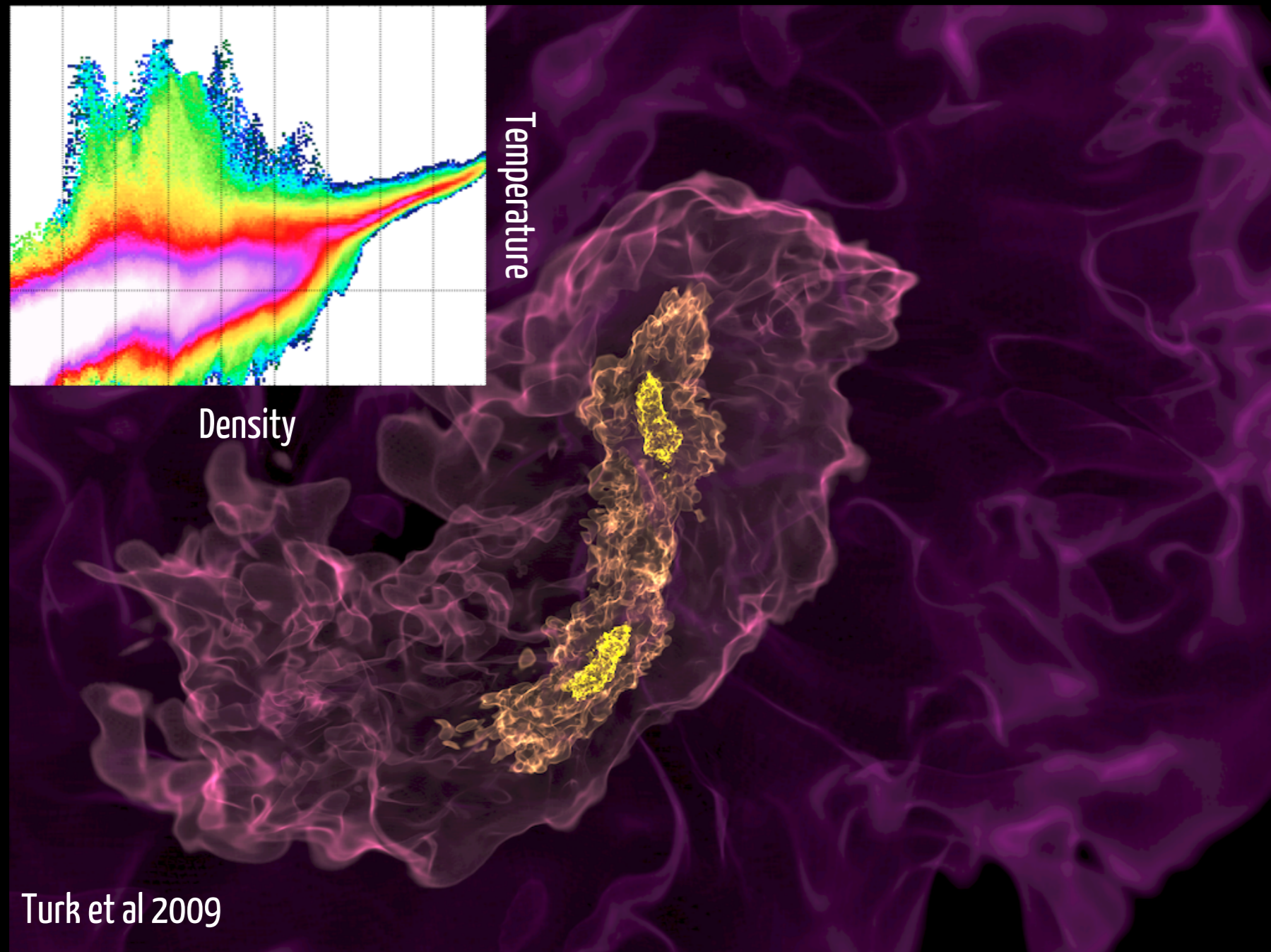


What is a visualization?

From the yt website:

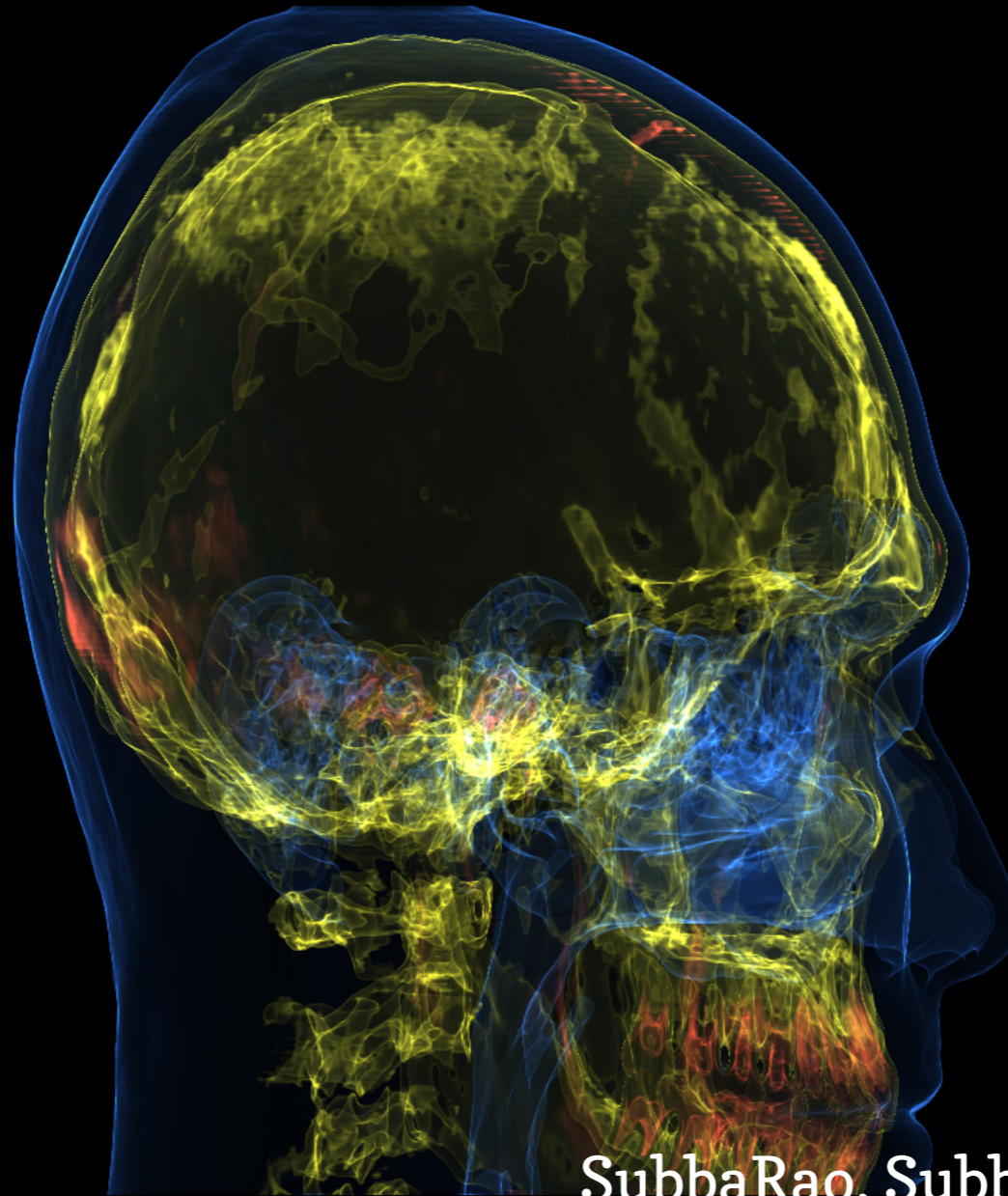
“yt is a python package for analyzing and visualizing volumetric, multi-resolution data from astrophysical simulations, radio telescopes, and a burgeoning interdisciplinary community.”



Simulation gas collapsing and forming two dense cores that will become some of the first stars in our Universe.

What is a visualization?

NeuroDome



SubbaRao, SubbaRao & Fisher

Outline of Week

~~◆ Day 1: Movies!~~

- ◆ Day 2: More movies! Start thinking about 3D stuffs
- ◆ Day 3: More 3D interactive movies/things, VR
- ◆ Day 4: Glue/Hololense Demo and Gallery Exhibition

Intro - Day 2, Viz

Everything for today is posted under day 2 of Viz of:
www.astroblend.com/ba2016

- * So far we have done some computational astrophysics - specifically N-body
 - * numerical methods: timestep size, order of solvers, checks for accuracy of sim (conservation laws)
 - * planets, galaxies, oh my! In 3D!
- * Played with making some movies
- * Started thinking about 3D...

If you have a trajectory movie, what others can you make?

Side-by-sides with energy or other axis? Phase plots? Add velocity arrows? What do you think will help show what you find interesting in your system?

Rendering in 3D: From 3D objects to images

Our task is to take our physical description of 3D space and convey to the computer how to bounce light around.

