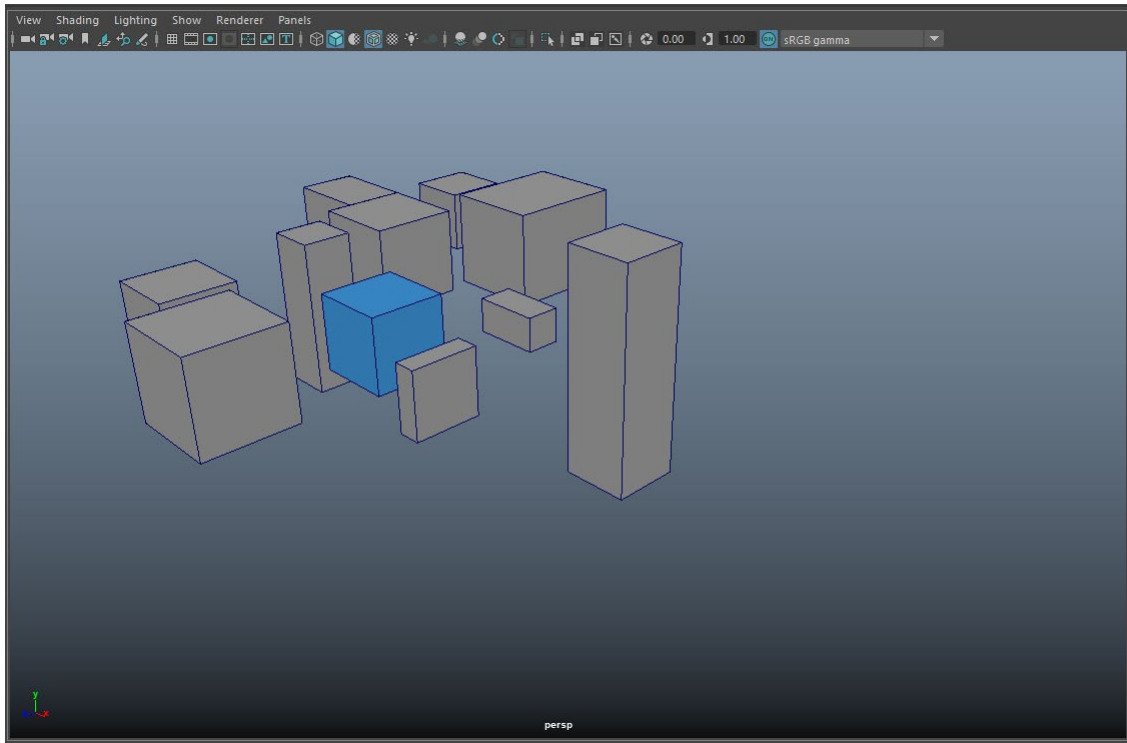


- **Ctrl+Alt+Click and Drag**: zooms in on the area specified by the mouse drag.







- Press **'F'** key: Zooms in on selected objects so that they fill the viewport.





# Manipulating Objects

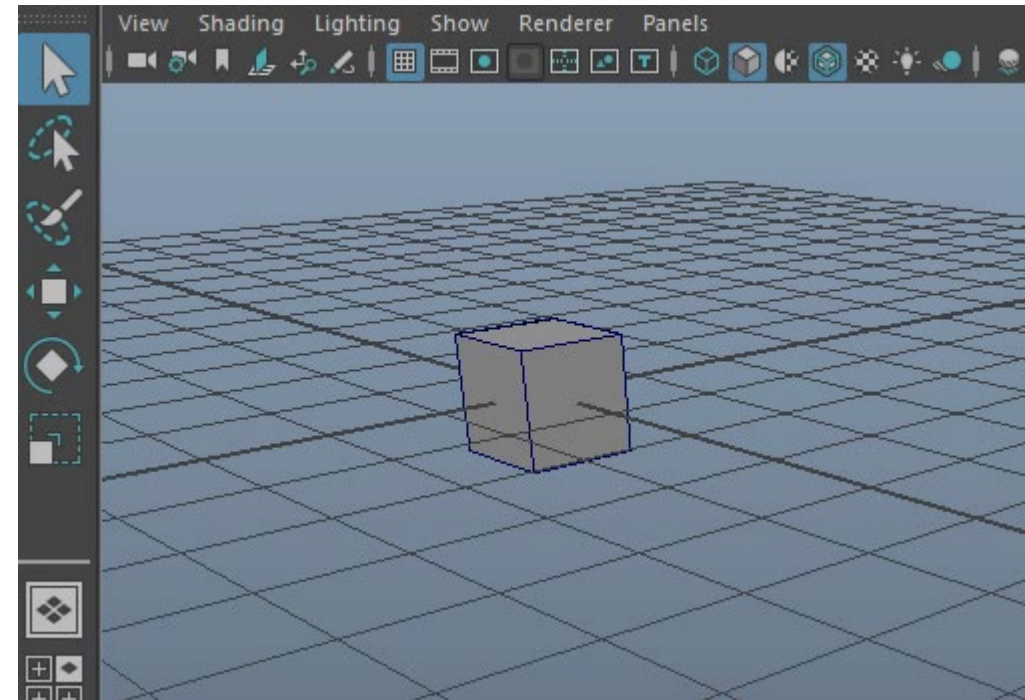
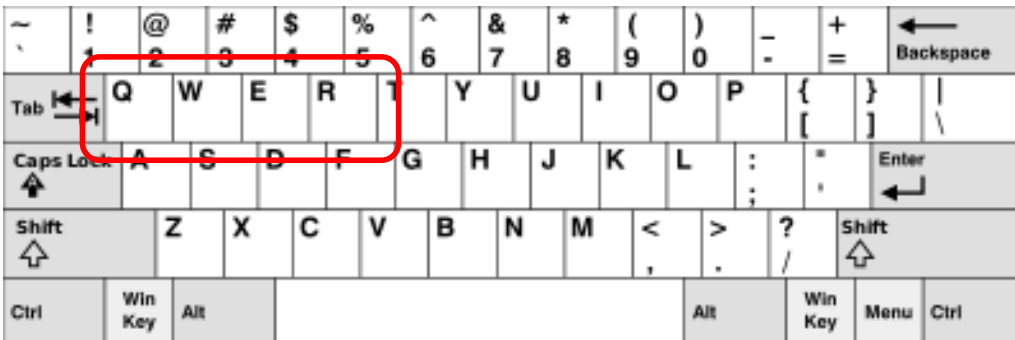
- Basic transformation tools

- Select (**Q**) 

- Move (**W**) 

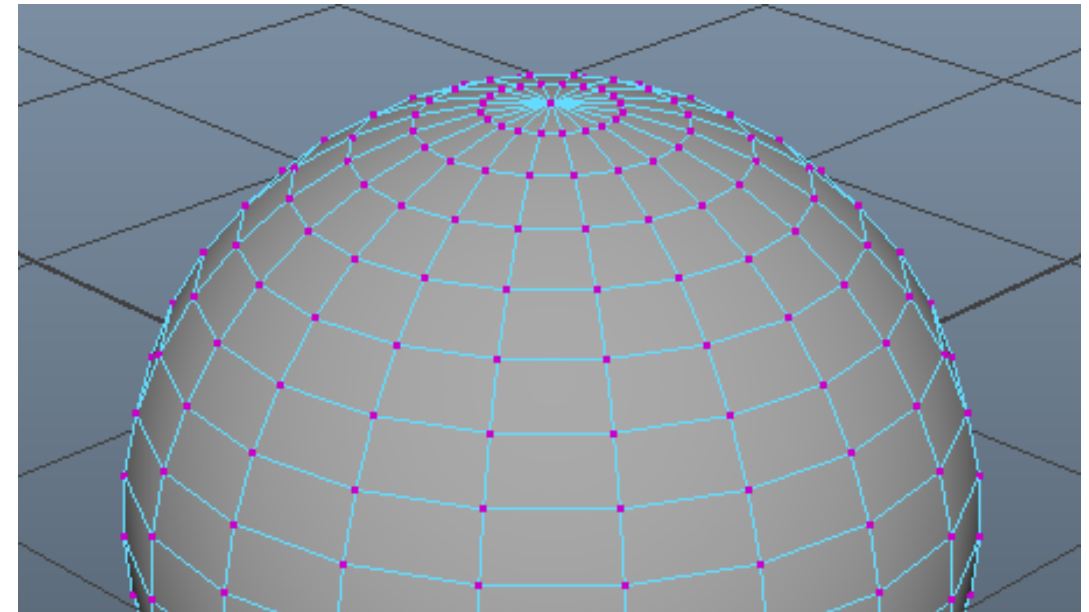
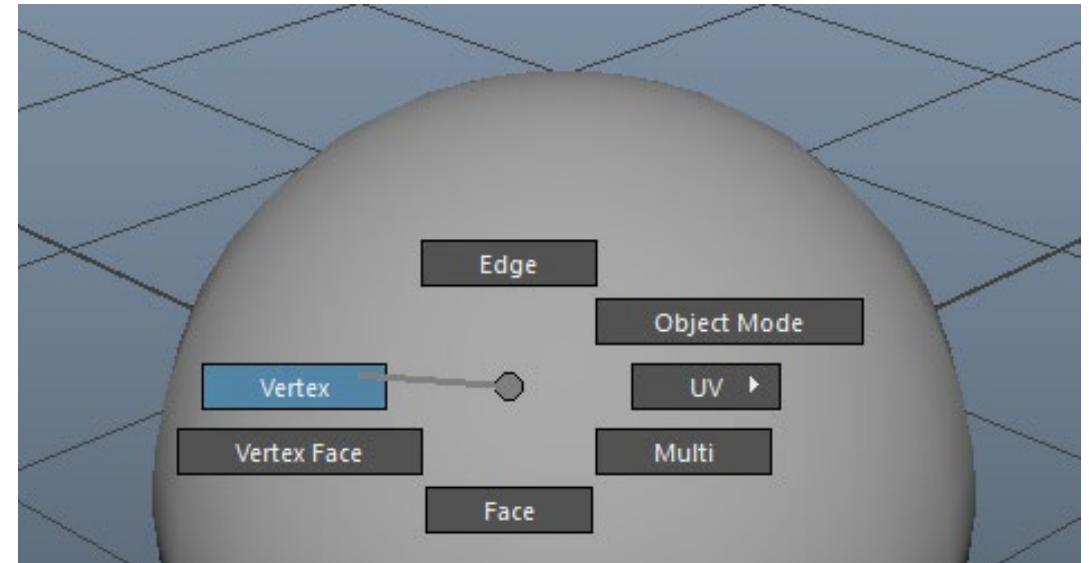
- Rotate (**E**) 

- Scale (**R**) 



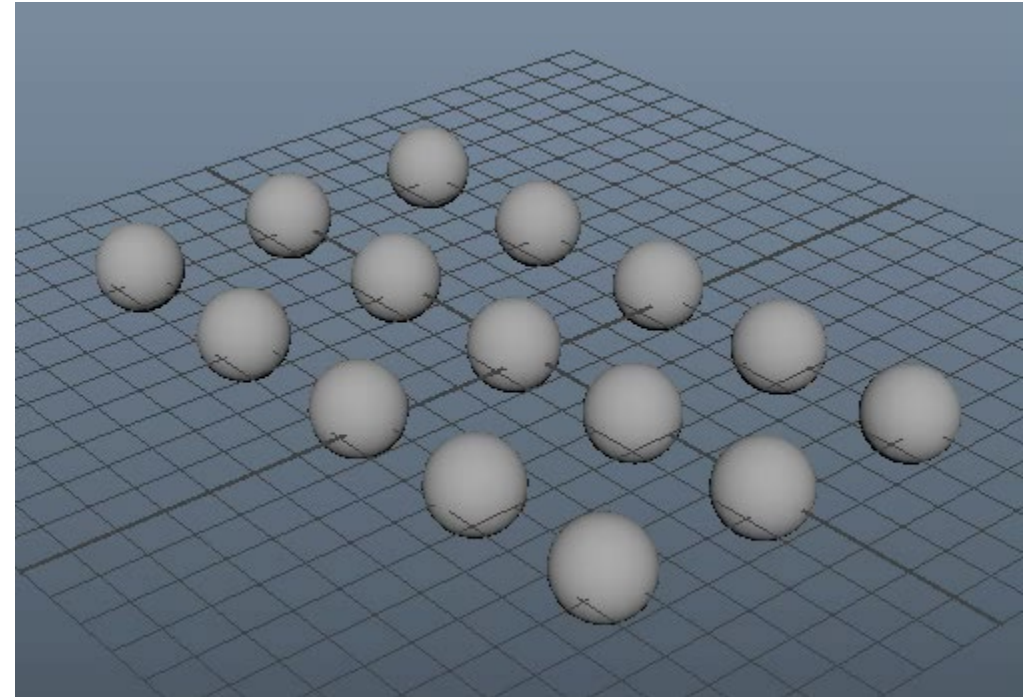
# Marking Menus

- *Pop-up menus* to quickly access *commonly-used tools*
- How to use
  - *Hold down RMB for a short while.*  
Then, a marking menu appears soon.
  - The menu is **context-aware**, which means it provides different menu items according to the context of your task.

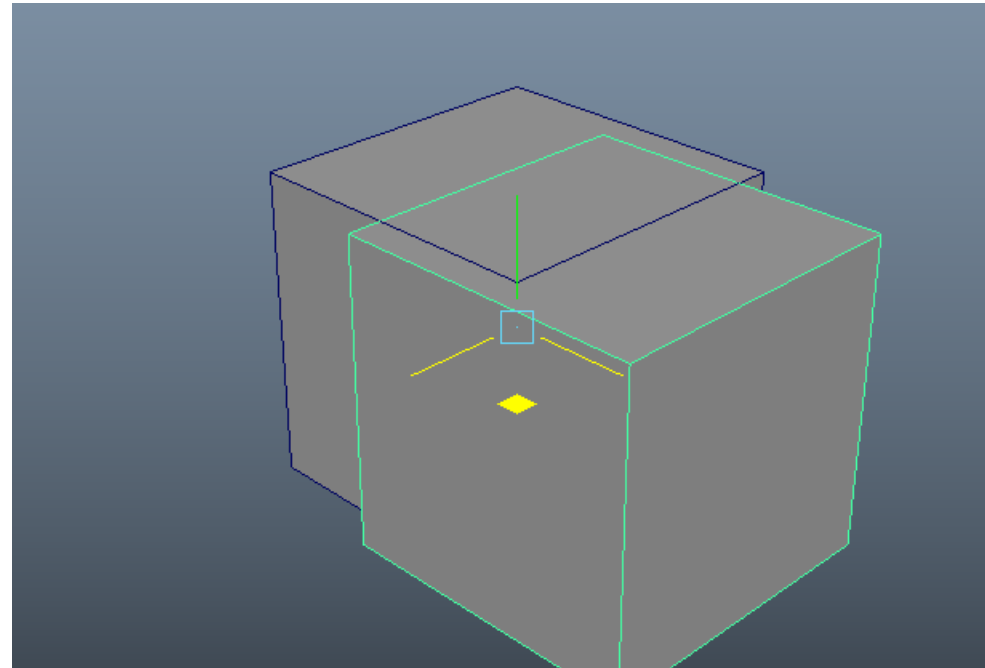
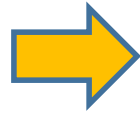
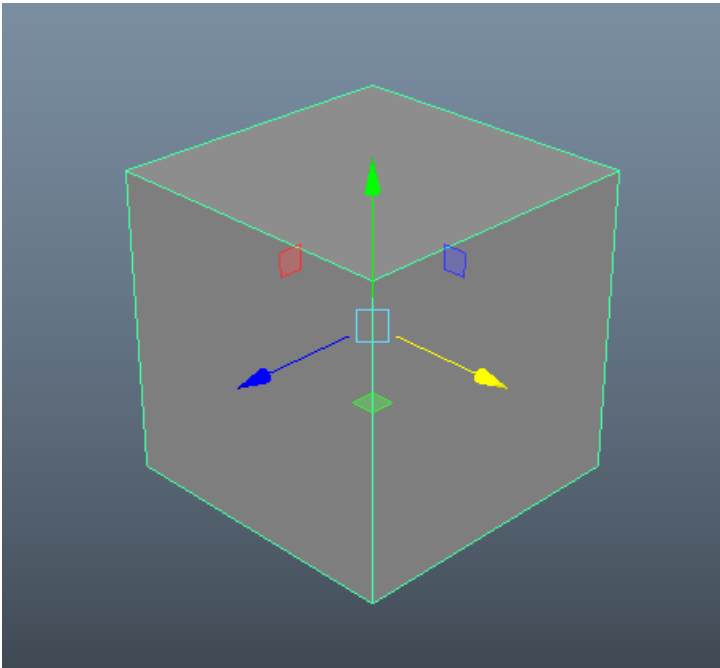


# Making Selections

- **Click an object** in the workplace
  - Its attributes appear in the Attribute Editor or Channel Box on the right.
- Multiple selections
  - **Shift + Click:**  
toggle the selection of an object.
  - **Ctrl + Click:**  
cancel the selection of an object.