Rendering in 3D: From 3D objects to images

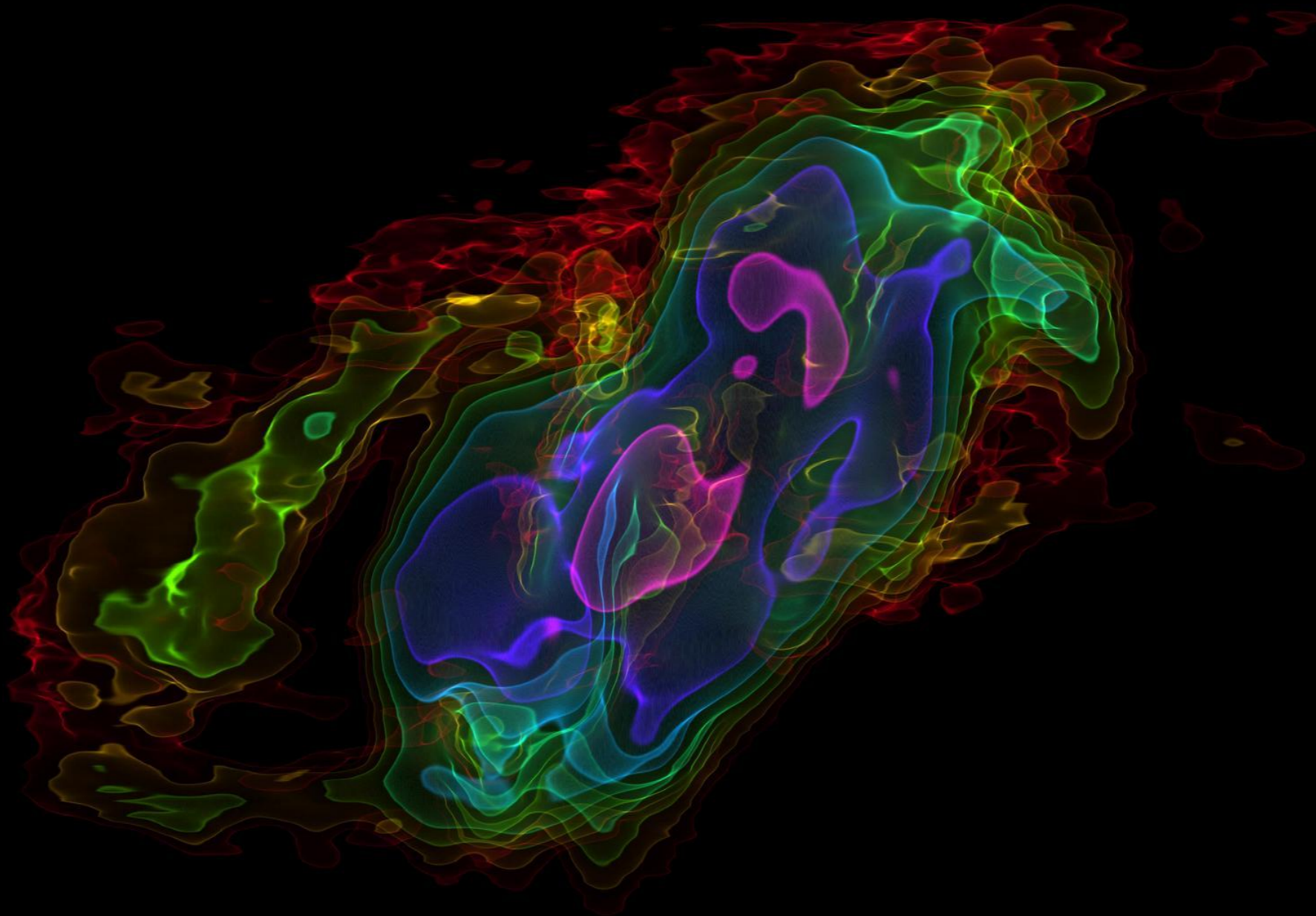
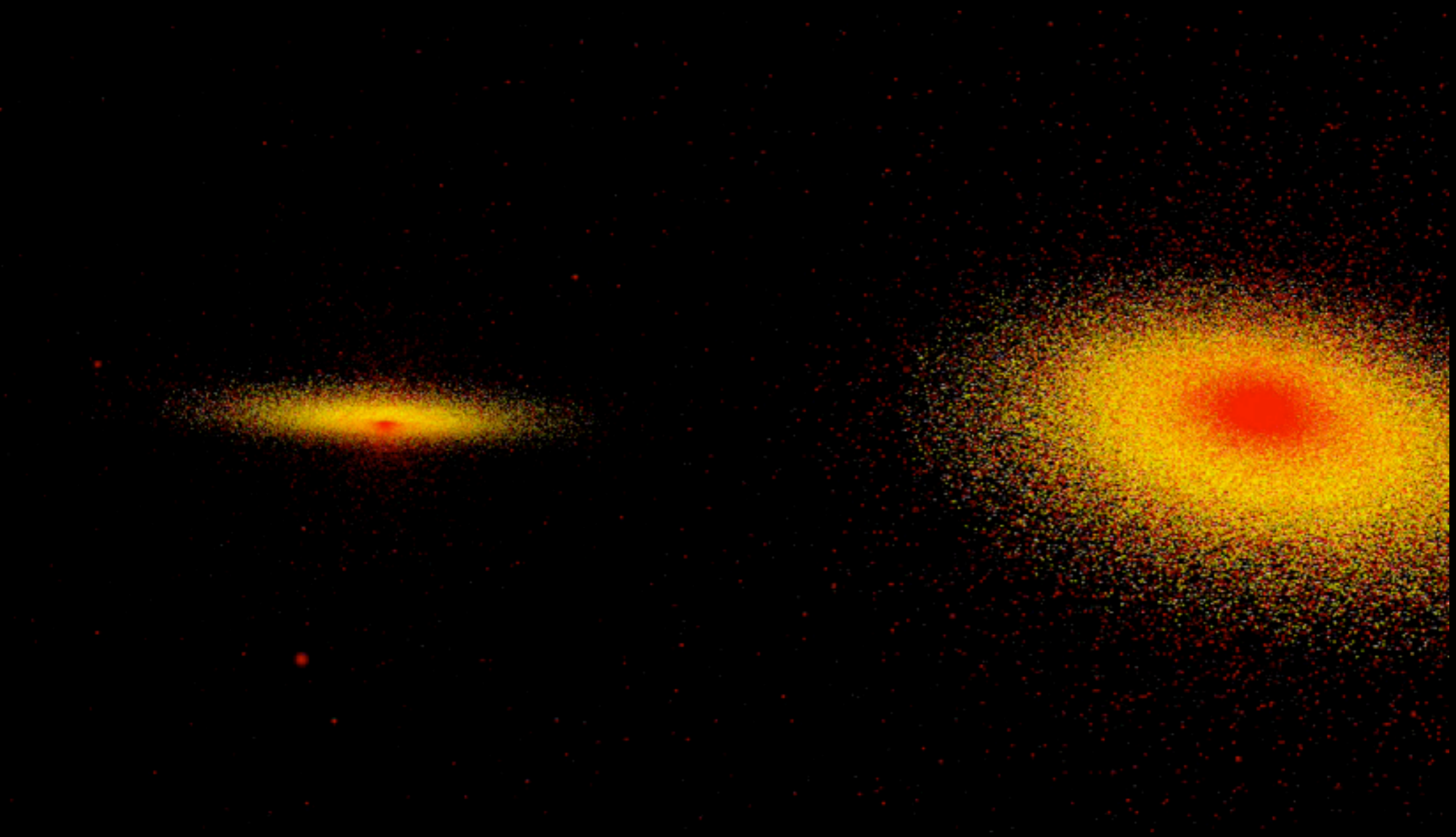


Image Credit: Erik Rosolowsky & ALMA

In this image there are layers of transmission and absorption (transmission function) which added together make this volume rendering

Rendering in 3D: From 3D objects to images



In this movie each particle is represented as an emitting point of light

Rendering in 3D: From 3D objects to images

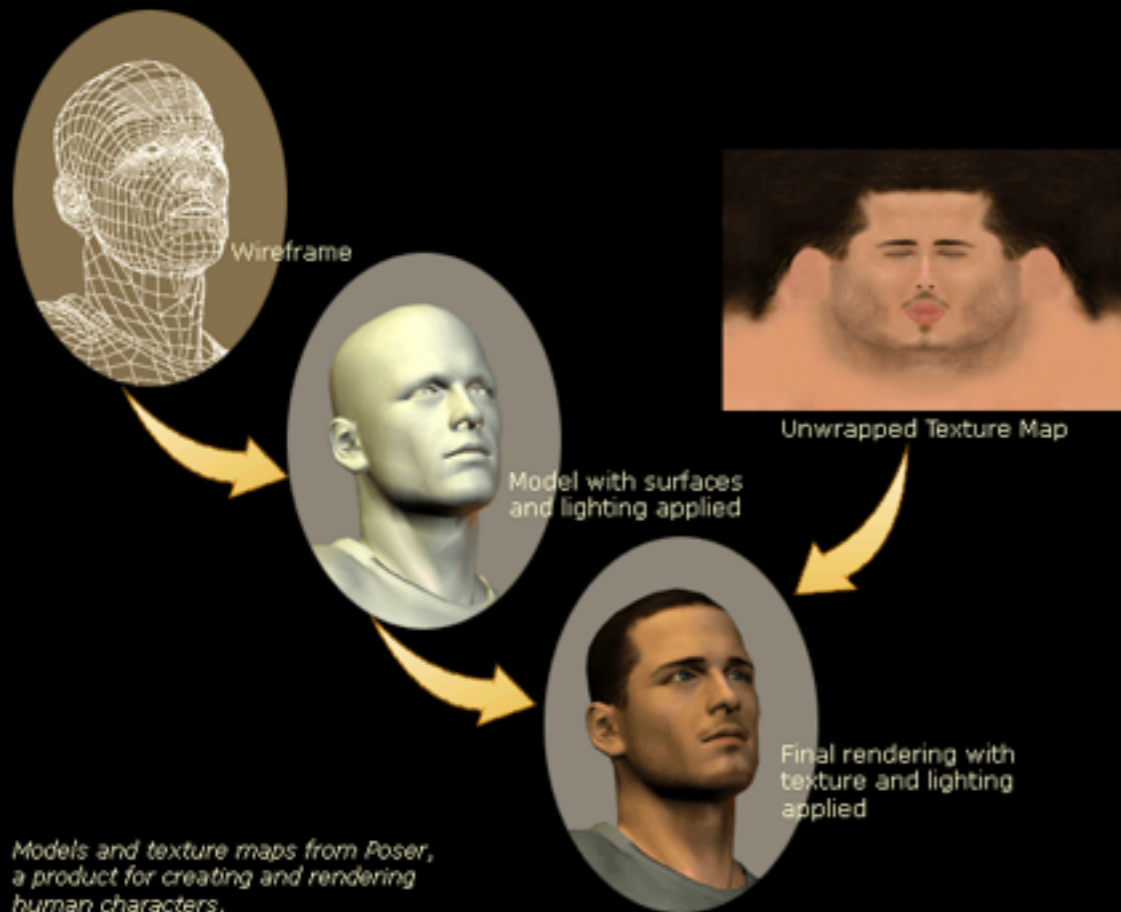
Our task is to take our physical description of 3D space and convey to the computer how to bounce light around.

The way we will do this is by generating specific Geometry Files that 3D rendering software (Sketchfab, MeshLab, Blender, Maya, Houdini, etc) know how to read and process.

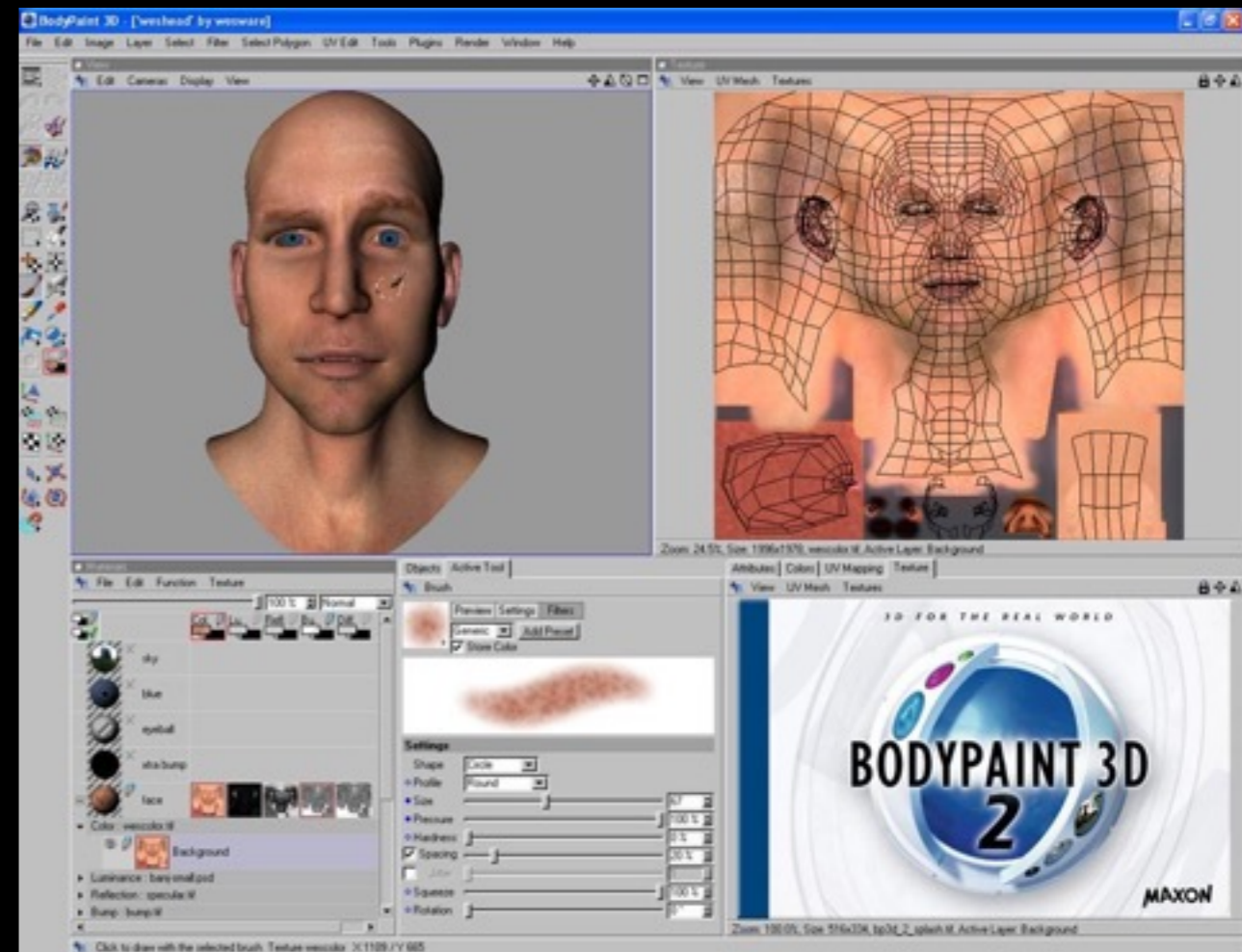
Software

- (1) Set up a Sketchfab account
- (2) Download MeshLab

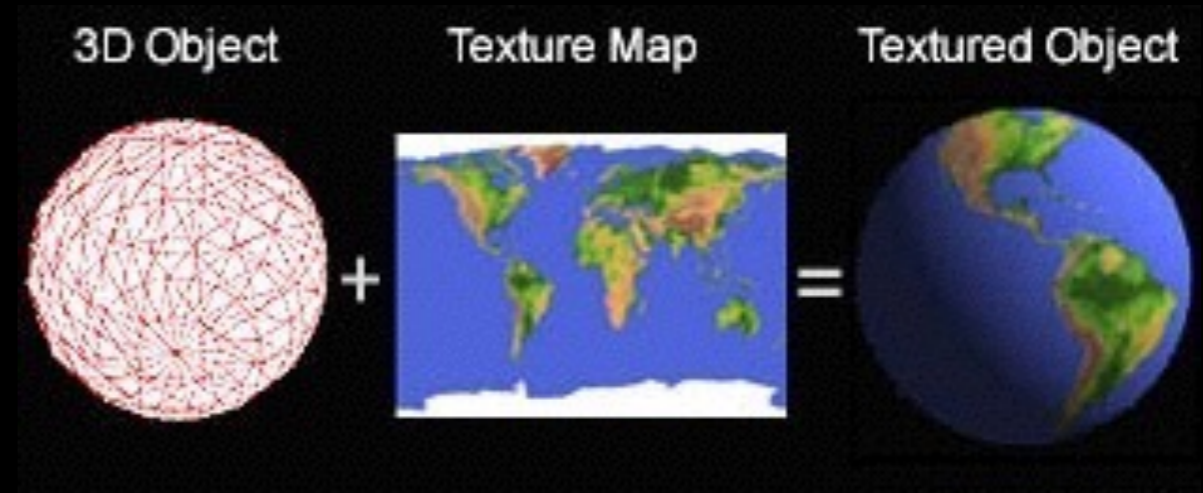
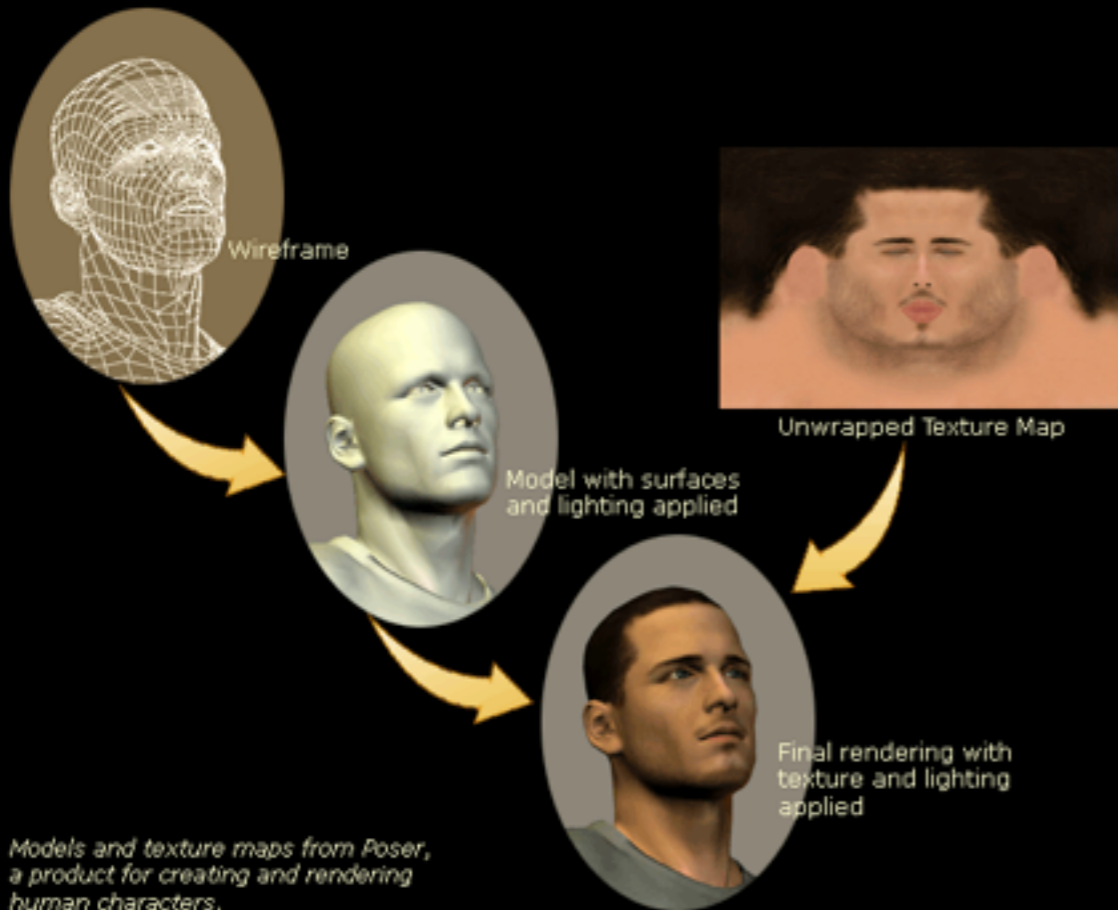
Planets - Texture Mapping