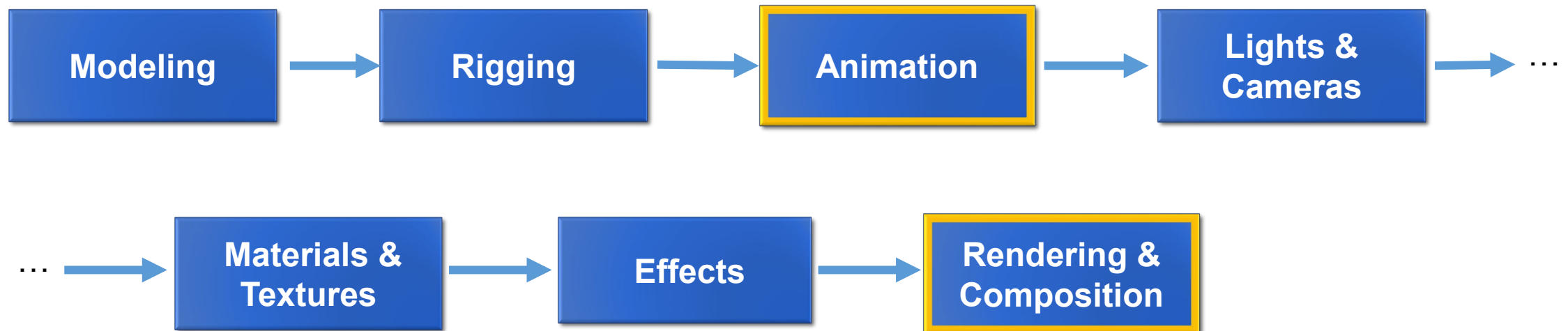


- Duplication of selected objects
  - Turn on the **Move** tool and drag the selected objects while holding down **Shift + LMB**.
  - Or simply press **Ctrl + D**.



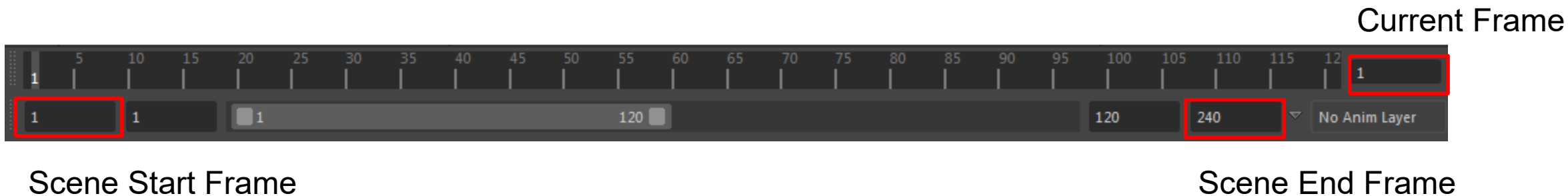
# Project: Solar System Animation

- Making Key-frame Animation
- Outputting Animation
- Outputting a High-quality Video



# Making Key-frame Animation

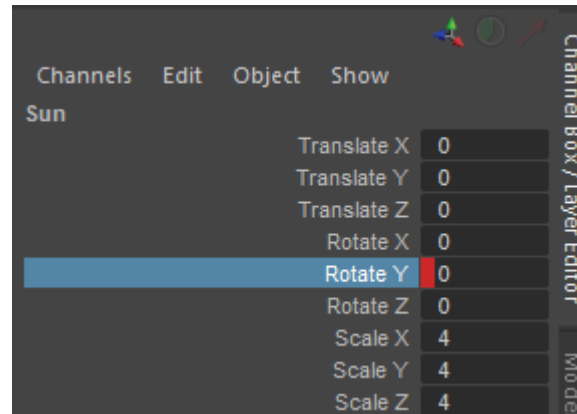
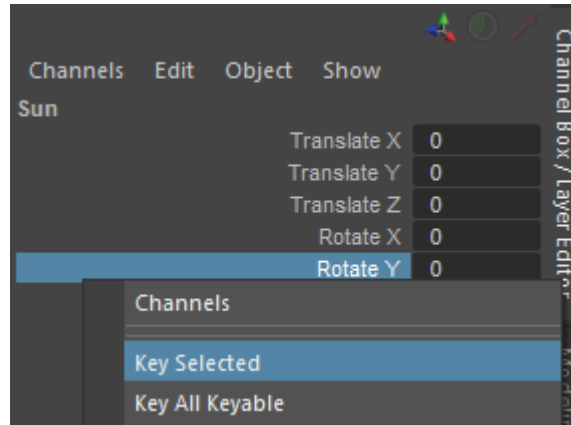
- What to animate
  - Rotate **the sun and the planets** about their own axes for their **self-rotation**.
  - Rotate **the moons around the planets** for their lunar orbits.
  - Rotate **the planets and their moons around the Sun**.
- Setup for animation
  - Set the **Scene Start Frame** to **1** and the **Scene End Frame** to **240** on the Range slider at the bottom of the user interface.



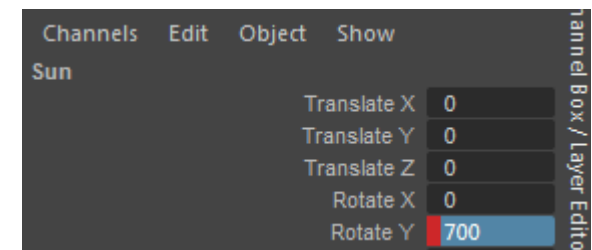
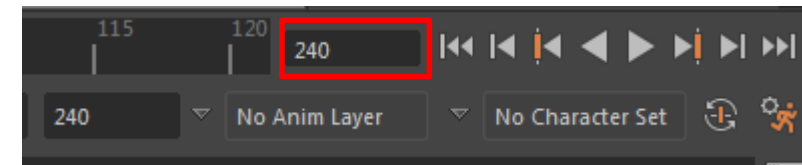


## • Self-Rotating Sun

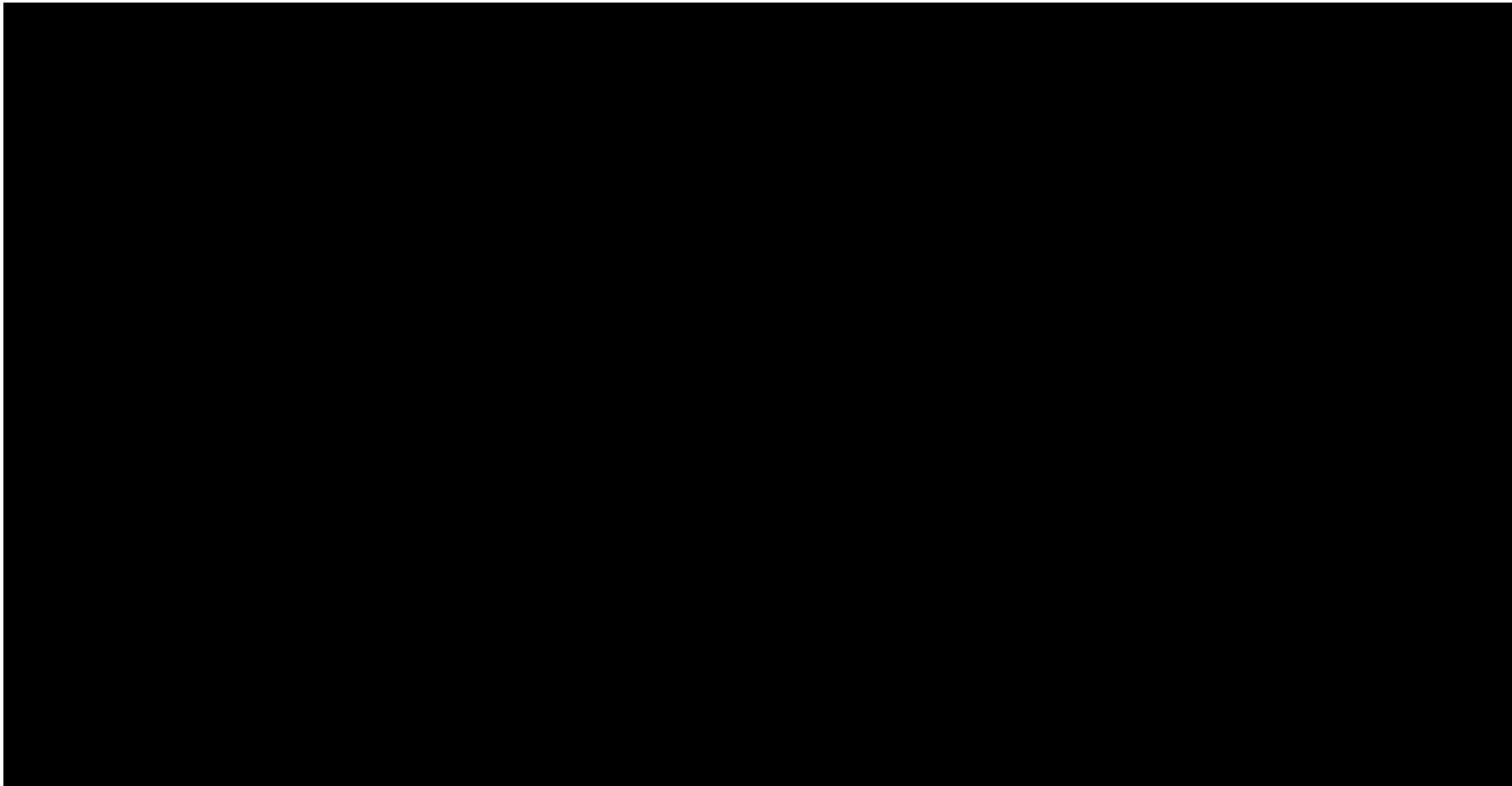
1. Select Sun and set the initial key frame for the Y-axis rotation.
  - Make sure you are on frame 1.
  - RMB+click the attribute name for **Rotate Y** in the Channel Box to show a pop-up menu.
  - Select **Key Selected** from the menu.



2. Go to frame 240 and select the Rotate tool (or press E).
  - Rotate Sun about the Y-axis a few times using the tool.
  - Choose **Key Selected** for **Rotate Y** again on the Channel Box.



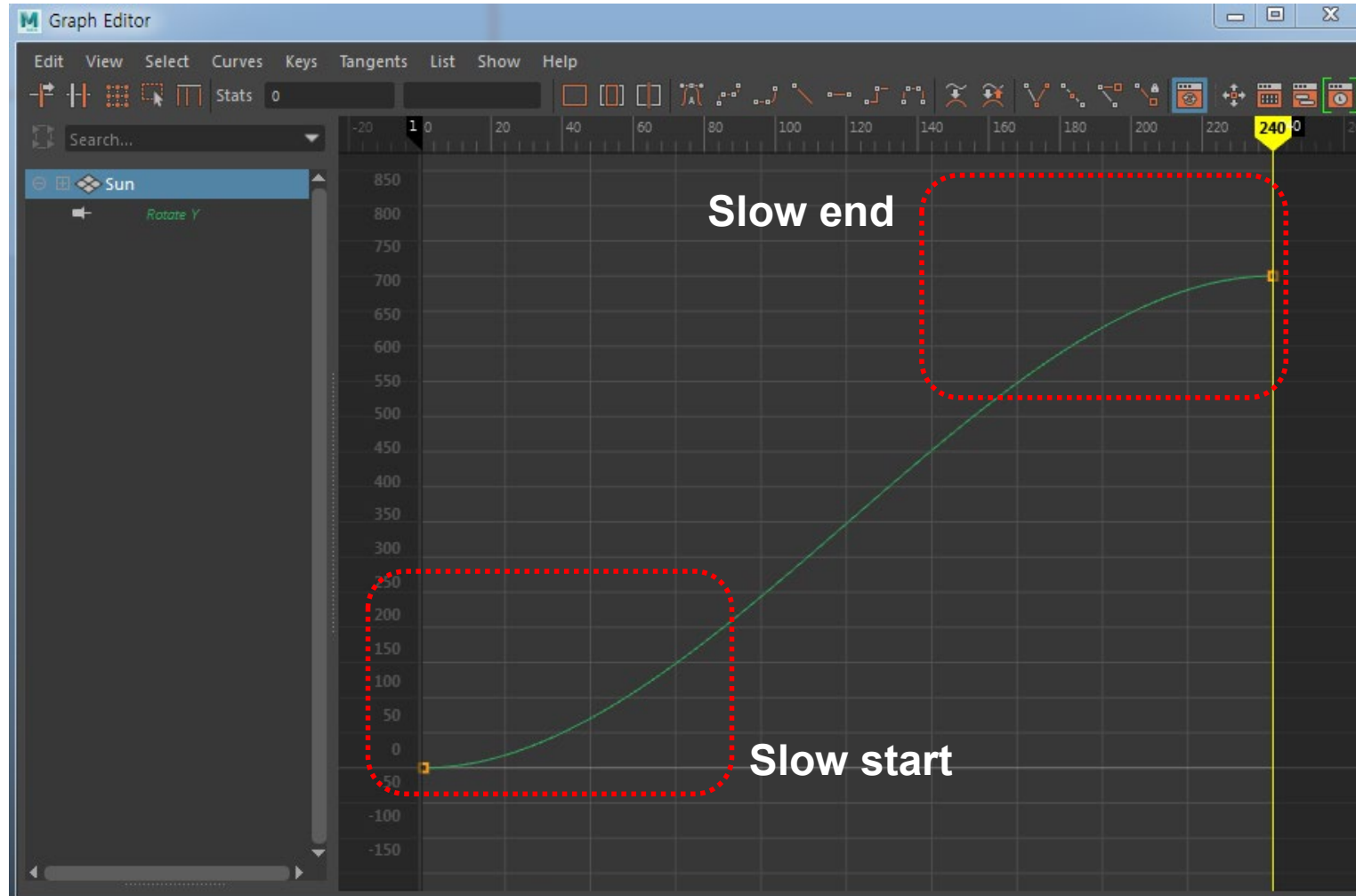
- Playing back the animation
  - Click  button in the Payback Controls or drag the cursor on the Time Slider.