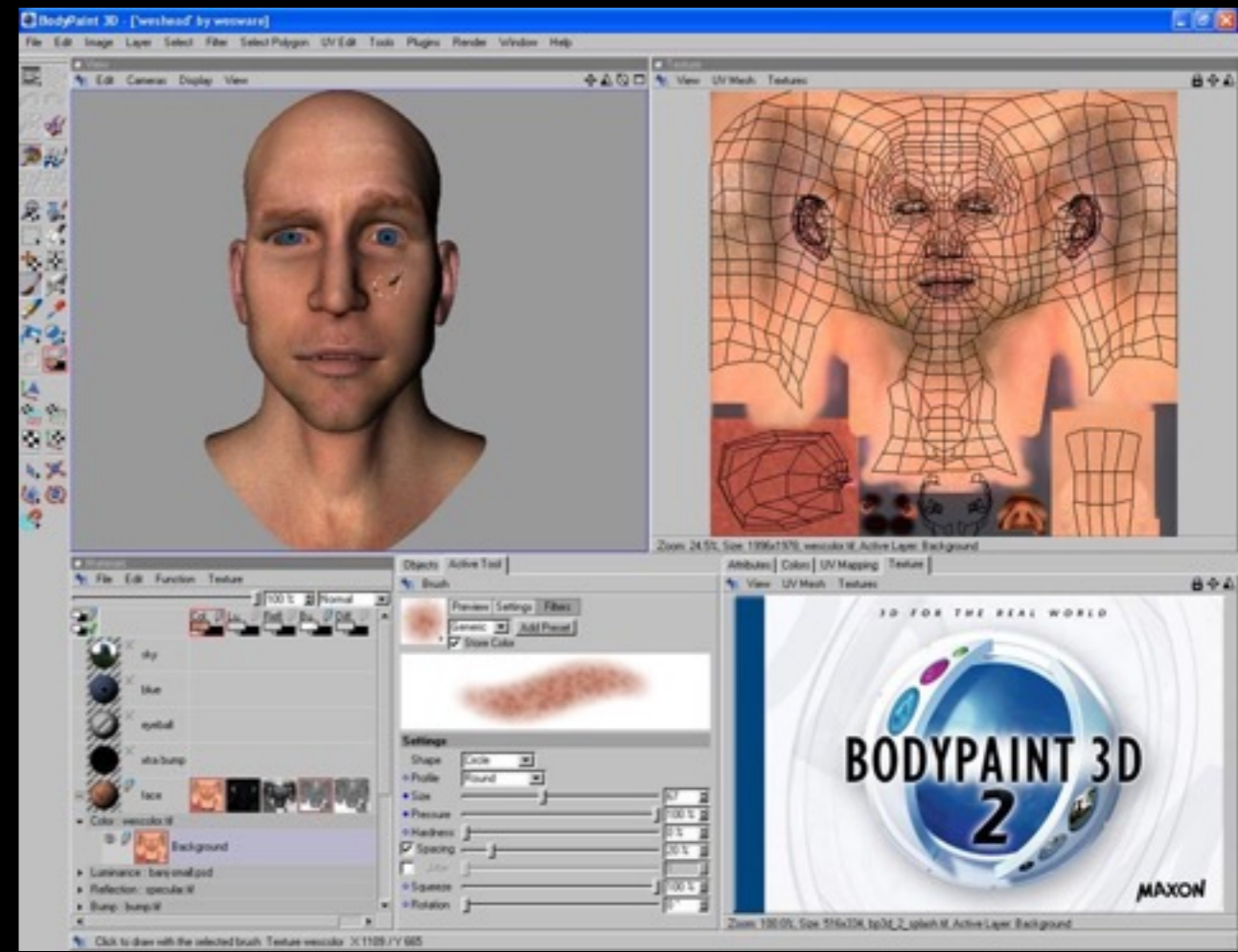
Models and texture maps from Poser, a product for creating and rendering human characters.



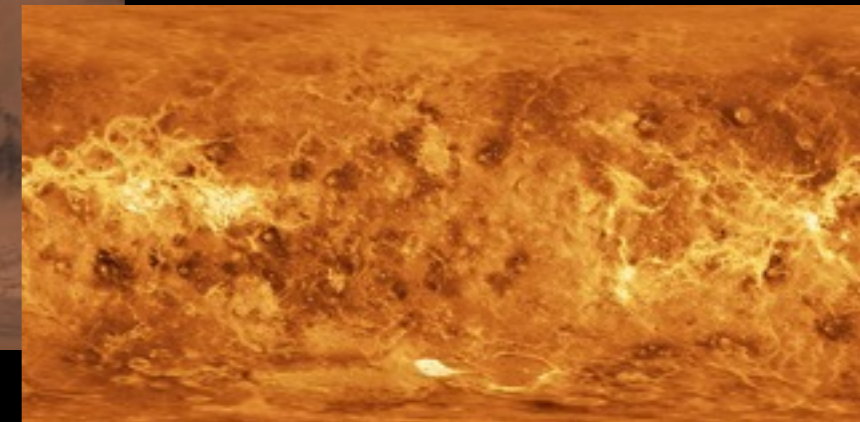
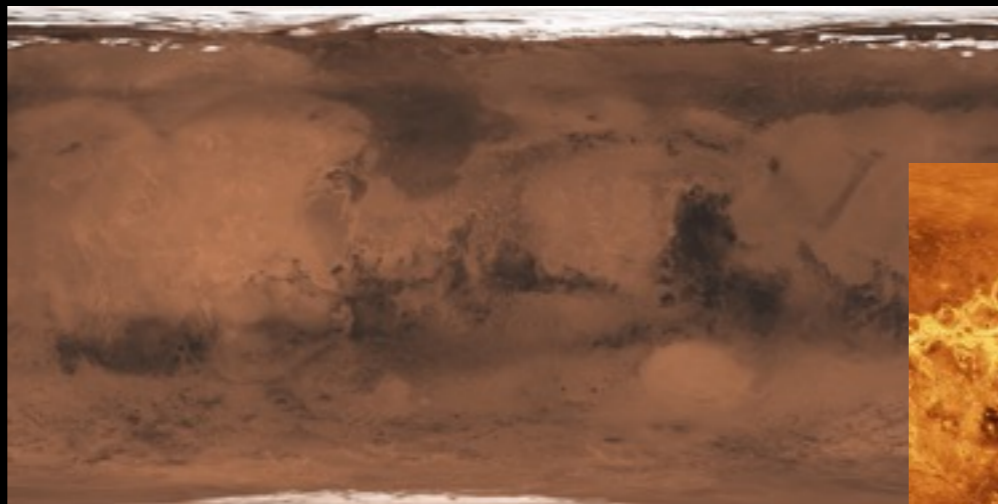
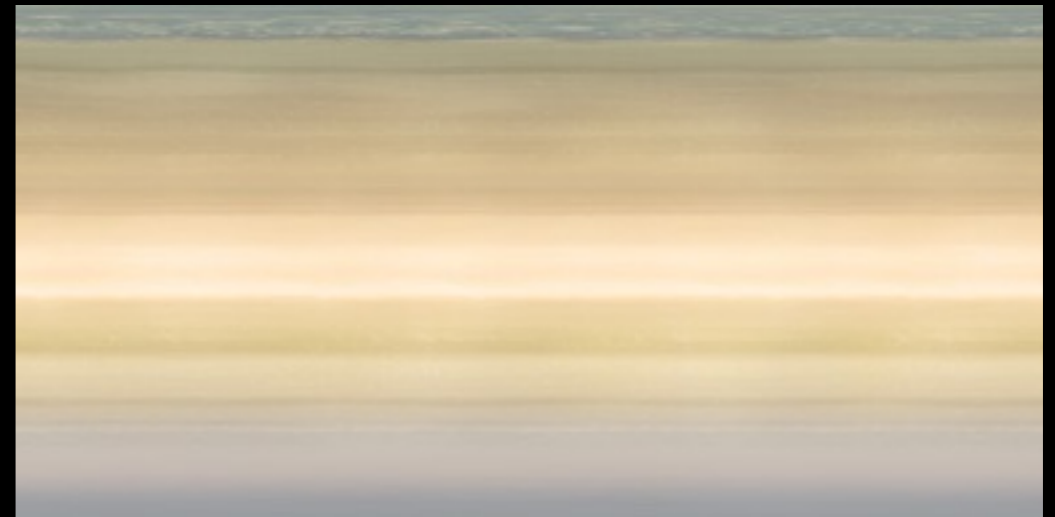
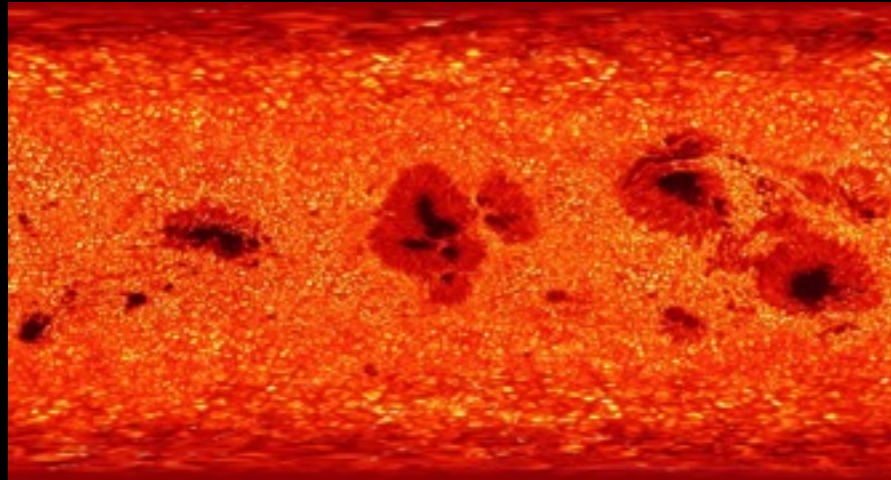
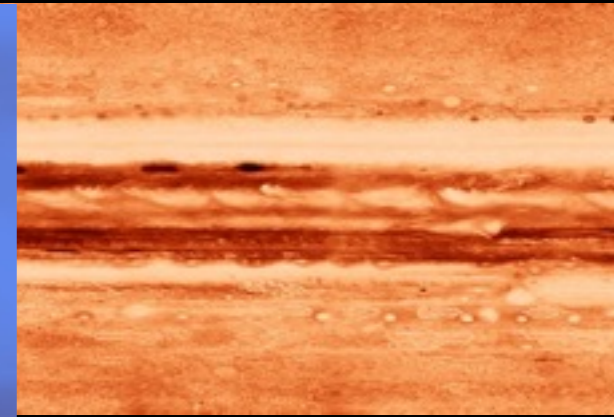
Planets - Texture Mapping



Models and texture maps from Poser, a product for creating and rendering human characters.



Planets - Texture Mapping



The OBJ File Format

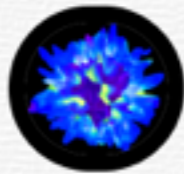
Steps:

- (1) Download “generic” planet data & OBJ library (zip file)
- (2) grab code
- (3) Run code
- (4) Profit?

Code

Planets

(2)

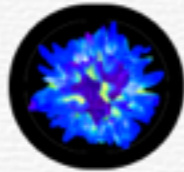


Code to make the set of OBJ + MTL Planet files

This code reads in planet data and makes the files needed to view a series of 3D spheres based on a single time snapshot (static model).

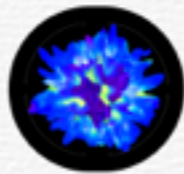
**From your planet data ->
directory with 3D geometry &
texture files**

Galaxies



Code to make the PLY file for an N-body galaxy sim

This code reads in 2-particle type galaxy data and makes a PLY file containing each particle as a colored vertex.