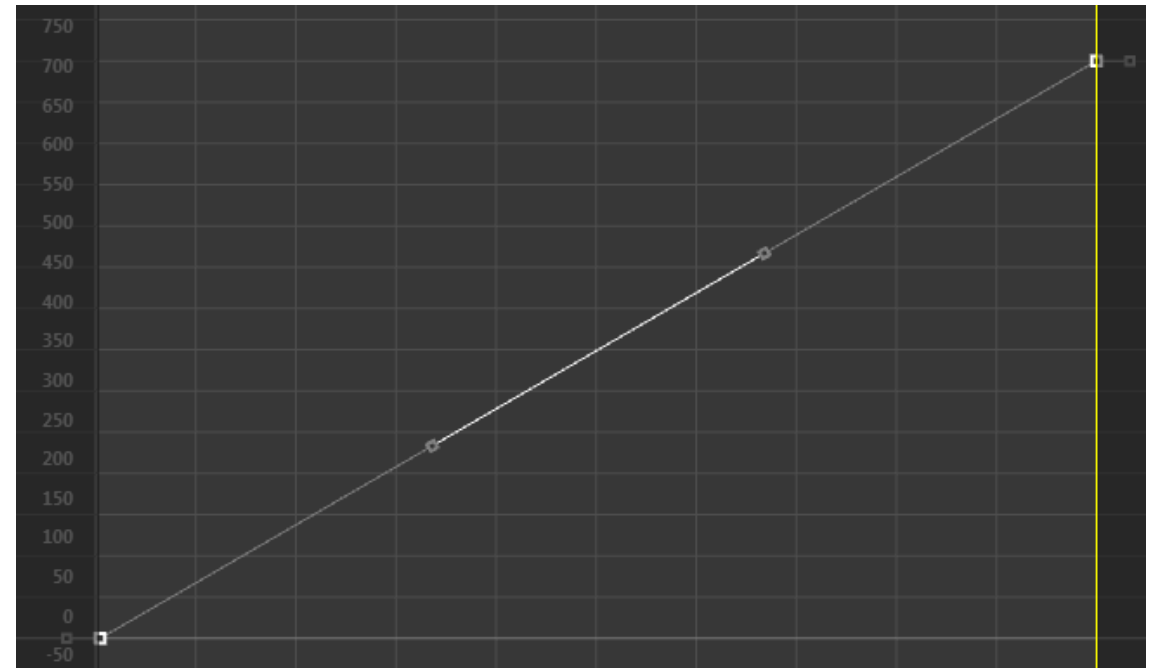
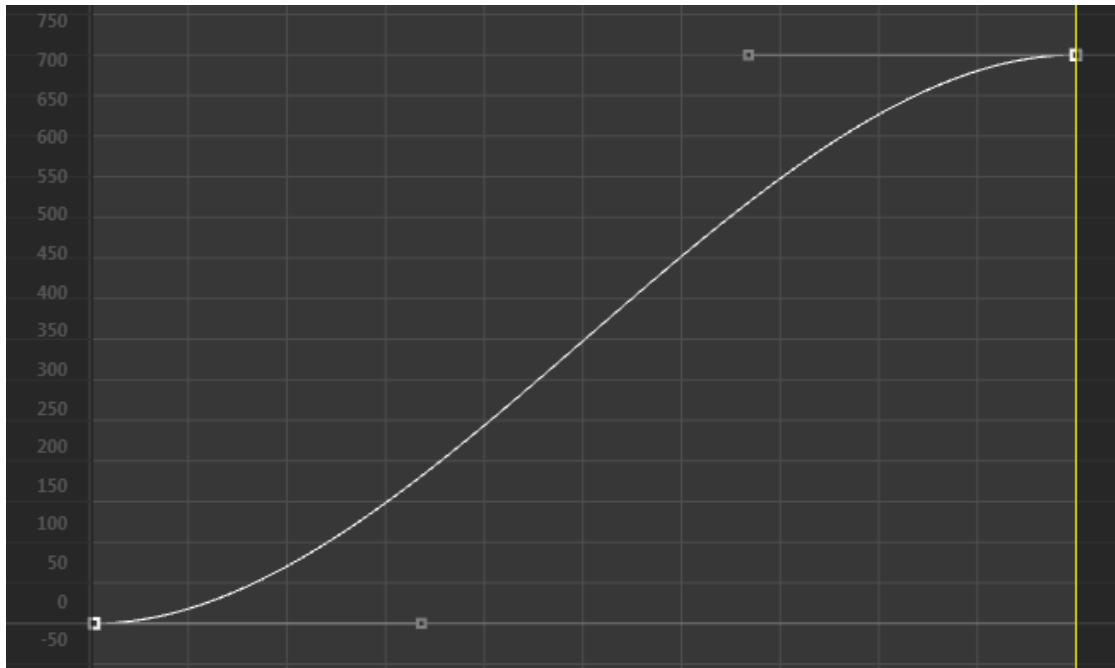
\* Issue: *slow start and slow end !!*

## » Graph Editor

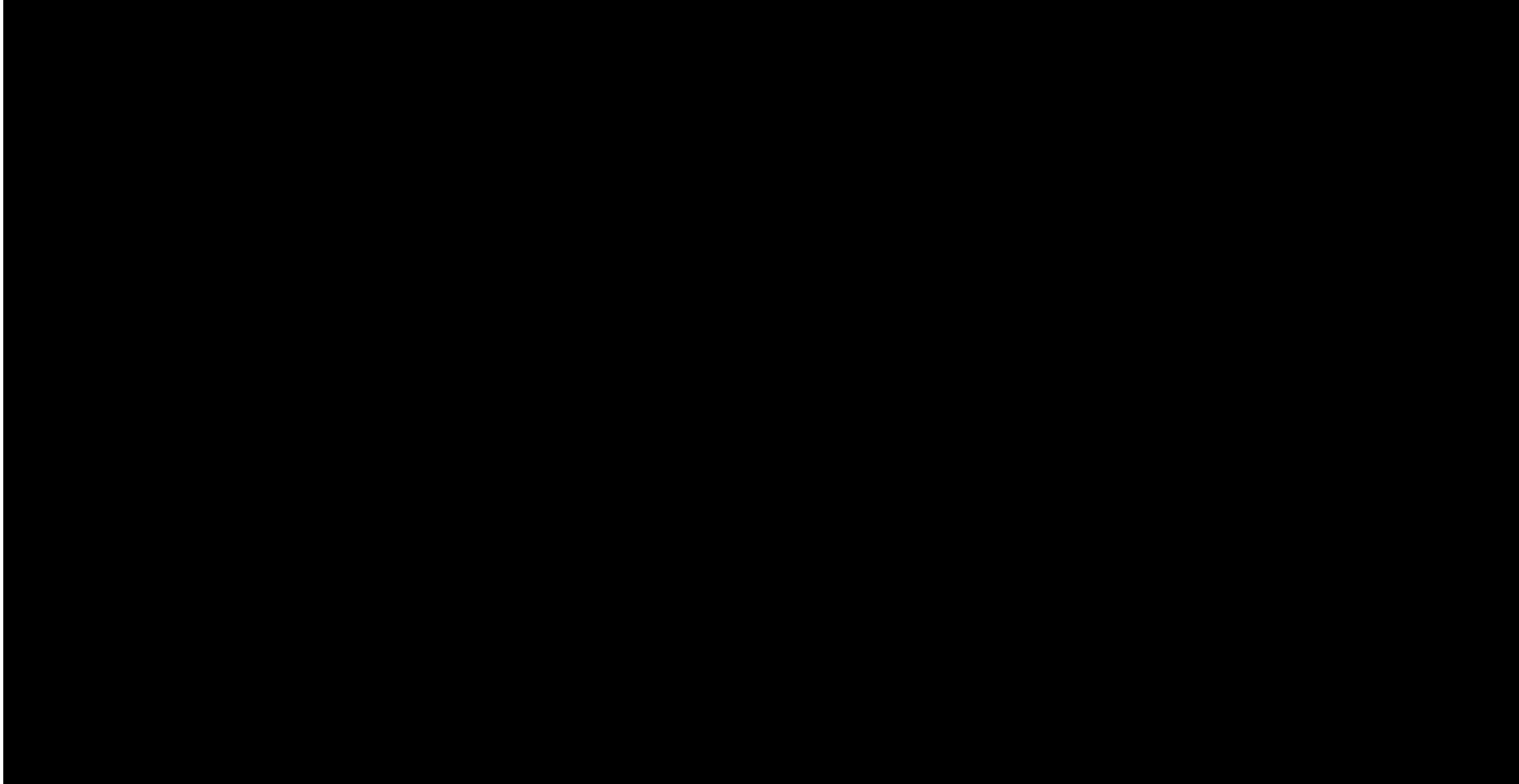
- Select the Sun and click **Windows → Animation Editors → Graph Editor**.



- While holding down a **Shift** key, select the **keys** at the front and the end.
- Then, choose **Tangents** → **Linear** (or click  icon).



- Resulting video

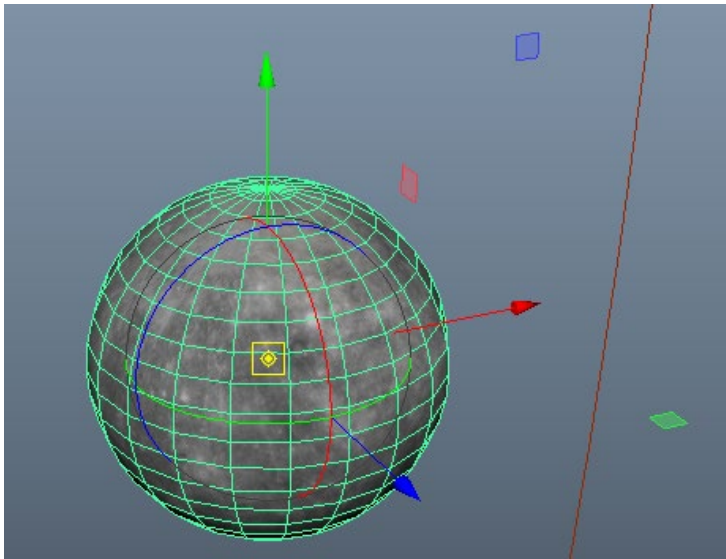


- **Self-Rotating Mercury**

- In a similar way to self-rotating the Sun sphere, self-rotate the Mercury about the Y-axis.

- **Animating Mercury to orbit the Sun**

- Pivot point



Pivot point placed at the center of the sphere (default)

Any rotation around object's center produces only its self-rotation.

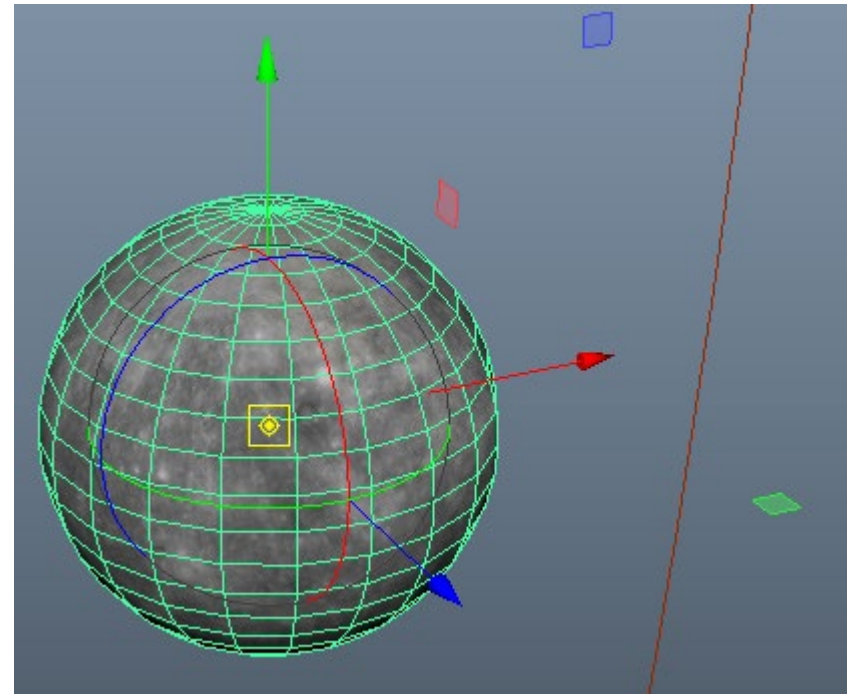
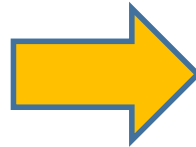
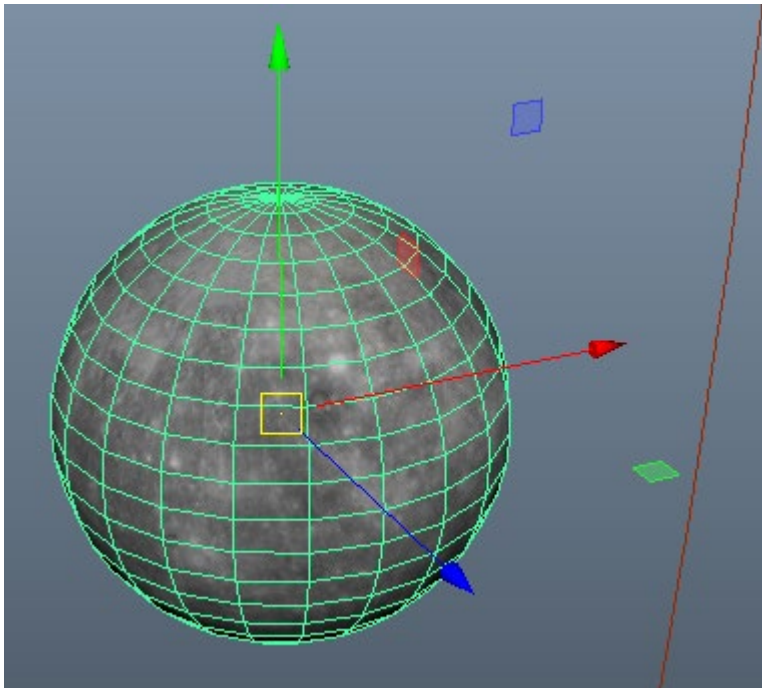
In order for Mercury to orbit the Sun, it must revolve around a pivot point that is placed at the center of the Sun sphere.

**Solution 1: moving the current pivot**

- Move the current pivot point to the center of the Sun sphere.
- *That would, however, negate Mercury's self-rotation.*

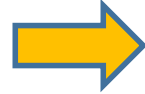
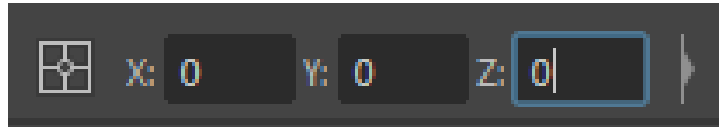
## » How to Move the Pivot Point

- Select the **Move** tool (or Press **W**) and press the **Insert** key. Then, a yellow dot shape will appear at the center of the handle of the Move tool.