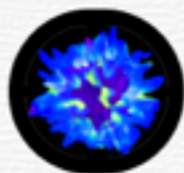
Code to make the PLY file for a hydro galaxy sim

This code reads in multi-particle type galaxy data and makes a PLY file containing each particle as a colored vertex. Make sure you have the "large galaxy data" from the resources list below for this code.

Resources

Planets

(1)

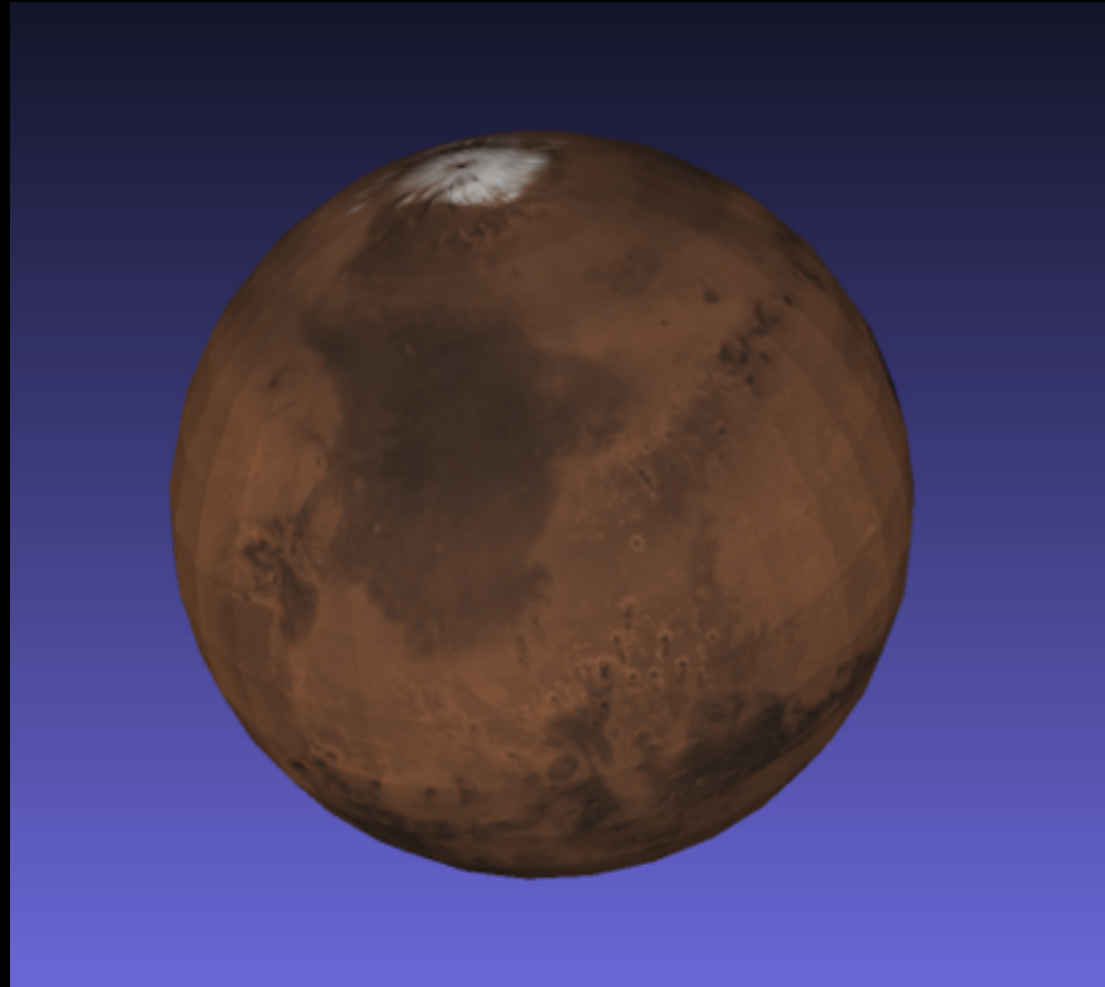


DOWNLOAD ME!!! Generic Planet Files + Texture Maps

These are the files to go in your "generic_dir" to plot planets in 3D.

The OBJ File Format

```
Jills-MacBook-Pro:MyPlanetSystem jillnaiman1$ ls
MyPlanetSystem.mtl  green_sun.jpg      neptunemap_1000.jpg
MyPlanetSystem.obj  jupiter_1200.jpg  sun_texture1.jpg
```



For each object (sphere) an OBJ file gives information for:

Vertex locations

Texture coordinates

Companion material file (.mtl file) gives information for:

Colors of faces

Names of mapped textures

NOTE: these sorts of files can be uploaded in MeshLab & Sketchfab

For Sketchfab make sure you upload all files: .obj, .mtl, and texture files

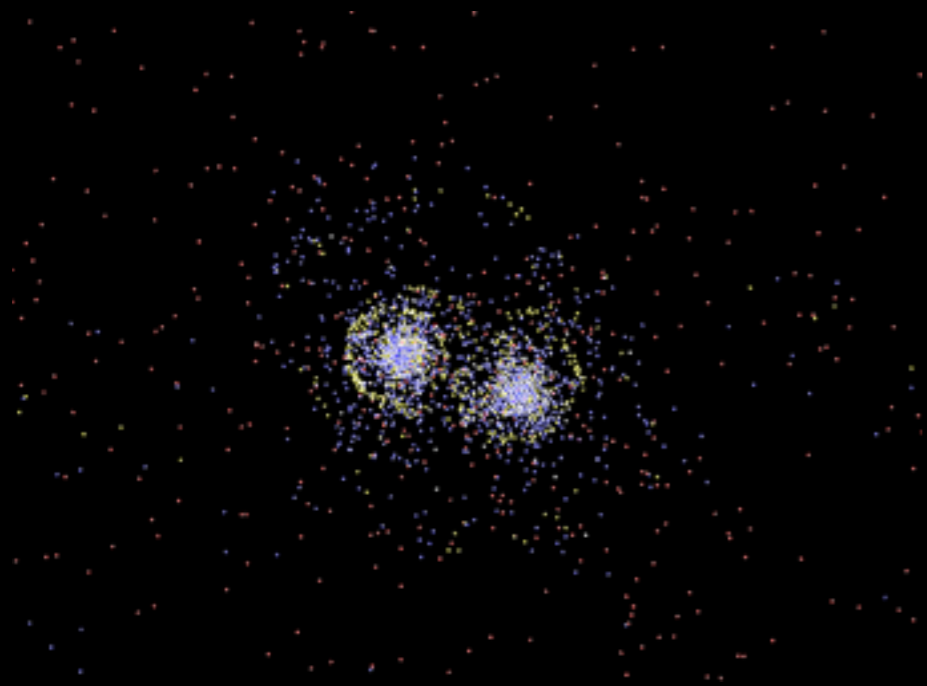
For MeshLab: select Render -> Color -> Per Mesh to see textures

The PLY File Format

For each vertex representing each particle, the PLY file stores:

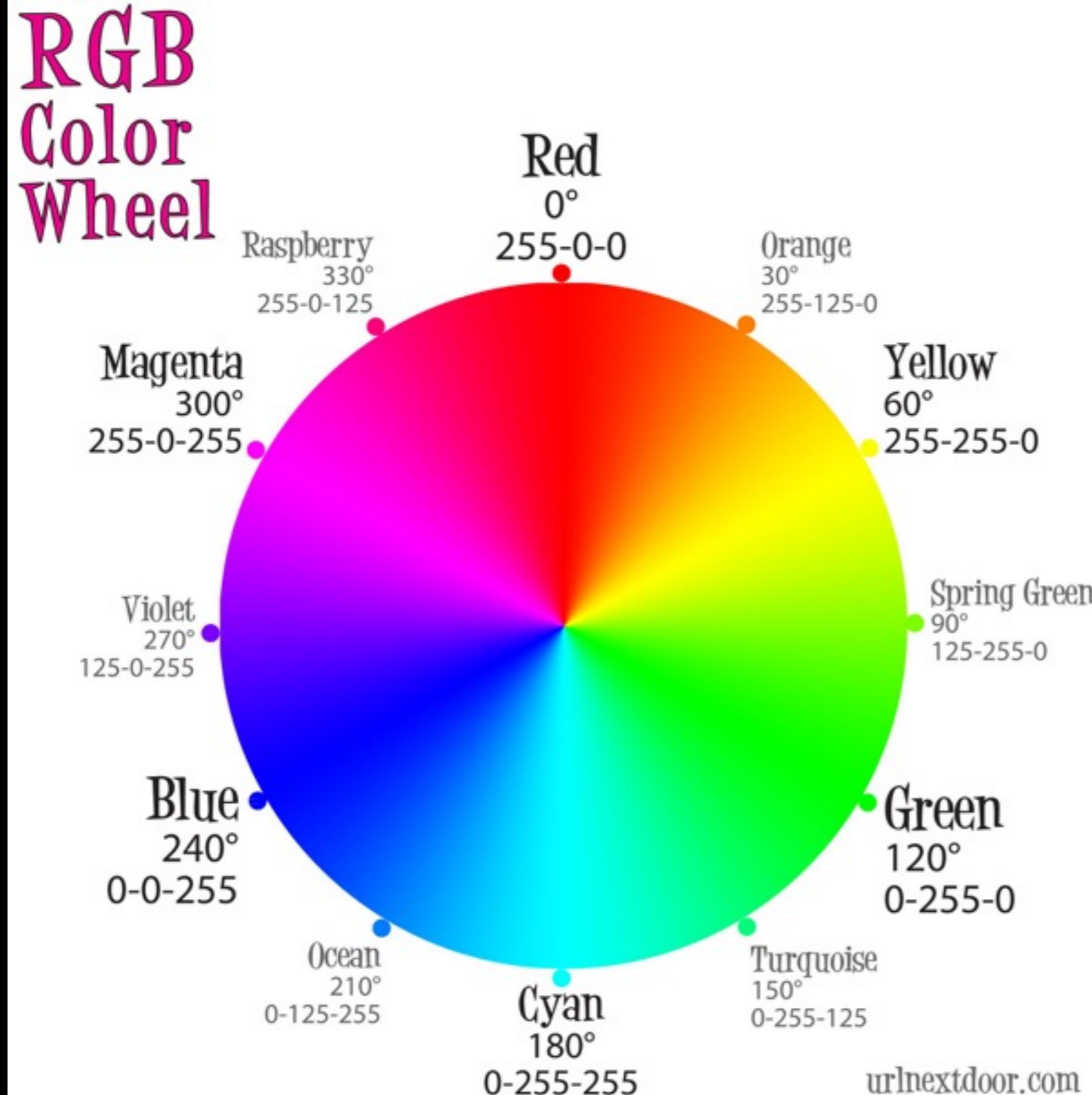
Vertex locations

Colors of each vertex



NOTE: these sorts of files can be uploaded Sketchfab only

A note about RGB colors



Some code the range is 0-255, others its 0-1... sorry

First, start with static uploads

Hints for Sketchfab (esp for PLY files):