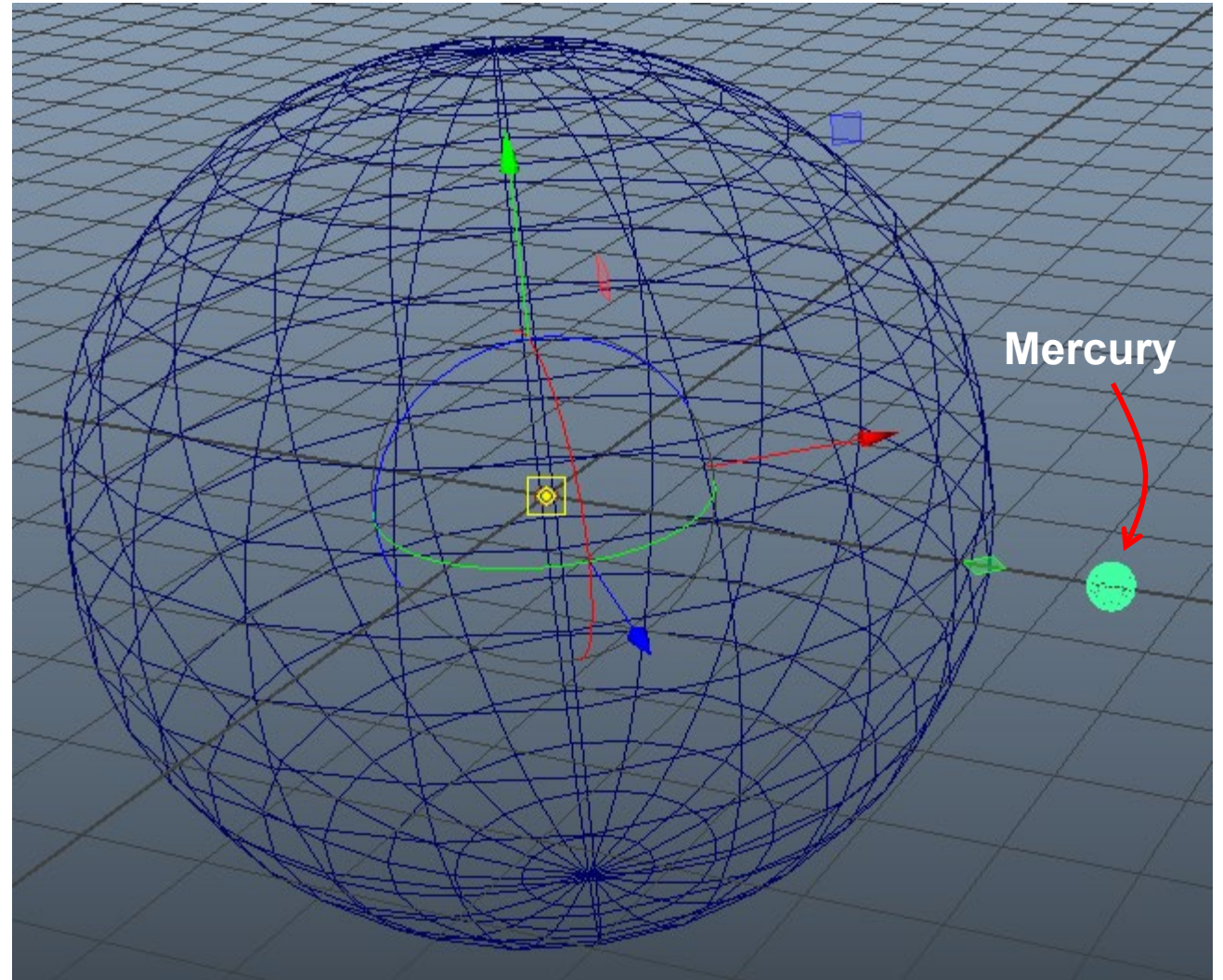


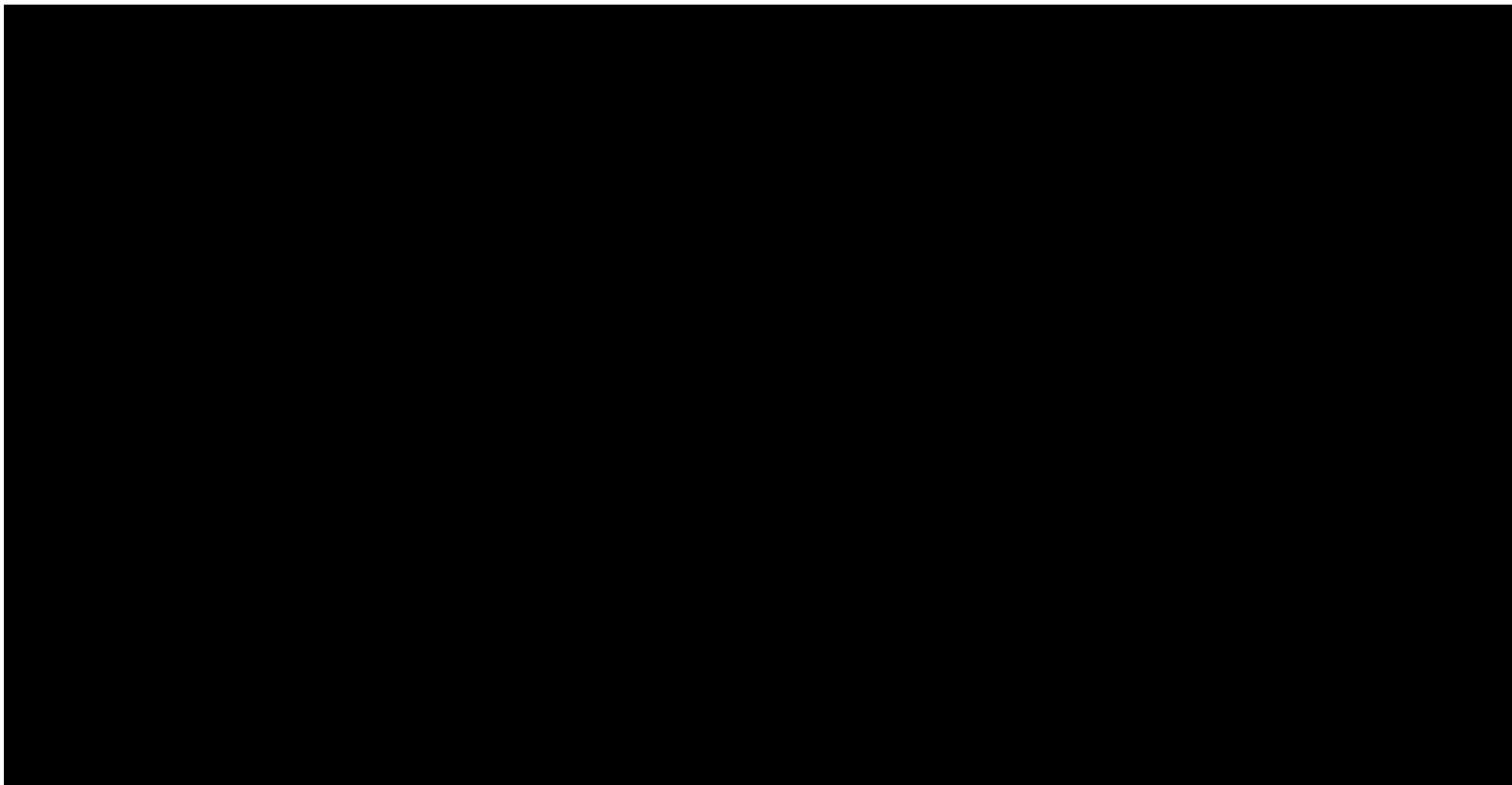
- In the **Quick Selection Field**, choose the **Absolute transform** option. Then, set x, y, z to **0** and press **Enter**.



Press **Enter**.

- It will place the pivot point at the origin of the world coordinate system.



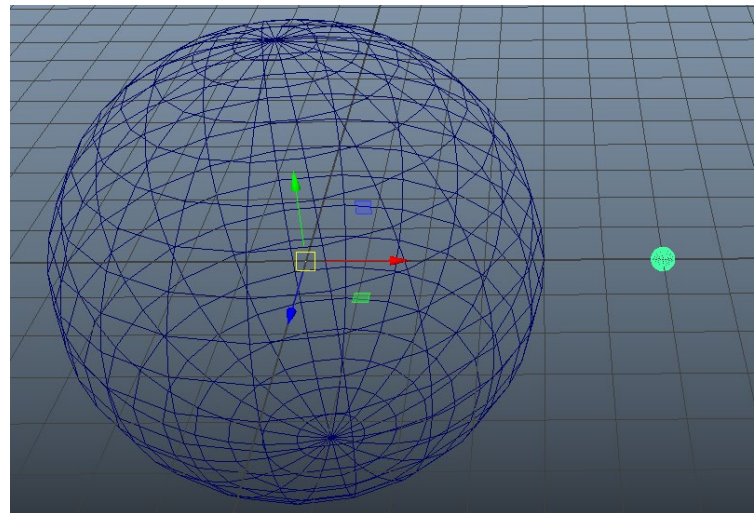
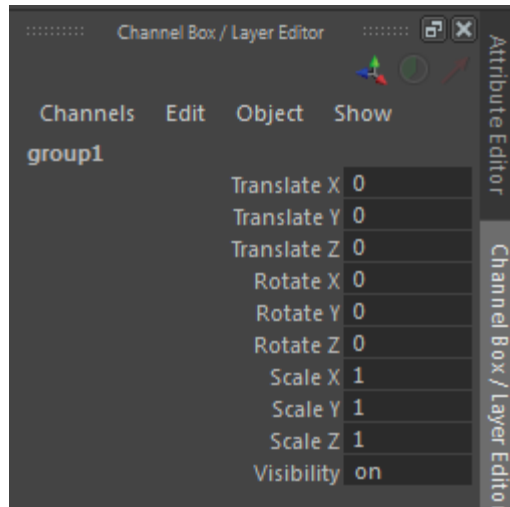


## Solution 2: adding a second pivot

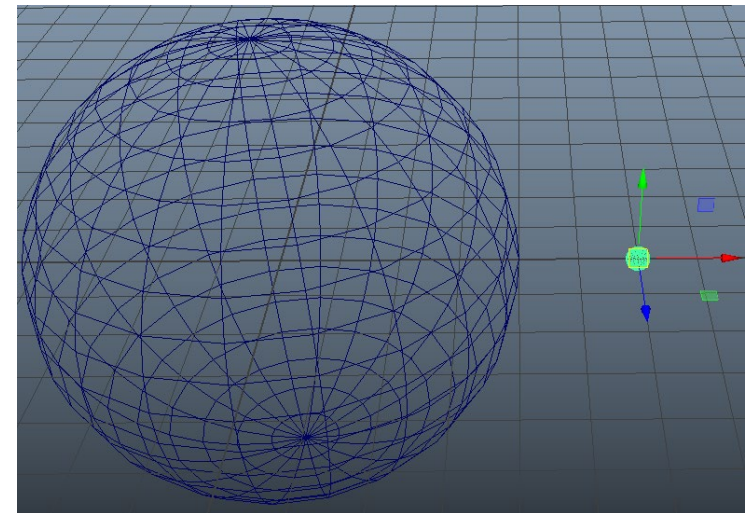
- Preserve the original pivot at Mercury's center so it can self-rotate.
- Add a second pivot point at Sun's center so that Mercury can revolve around it.

How can we do so?

1. With Mercury selected, choose the **Rotate** tool (or press **E**) and then choose **Edit** → **Group** (or press **Ctrl+G**).
2. The Channel Box displays attributes for a new group named **group1**.
  - Notice that the pivot point of **group1** is placed at the origin while Mercury maintains its own pivot.

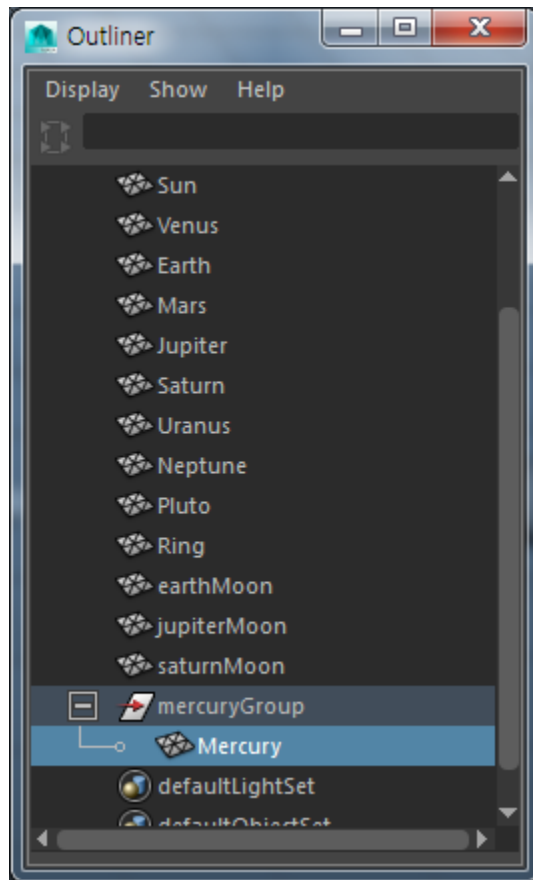


Pivot of **group1**



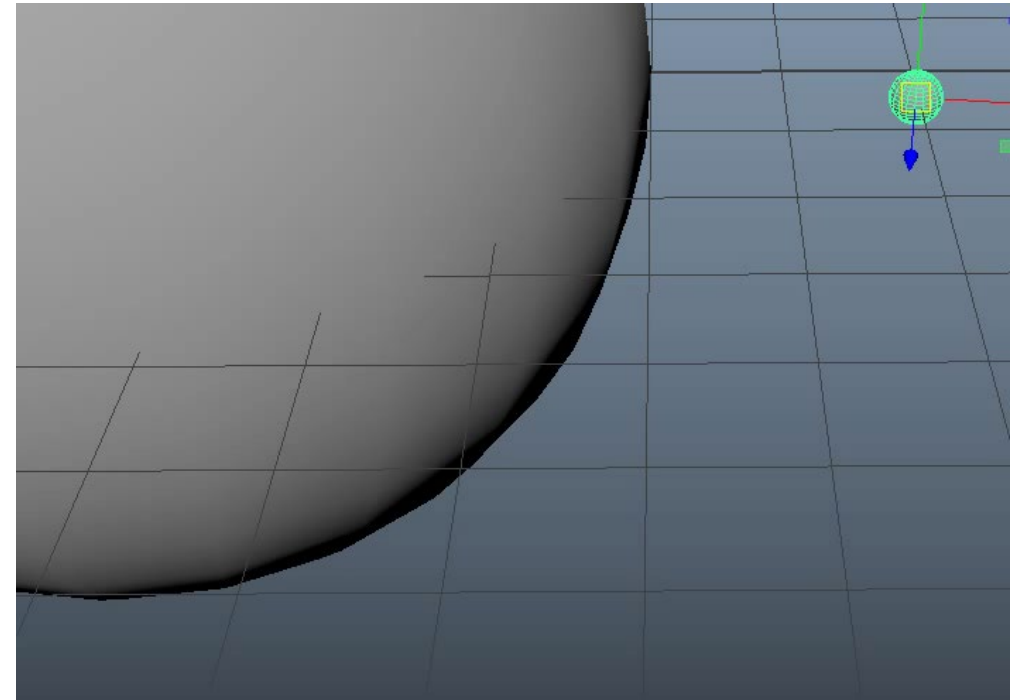
Pivot of the Mercury sphere

3. Rename the group **mercuryGroup** on the Channel Box.
4. Set key frames for Y Rotate of mercuryGroup at frames 1 and 240 for Mercury to orbit the Sun (You may enter -720 in Rotate Y at frame 240).



Outliner window  
(Windows → Outliner)

Note: The transformation of a group is applied to all its elements.

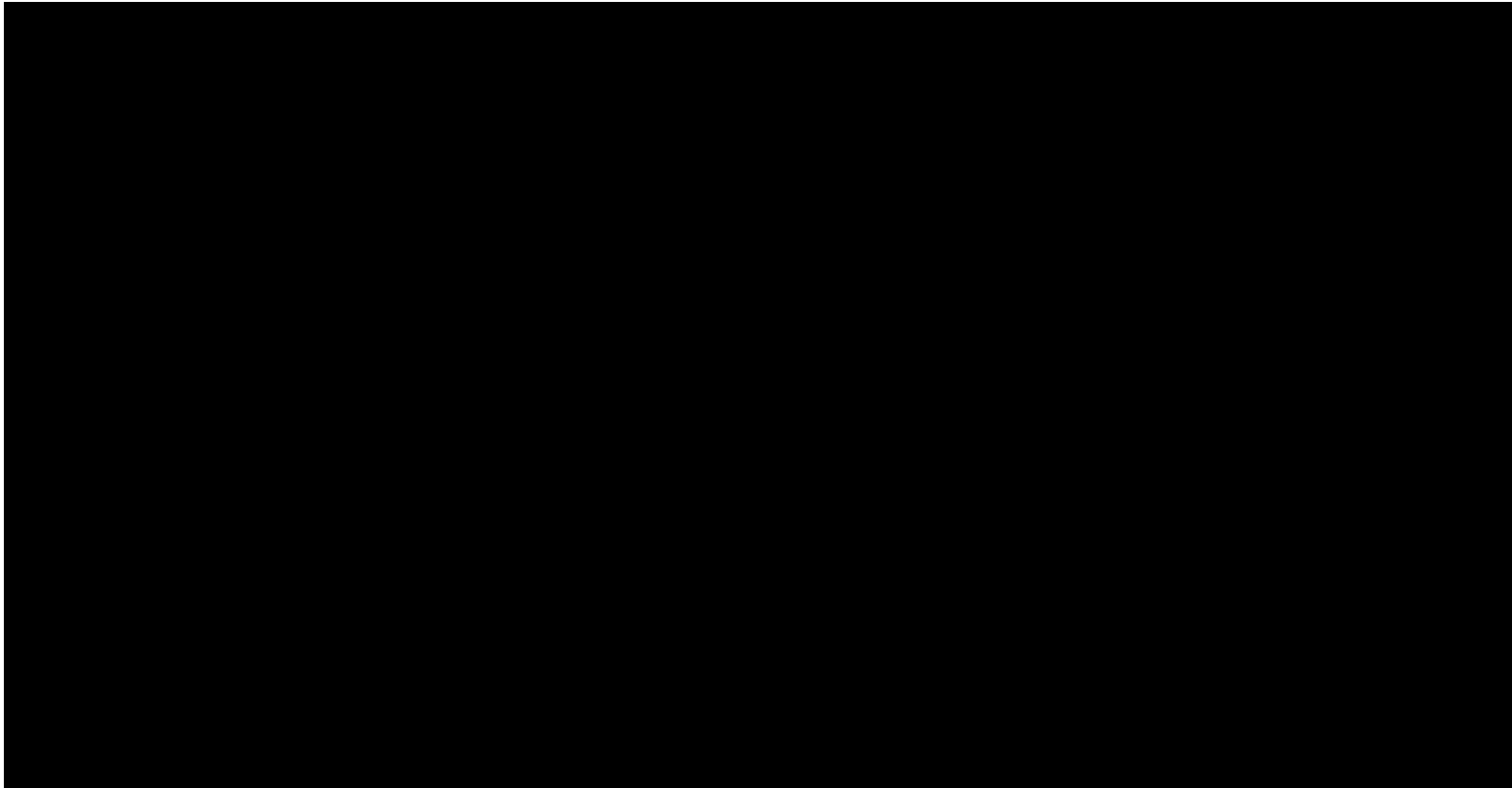


## • Rotating Venus

1. Follow the same procedure as for Mercury's **self-rotation** and **orbit around the Sun**.
  - Make sure to name the group containing Venus **venusGroup**.
  - Each planet's **orbital speed should be different** from those of the others.