Sketchfab EXPLORE COMMUNITY BLOG Search UPLOAD

This model is a draft
Only you can see this model. If you are happy with the result, you can publish it. You can also improve the result by fixing some minor issues: [See issues](#)

EDIT 3D SETTINGS PUBLISH ANYWAY

Big Galaxy

by **jnaiman** PRO
VIEW PROFILE

ABOUT THIS MODEL

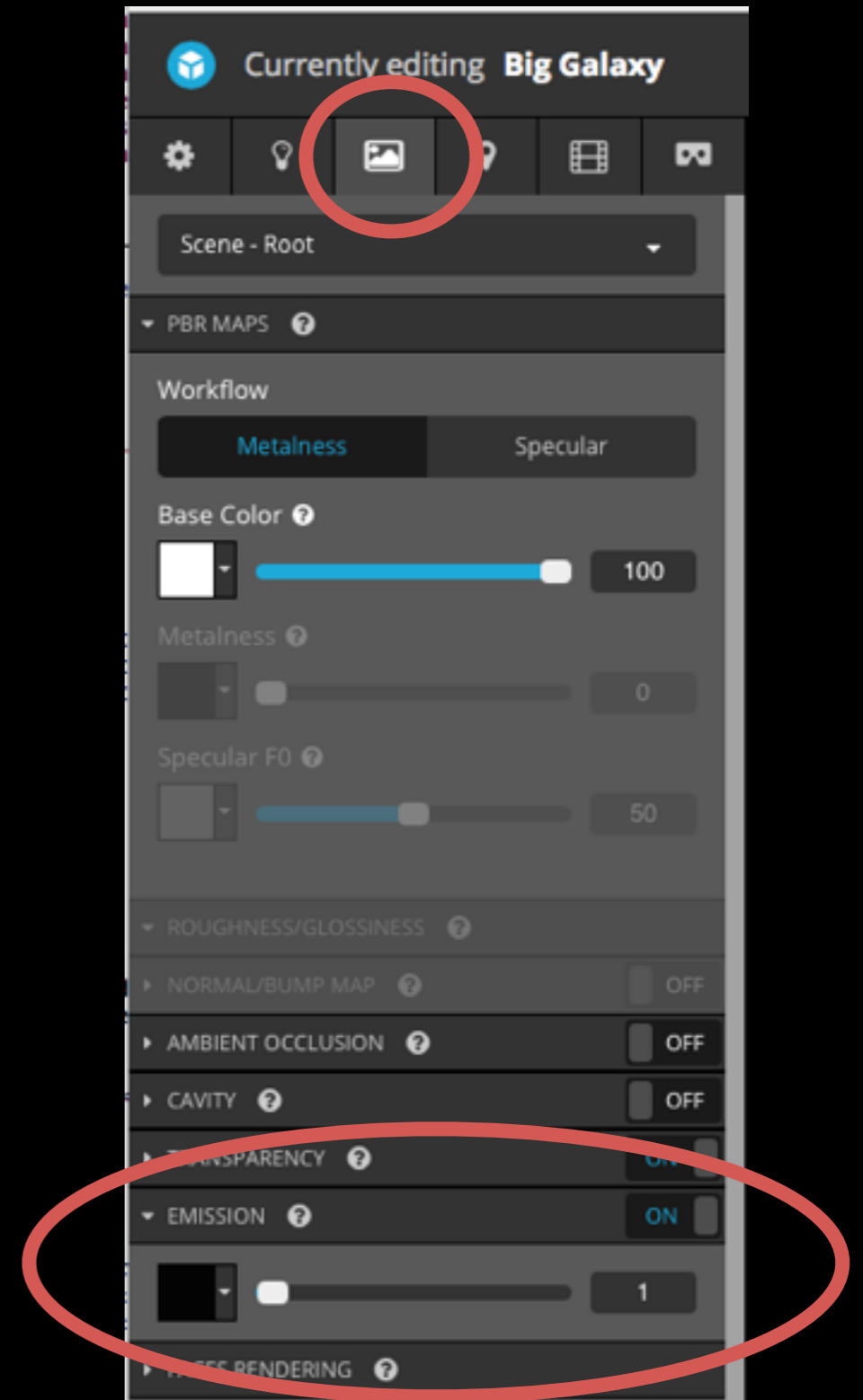
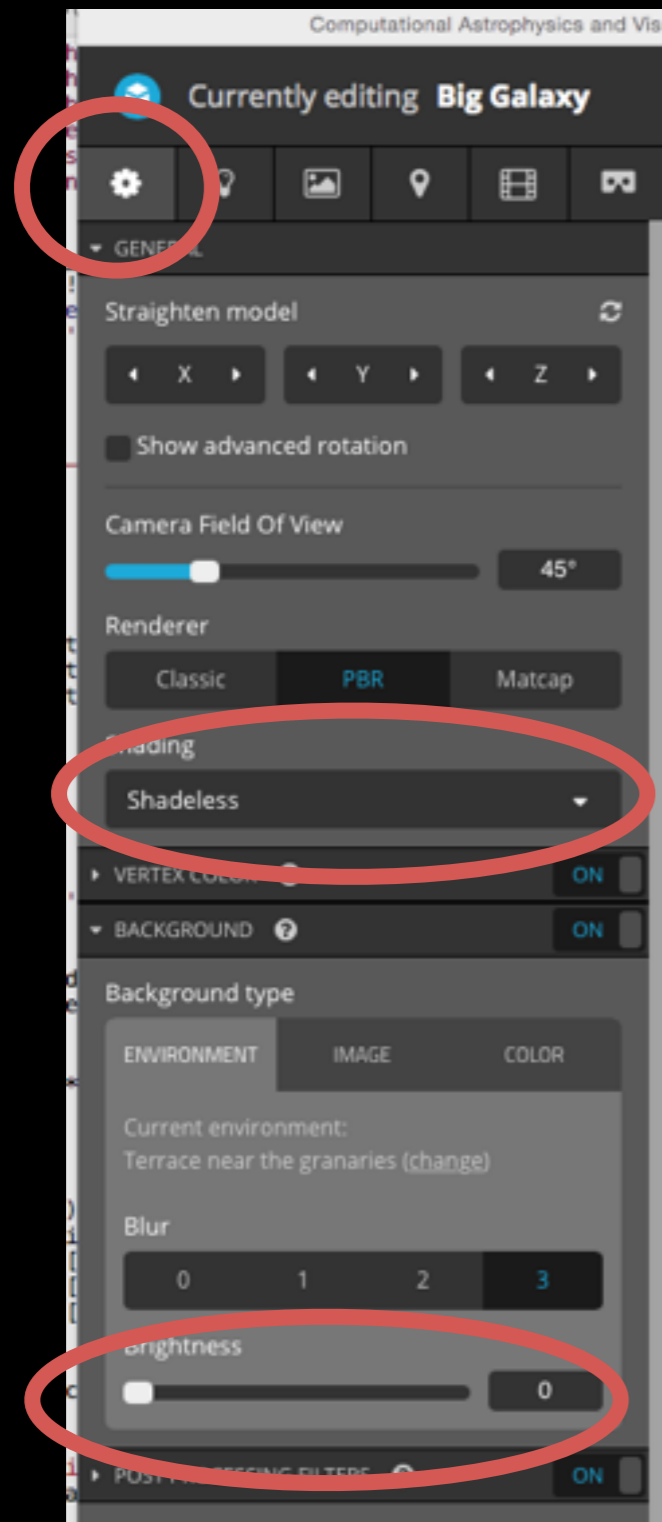
0 faces
5.4k vertices

SETTINGS

Click on 3D settings

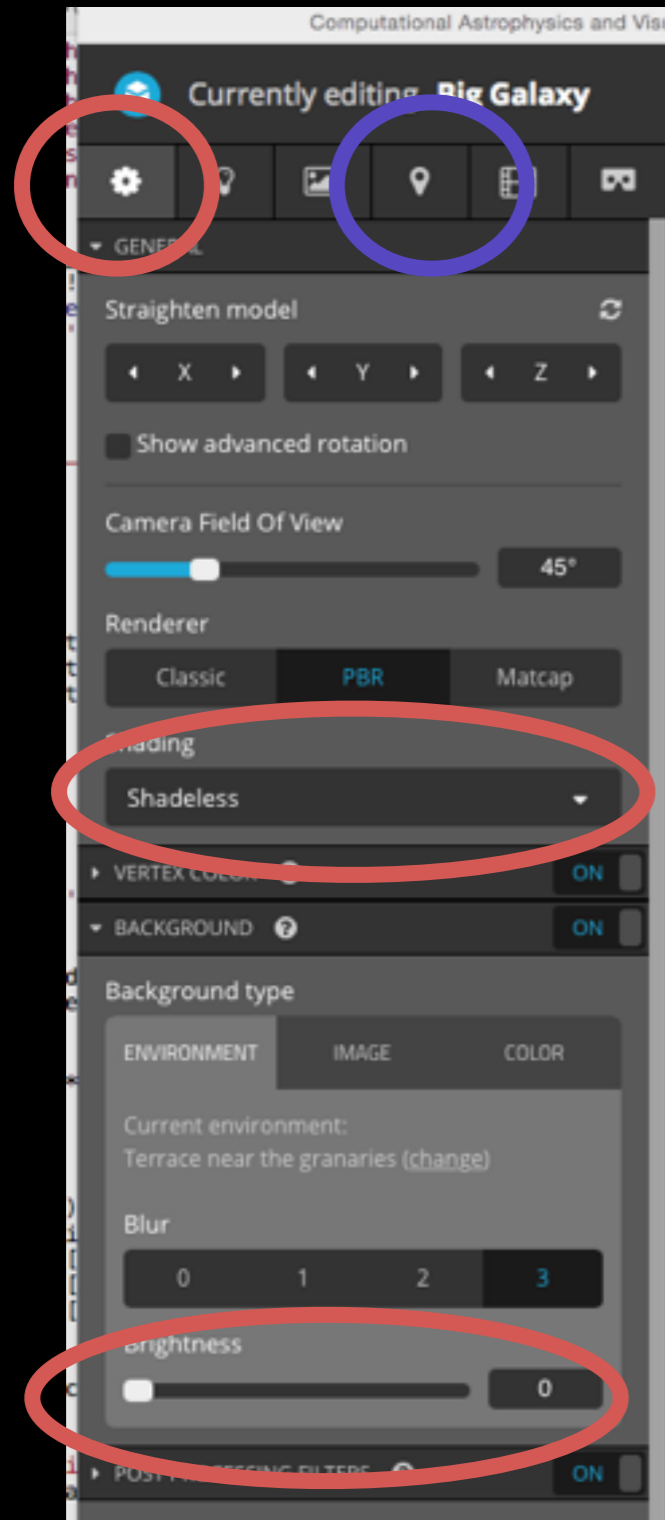
First, start with static uploads

Hints for Sketchfab (esp for PLY files):