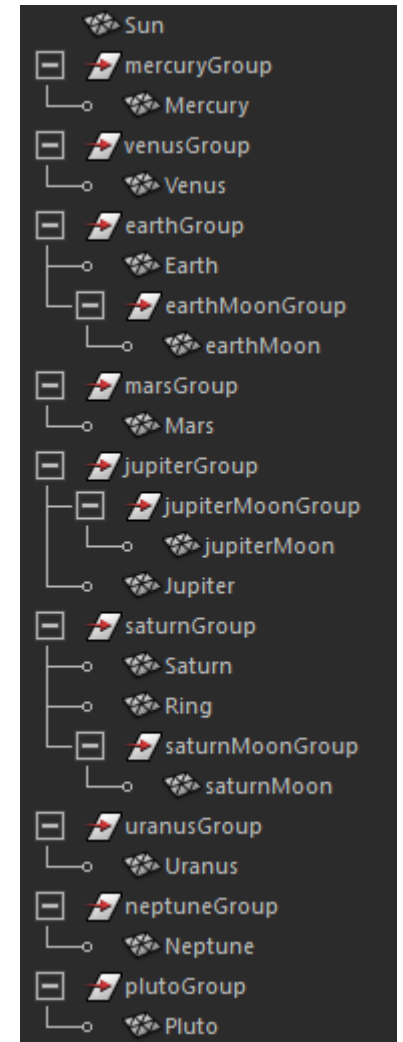
## • Rotating Earth and its Moon

1. Give Earth and Moon their respective self-rotation animation.
2. Group Moon to itself and name the group **earthMoonGroup**.
  - Copy the x position of the Earth. Then, move the pivot point of earthMoonGroup to the copied position accurately using the Quick Selection Field.
  - Set key frames for Y Rotate of earthMoonGroup at frames 1 and 240 for Moon to orbit Earth.
3. Select Earth and earthMoonGroup and group them by choosing **Edit → Group**.
4. Rename the group **earthGroup** and set its key frames at frames 1 and 240 so that Earth and Moon orbit the Sun sphere.



- **Rotating other planets and their moons**

1. Follow the previous steps to produce self-rotation and orbit around the Sun.





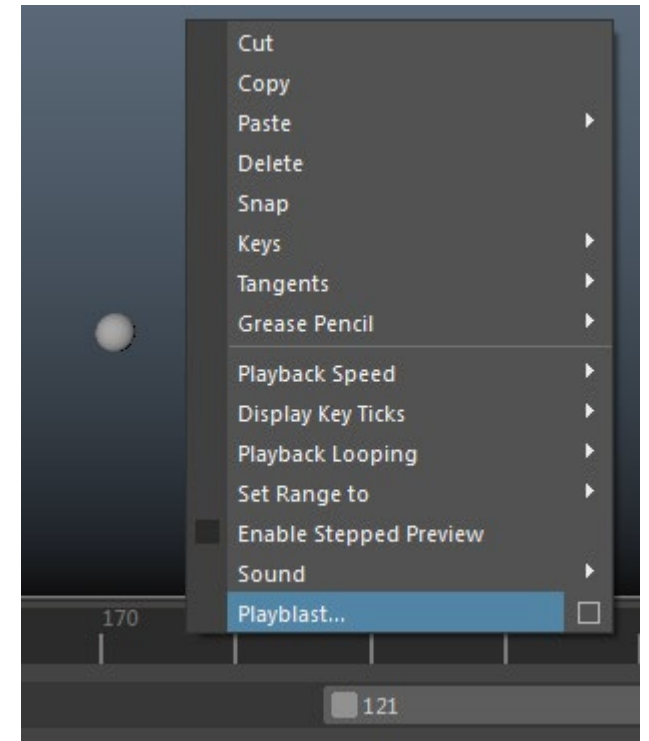
# Outputting Animation

- **Playblasting**

- A fast way of outputting an animation as a video file
- Mainly used to test intermediate results

- How to use

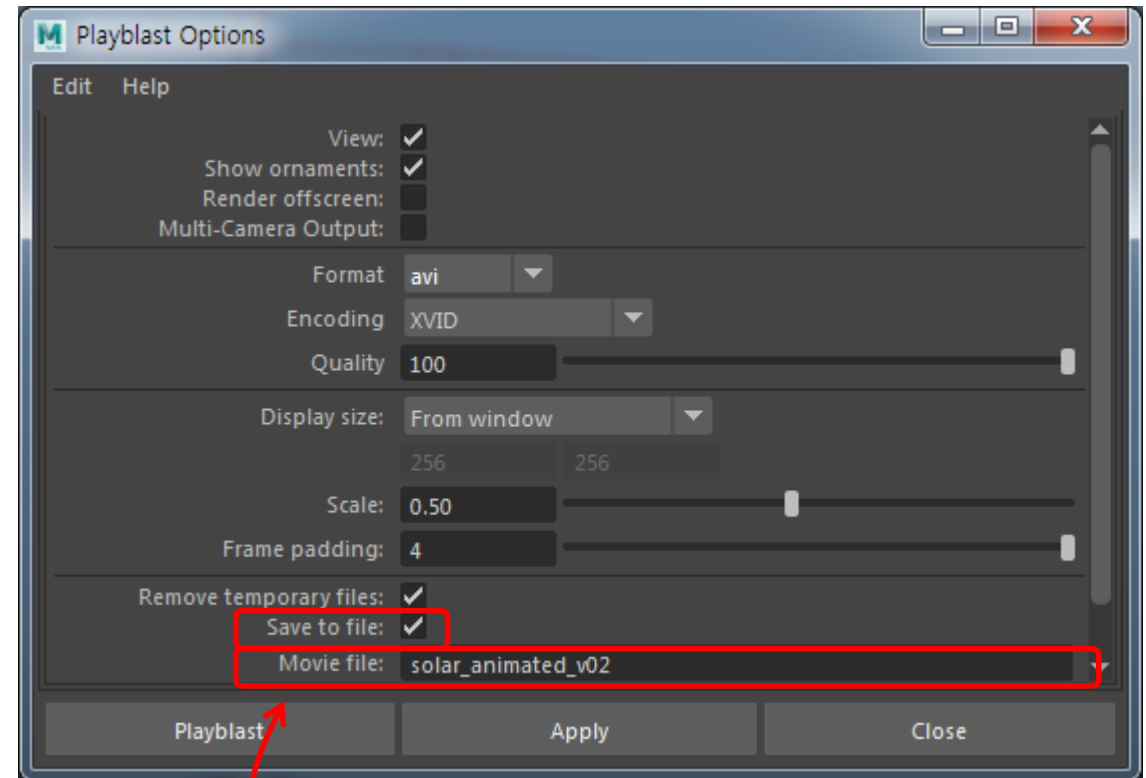
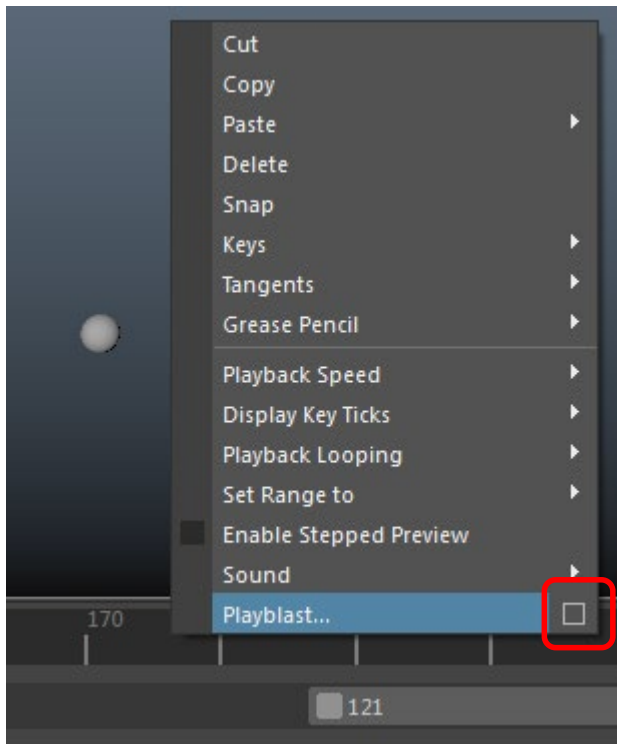
- RMB+click anywhere in the Timer slider and select **Playblast**.





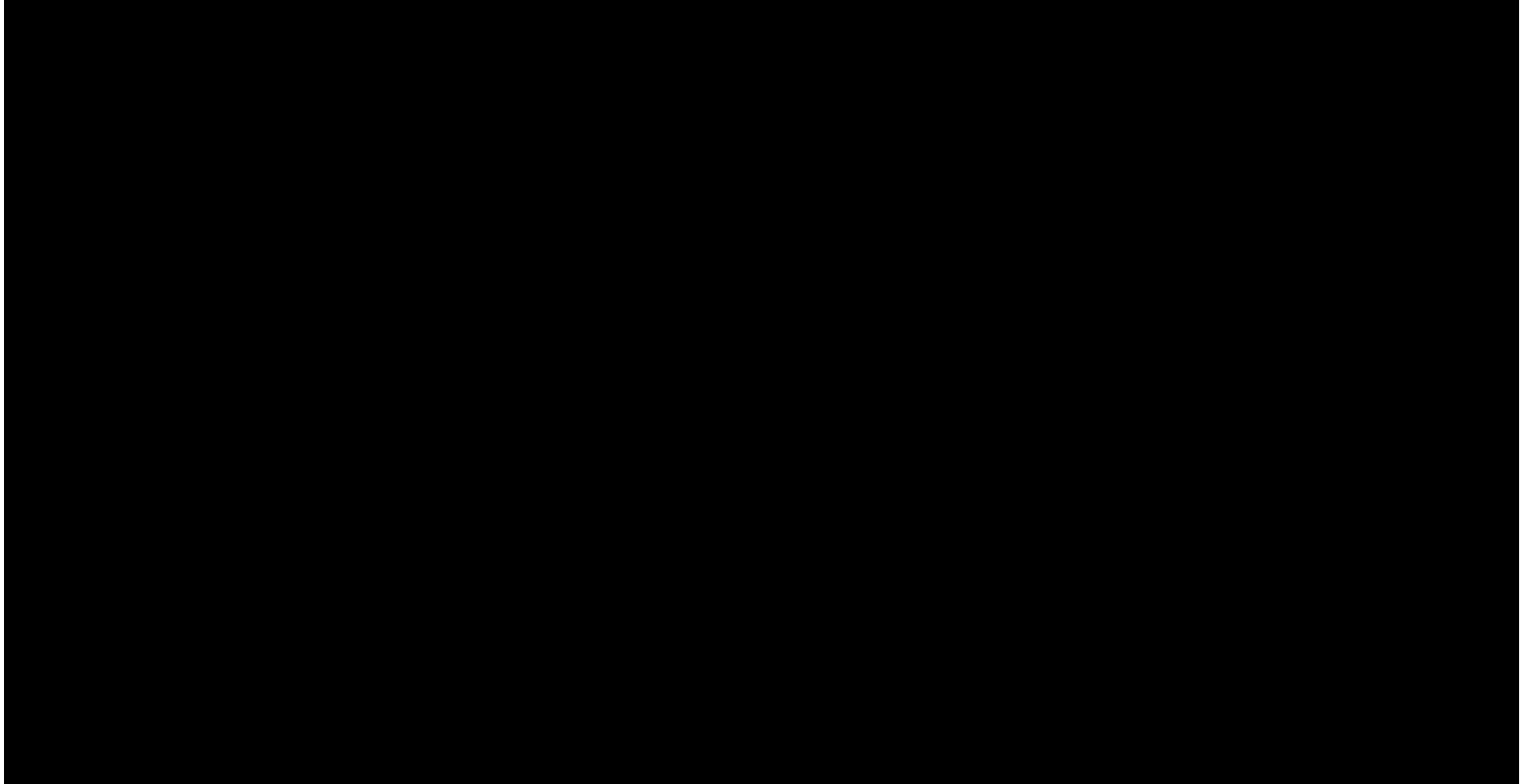
How to save the output file:

- Click ☐ next to “Playblast...” to open Playblast Options.
- The resulting animation file will be stored to the **Movies** subfolder under your project folder if you check the “**Save to file**” option”.



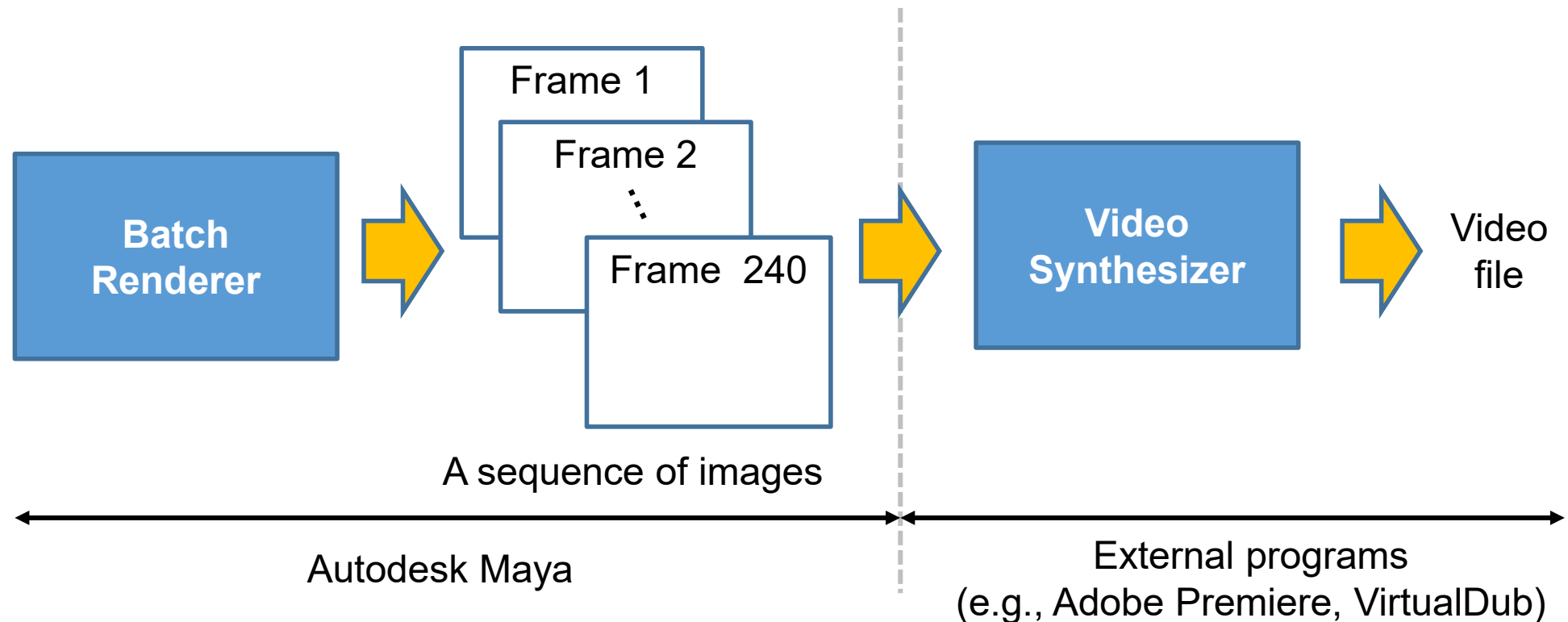
Type over here a desired file name.

- Resulting video




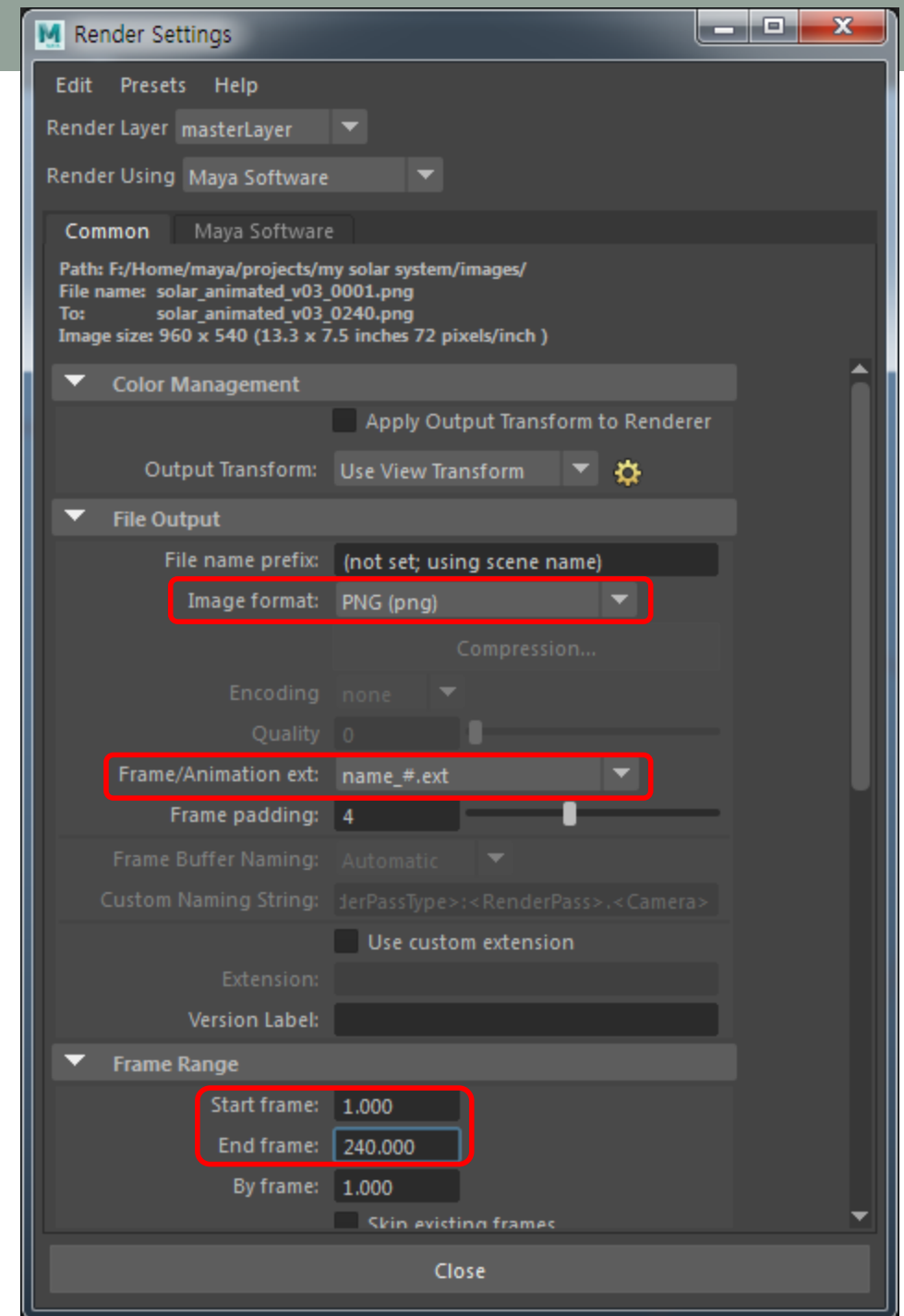
# Outputting a High-quality Video

- Playblasting is fast to produce a resulting video but its rendering quality is quite low.
- In order to produce a high-quality video, we should render each of all the frames with more computational time. Once all frames are rendered, we can combine the resulting images into a single video using other image composition tools.

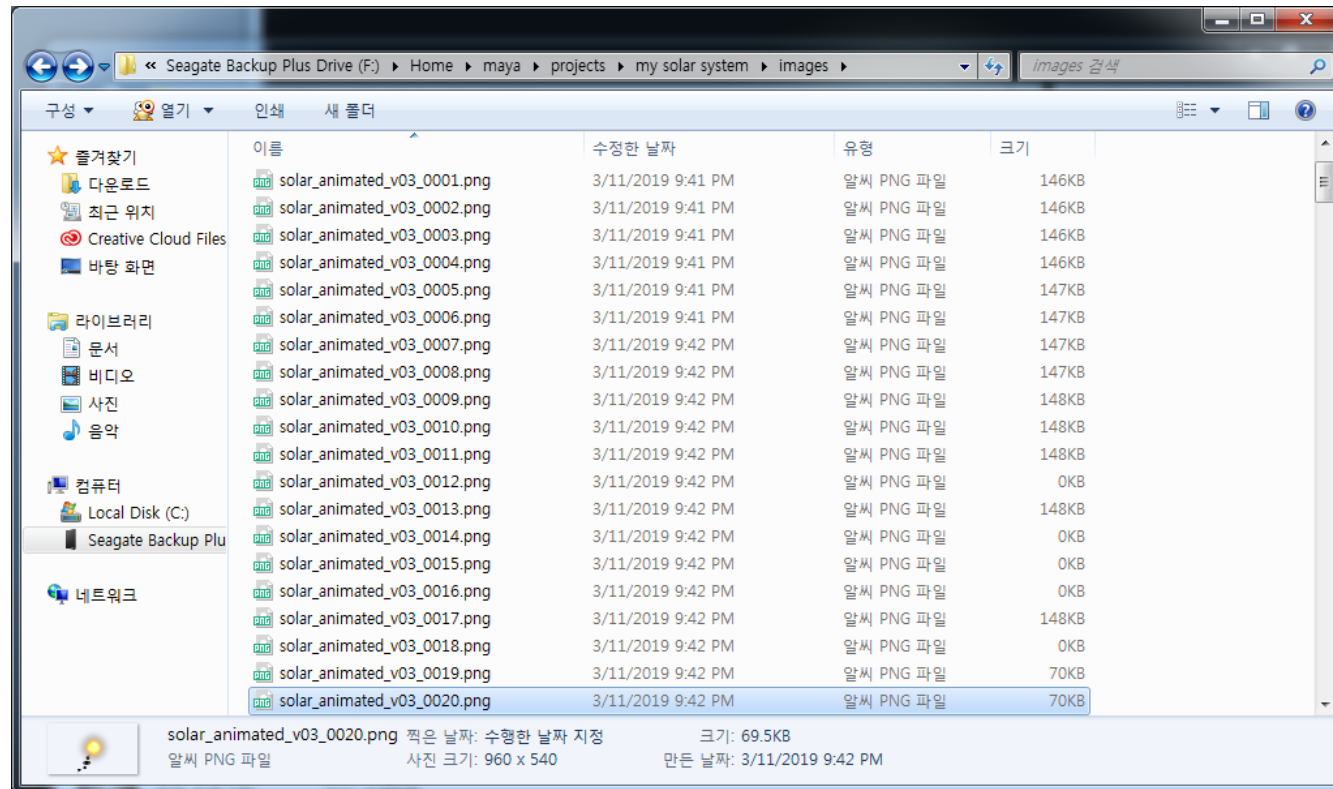


## » How to use the batch renderer

- Set the menu set to **Rendering** and choose **Render → Render Settings...** (or click  in the status line).
- Set **Image format** to **PNG** (any other format we want to apply).
- Set **Frame ext** to “**name\_#.ext**”, where **#** will be replaced by each frame number.
- Set **Start frame** and **End frame** to **1** and **240**, respectively.

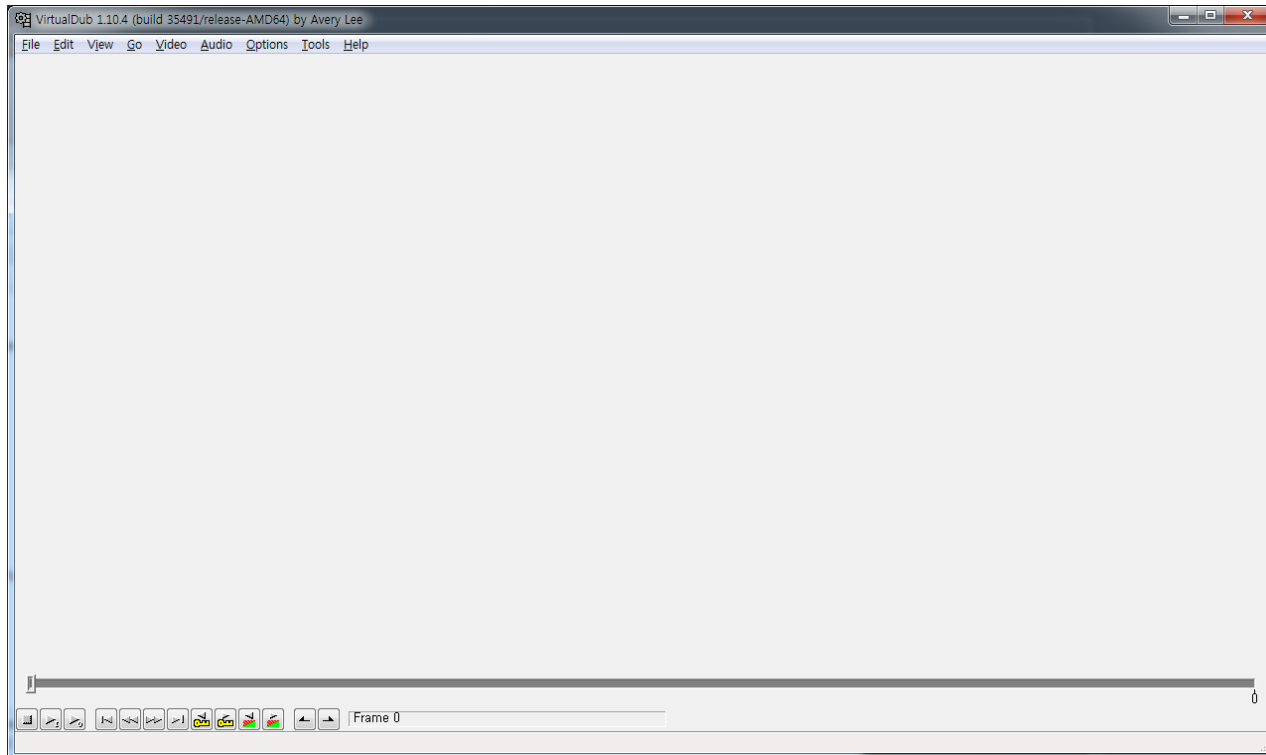


- Select **Render** → **Batch Render** to produce a sequence of rendered images (it will take a certain amount of time).
- You can find the rendered images in the **images** subfolder under the current project folder.



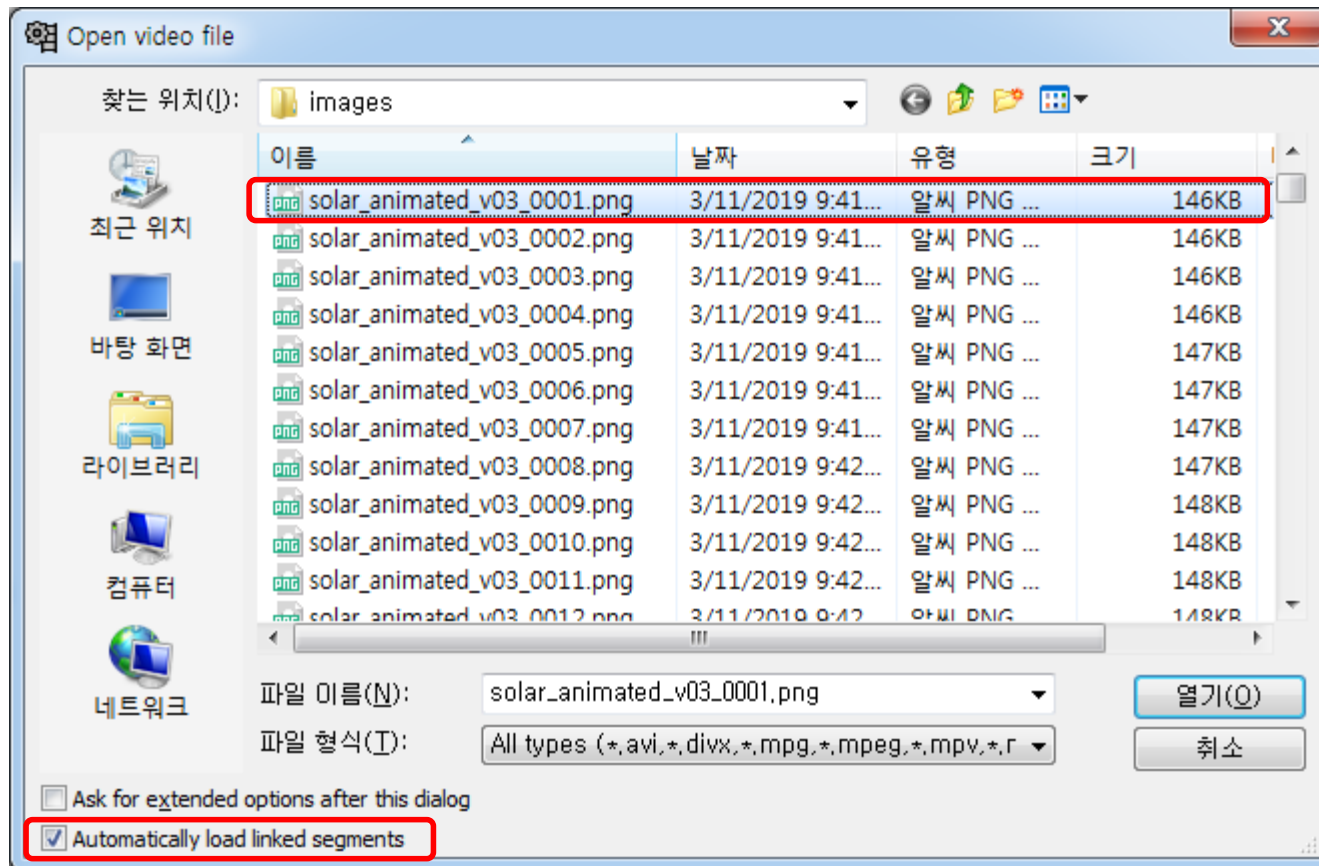
## » How to use VirtualDub

- Visit the following website: <http://virtualdub.sourceforge.net/>
- Download a zip file for VirtualDub.
  - Latest version: **Release build -- 1.10.4 (stable), 64-bit (x64) version**
- Unzip the downloaded file and execute Veedub64.exe (⚙️).