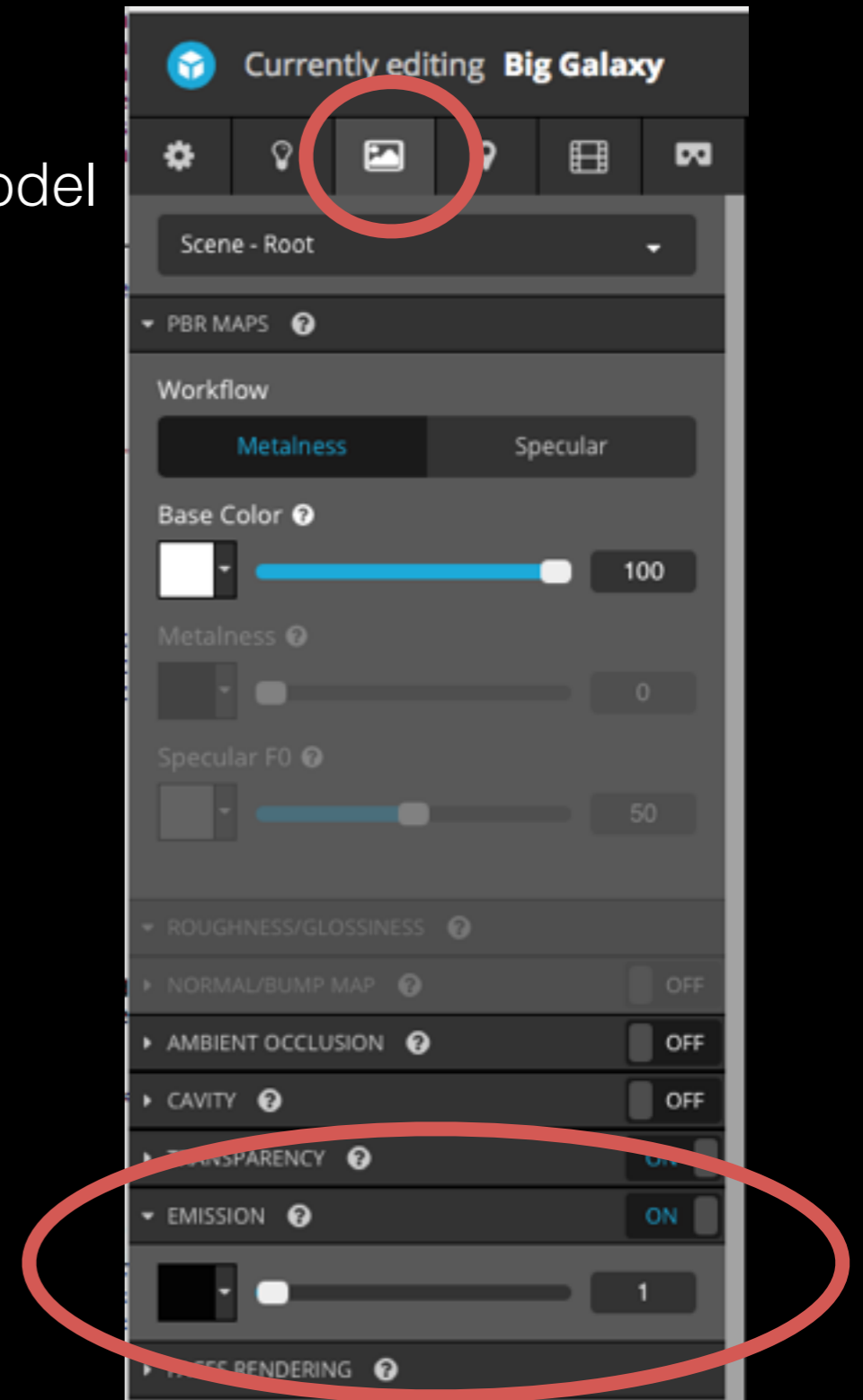


First, start with static uploads

Hints for Sketchfab (esp for PLY files):



Annotations to your model

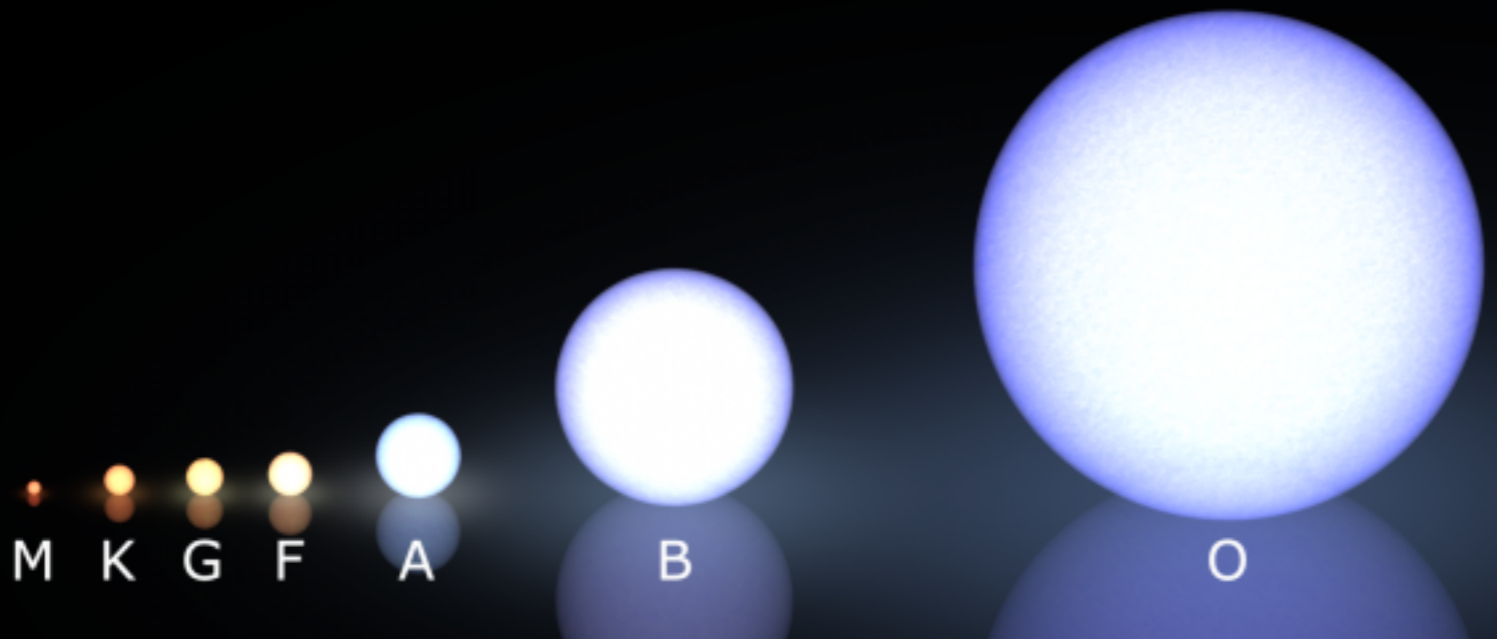


The OBJ File Format - Planets

Extra things to consider for stars in planet viz's:

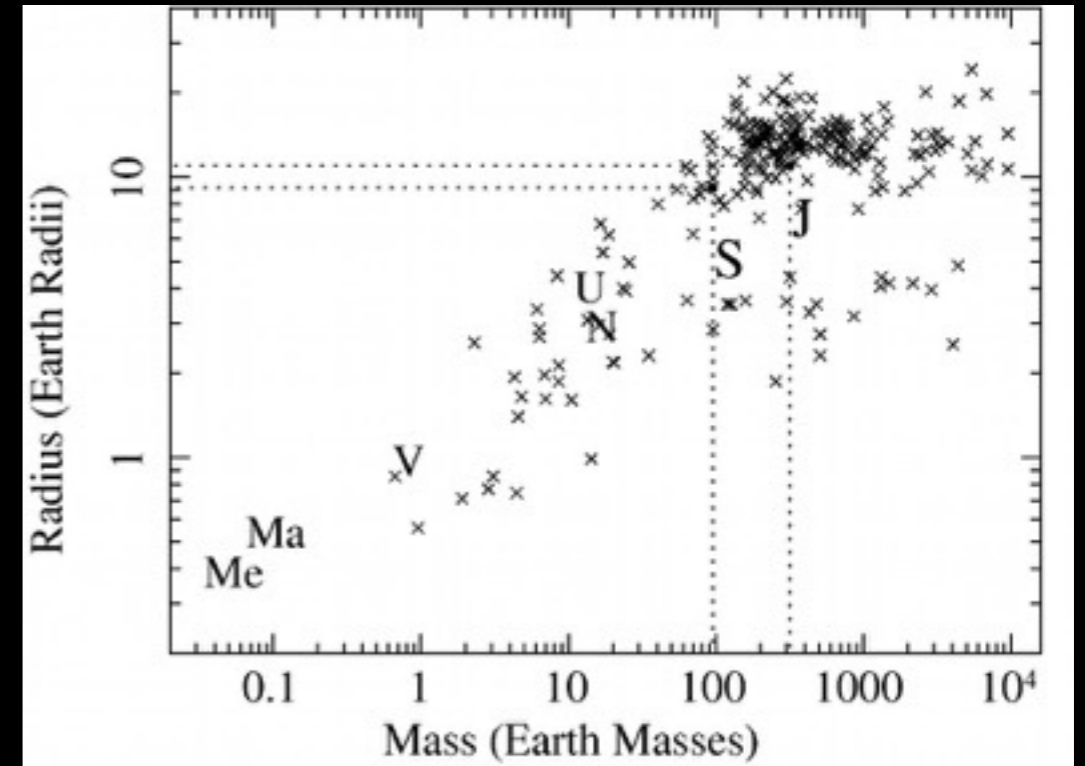
Main Sequence Stars							
	O	B	A	F	G	K	M
Spectral Type:	O	B	A	F	G	K	M
Temperature:	40 000K	20 000K	8500K	6500K	5700K	4500K	3200K
Radius (Sun=1):	10	5	1.7	1.3	1.0	0.8	0.3
Mass (Sun=1):	50	10	2.0	1.5	1.0	0.7	0.2
Luminosity (Sun=1):	100 000	1000	20	4	1.0	0.2	0.01
Lifetime (million yrs):	10	100	1000	3000	10 000	50 000	200 000
Abundance:	0.00001%	0.1%	0.7%	2%	3.5%	8%	80%