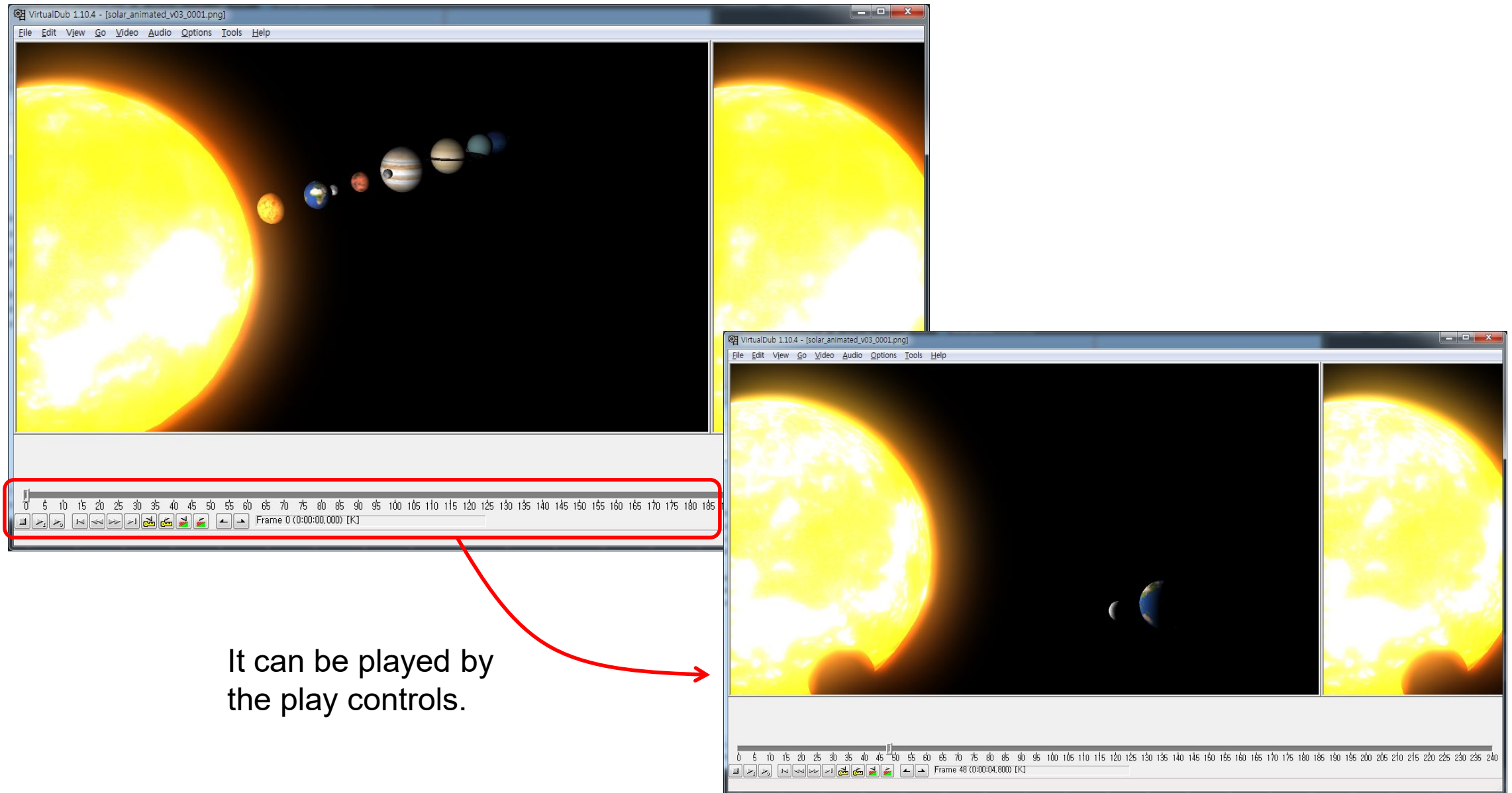
Initial screen of VirtualDub

- Choose **File → Open video file** in the menu bar.
- Select the first file of all the rendered image files and press the **Open** button.
- Make sure that **Automatically load linked segments** is checked.

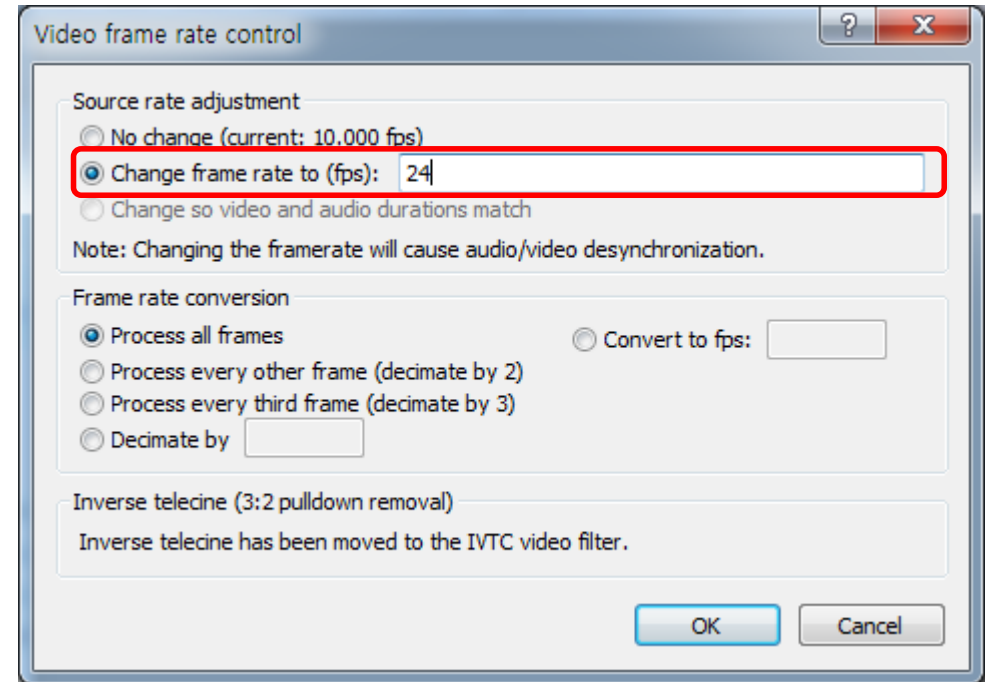
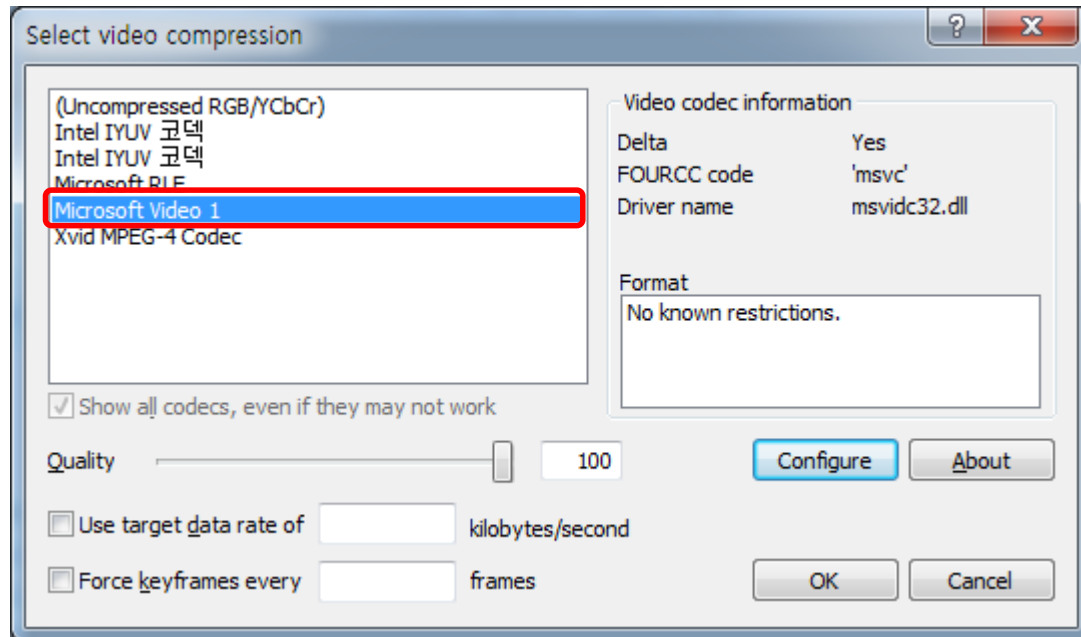




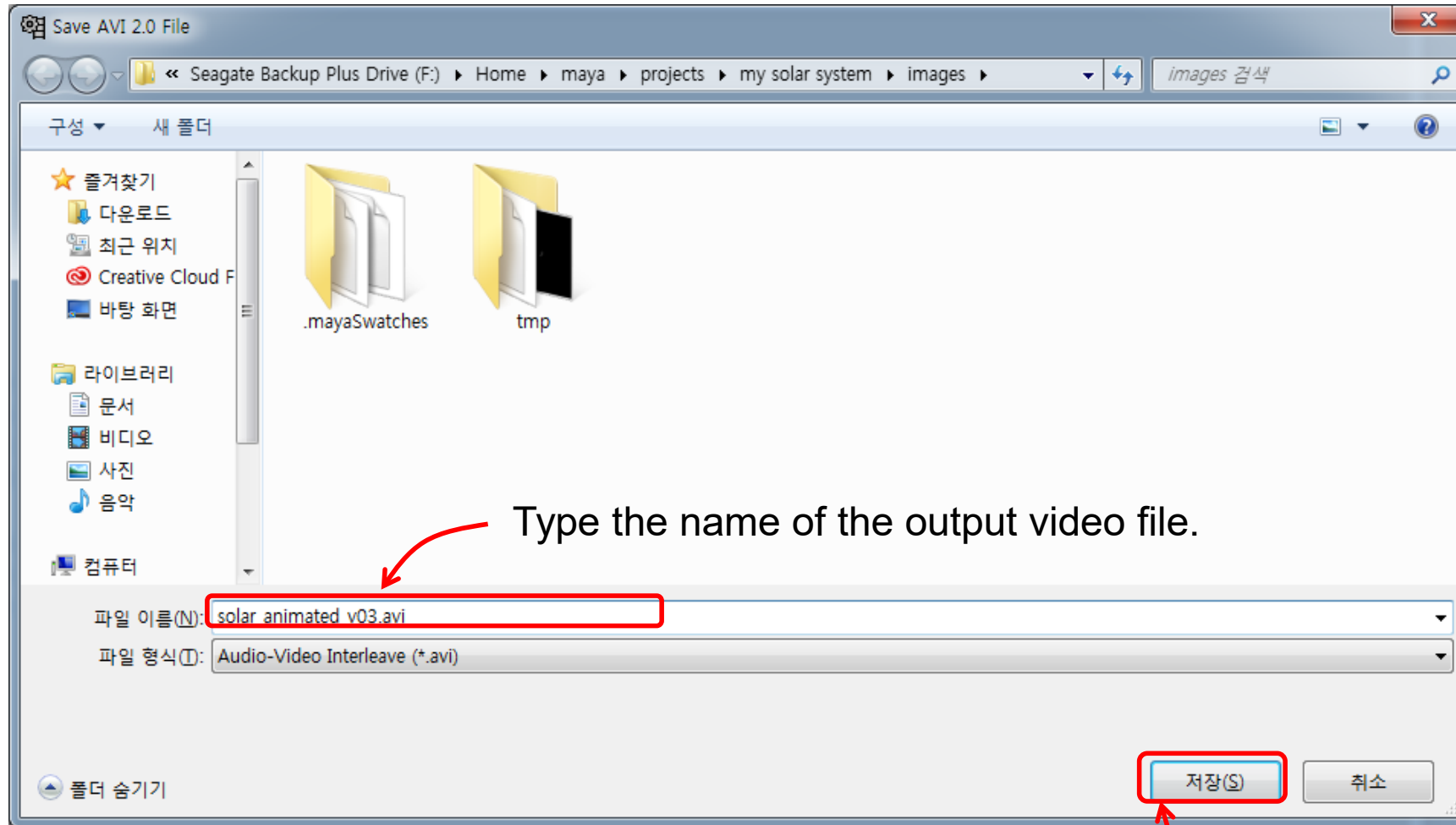
- Then, all the images will be loaded into VirtualDub.



- Choose **Video → Frame rate** in the menu bar and change the frame rate to **24 fps**.
- Choose **Video → Compression...** and select a suitable video compressor.



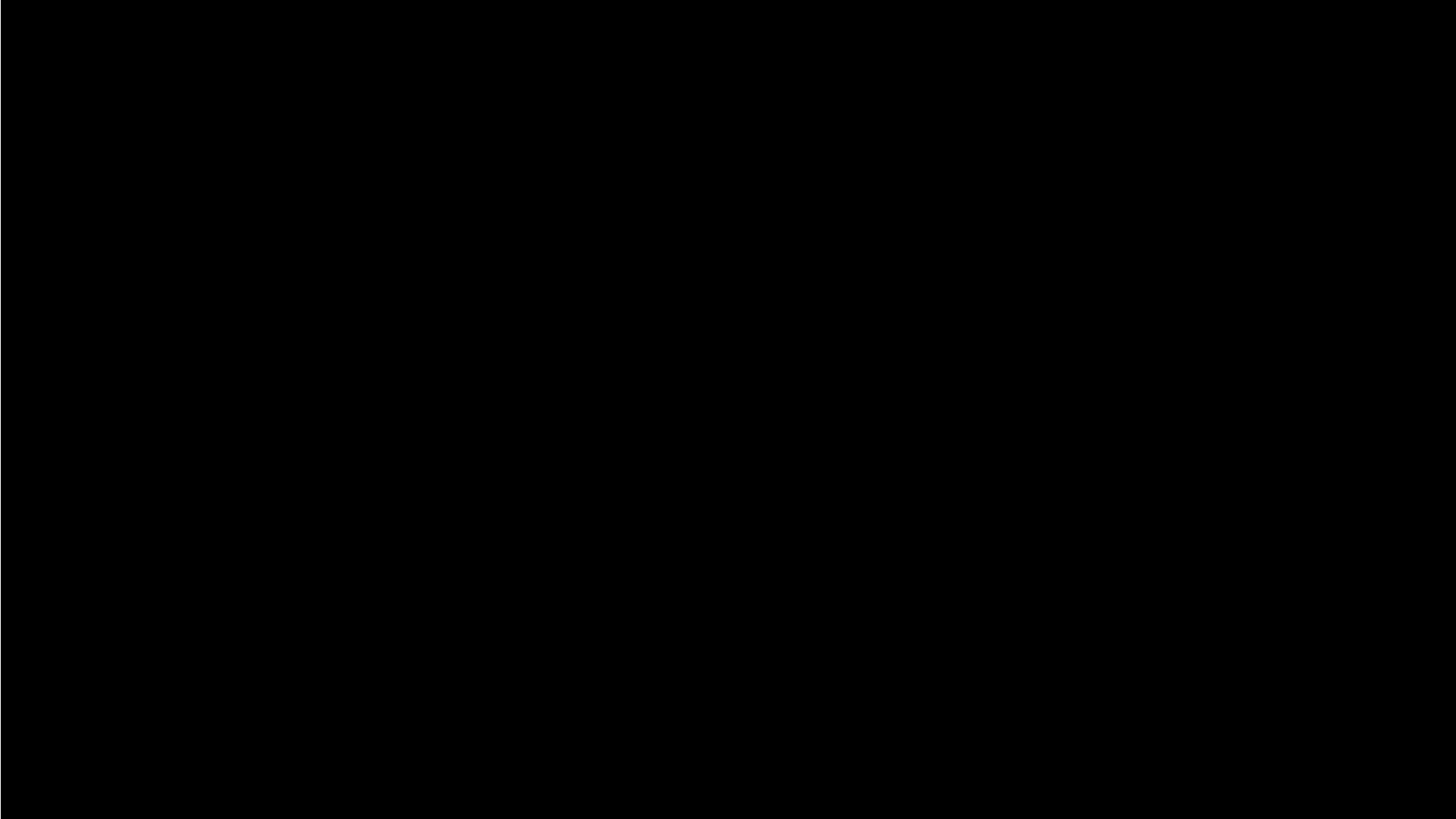
- Finally, save the video file by choosing **File → Save as AVI...** in the main menu.



Type the name of the output video file.

Click the Save button.

- Output video



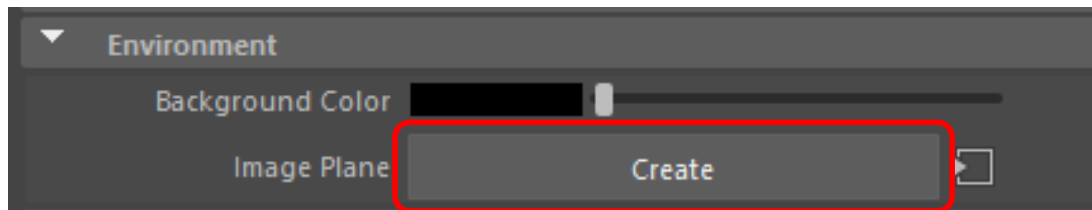
# Extending My Solar System

- Try to extend your solar system as you want so that the animation looks more interesting.
- Examples
  - Adding a background image
  - Adding a rocket animation
  - Adding moving meteoric stones
  - Putting it all together
  - Adding Galaxy Effects

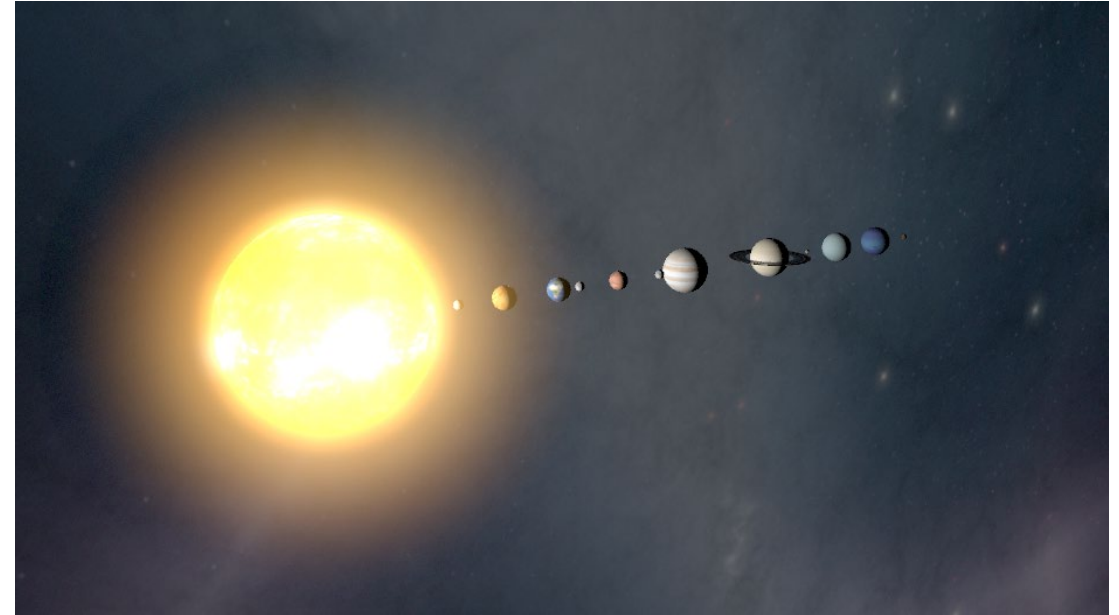


# Adding a Background Image


- Add the background using a universe image from the Internet. To make a texture background
  - Select **View → Camera Attribute Editor** from the panel menus.
  - In the **Attribute Editor**, under the **Environment** section, click the **Create** button to the right of the **Image Plane** attribute.

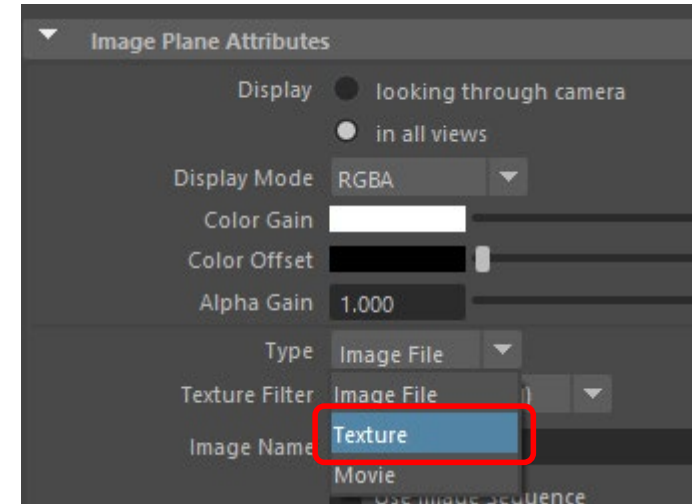
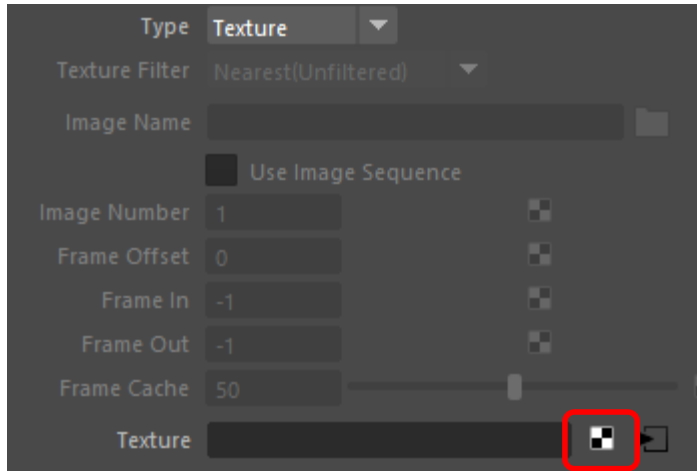


This makes an image plane and connects it to the camera.



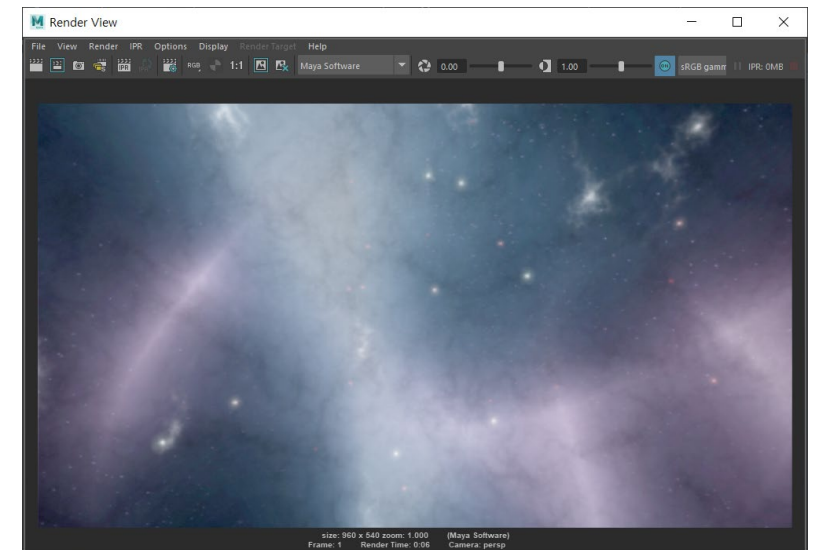


- Set the **Type** attribute for the image plane to **Texture**.
- Click the texture icon  next to the **Texture** attribute.



In the **Create Render Node** window that appears, select the texture you want to use as a background (for example, an **Environment Texture**).

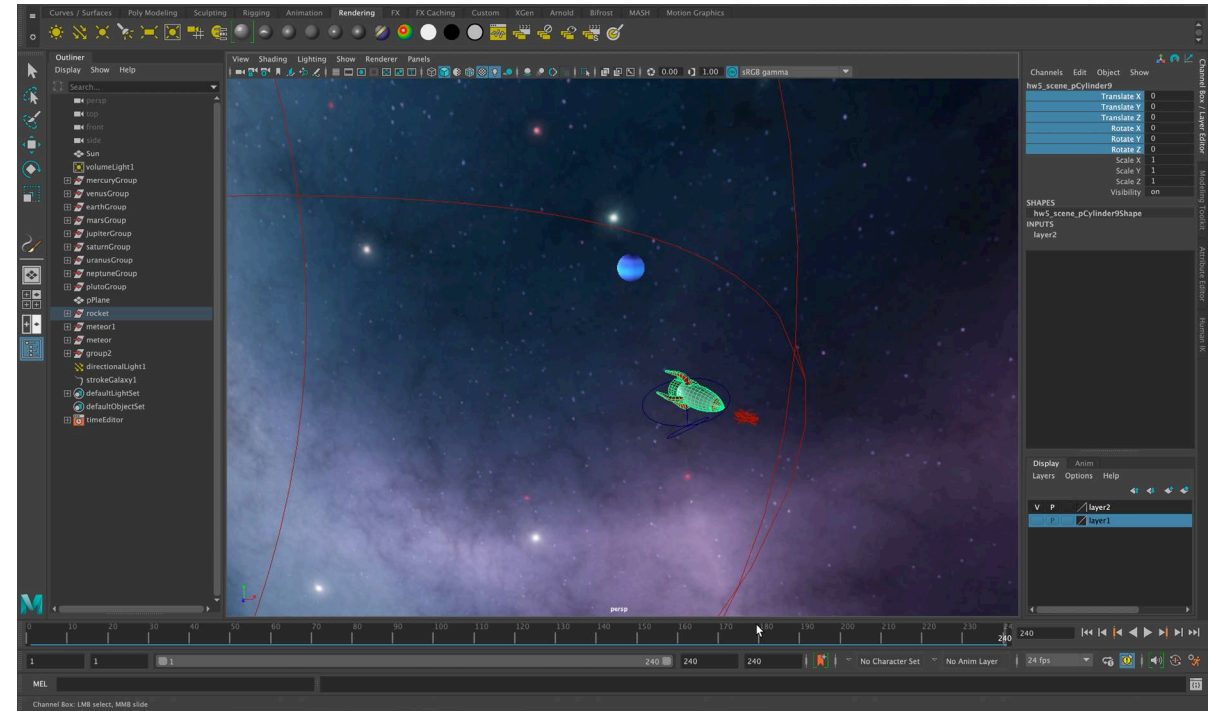
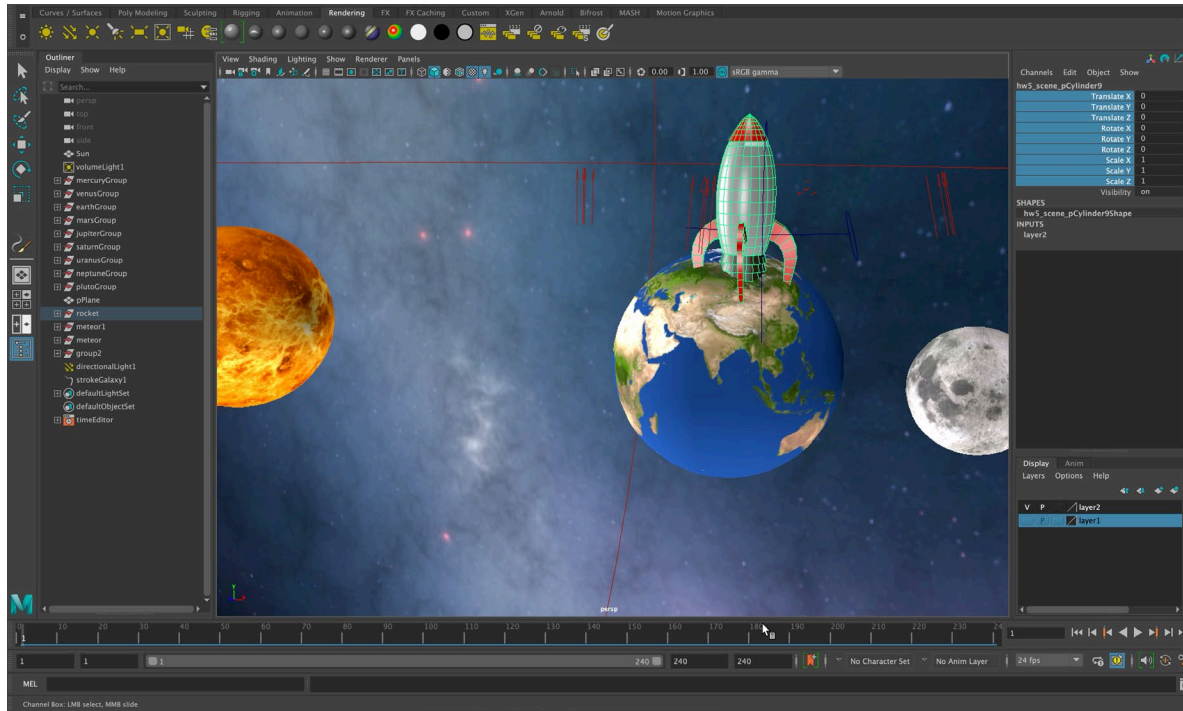
- This connects the texture to the image plane.



# Adding a Rocket Animation



- Import the maya scene, 'Rocket' and produce its keyframe animation:
  - At the first frame, set keys for the starting position of the rocket.
  - At the last frame, set another keys for the end position of the rocket
  - Then, you can see the intermediate robot motion between the first frame and the last frame.
  - Likewise, add keys for the scale and rotation of the rocket if desired.

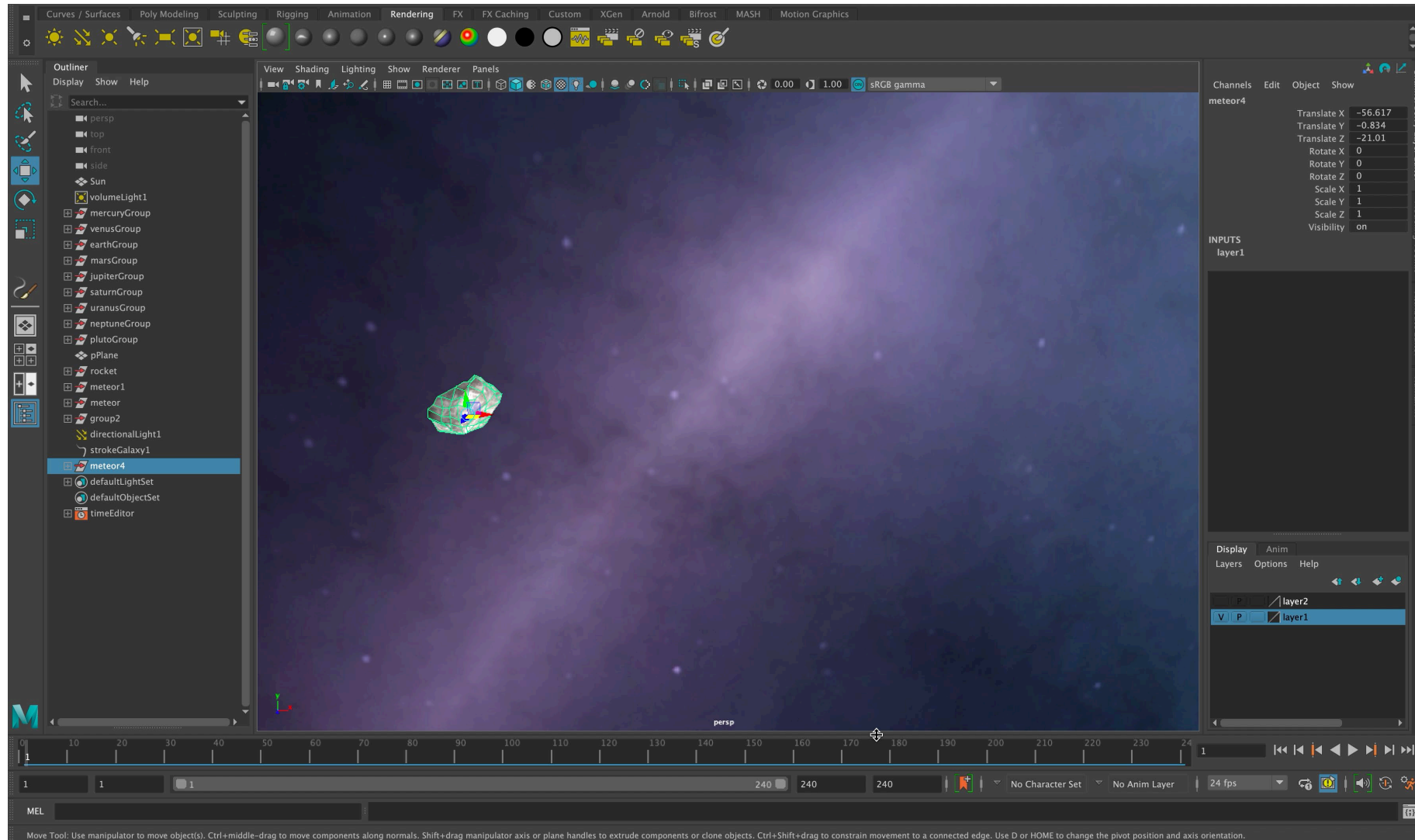


# Adding Moving Meteoric Stones





- Import the maya scene, 'Meteoric stone'. You may duplicate the stone multiple times.
- Group all your stone models and produce a keyframe animation for these stones.



# Putting It All Together



# Adding Galaxy Effects





- Select **Generate → Get Brush** in the Main menu and find **galaxy.mel** under **Examples → Paint Effects → Galactic** folder.
- Then, choose **Generate → Paint Effects Tool** and draw a curve (draw more than one curve if you want). In the **Attribute Editor**, change the property of the brush:
  - **Global scale: 7**
  - **Brush Profile → Width: 0.3**
  - **Shading:** Change the **Color1** and **Color2** under **Tube Shading**
  - **Glow:** Set **Glow** to **1.0** and change the **Glow Color**.