Giant Stars	White Dwarfs	Supergiant Stars
Low mass stars near the end of their lives.	Dying remnant of an imploded star.	High mass stars near the end of their lives.
Spectral Type: Mainly G, K or M	Spectral Type: D	Spectral Type: O, B, A, F, G, K or M
Temperature: 3000 to 10 000K	Temperature: Under 80 000K	Temperature: 4000 to 40 000K
Radius (Sun=1): 10 to 50	Radius (Sun=1): Under 0.01	Radius (Sun=1): 30 to 500
Mass (Sun=1): 1 to 5	Mass (Sun=1): Under 1.4	Mass (Sun=1): 10 to 70
Luminosity (Sun=1): 50 to 1000	Luminosity (Sun=1): Under 0.01	Luminosity (Sun=1): 30 000 to 1 000 000
Lifetime (million yrs): 1000	Lifetime (million yrs): -	Lifetime (million yrs): 10
Abundance: 0.4%	Abundance: 5%	Abundance: 0.0001%

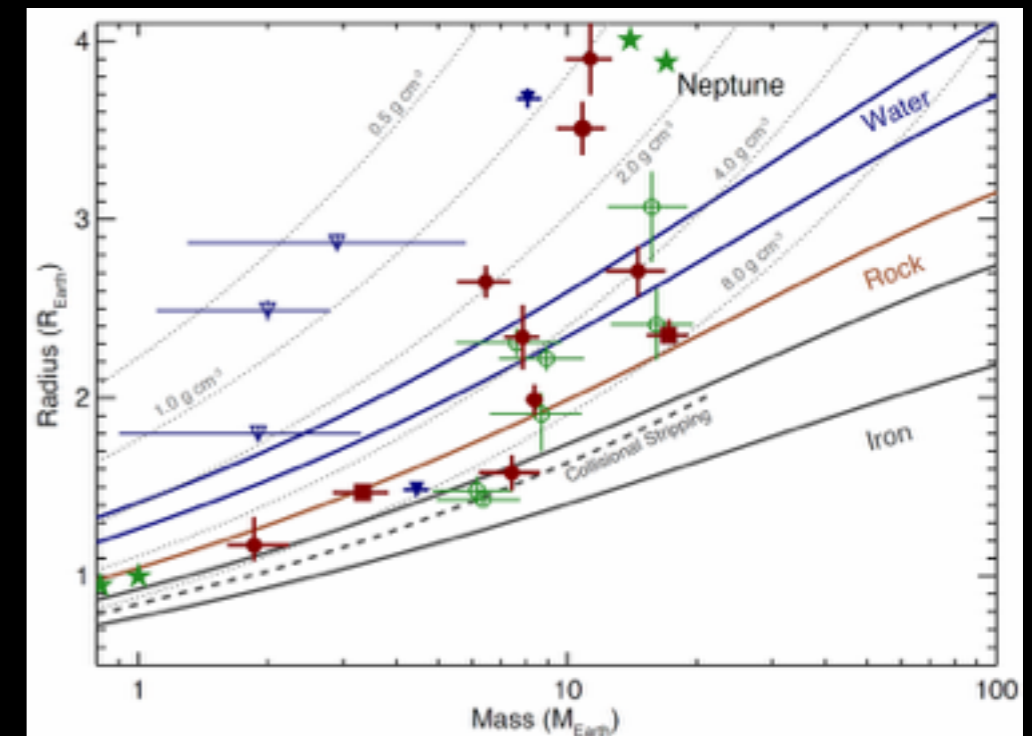
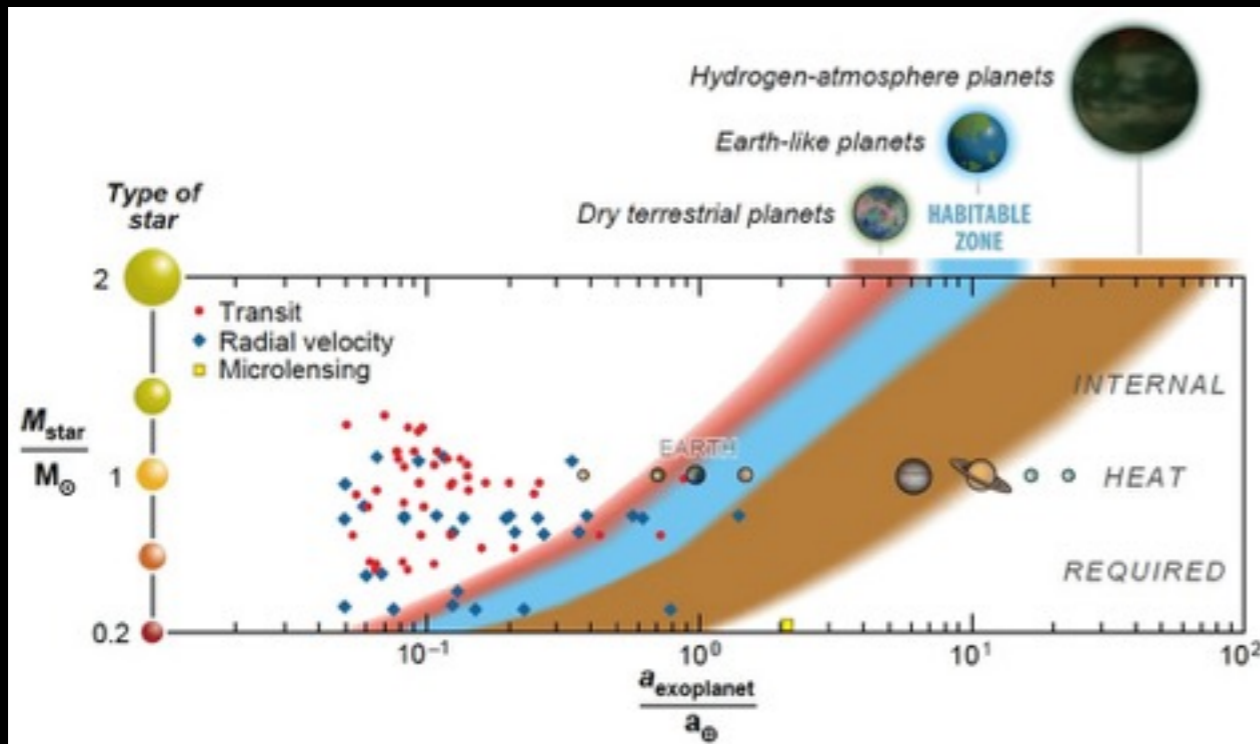


The OBJ File Format - Planets

Extra things to consider for planets in planet viz's:

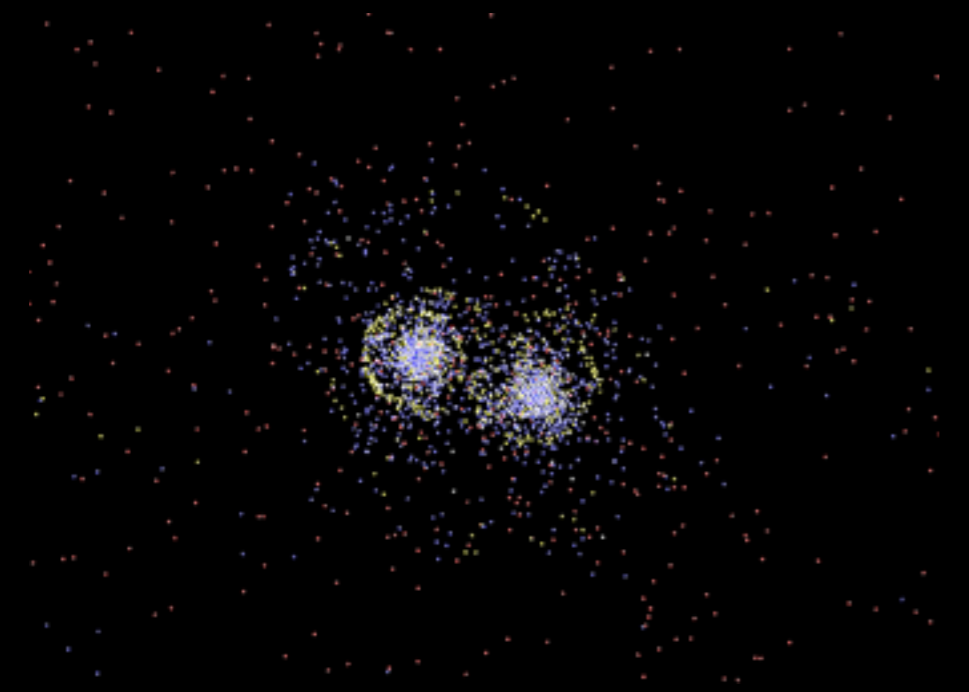


Radii tend to get bigger with mass



Different planet compositions mean different “looking” planets

The PLY File Format - Galaxies



What should each particle color be? Why? Can it change based on the time of the snapshot? Which particles are useful to see, which aren't?