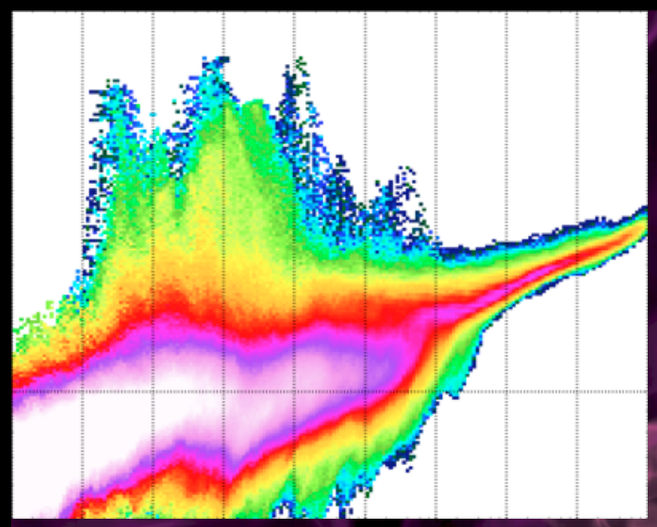
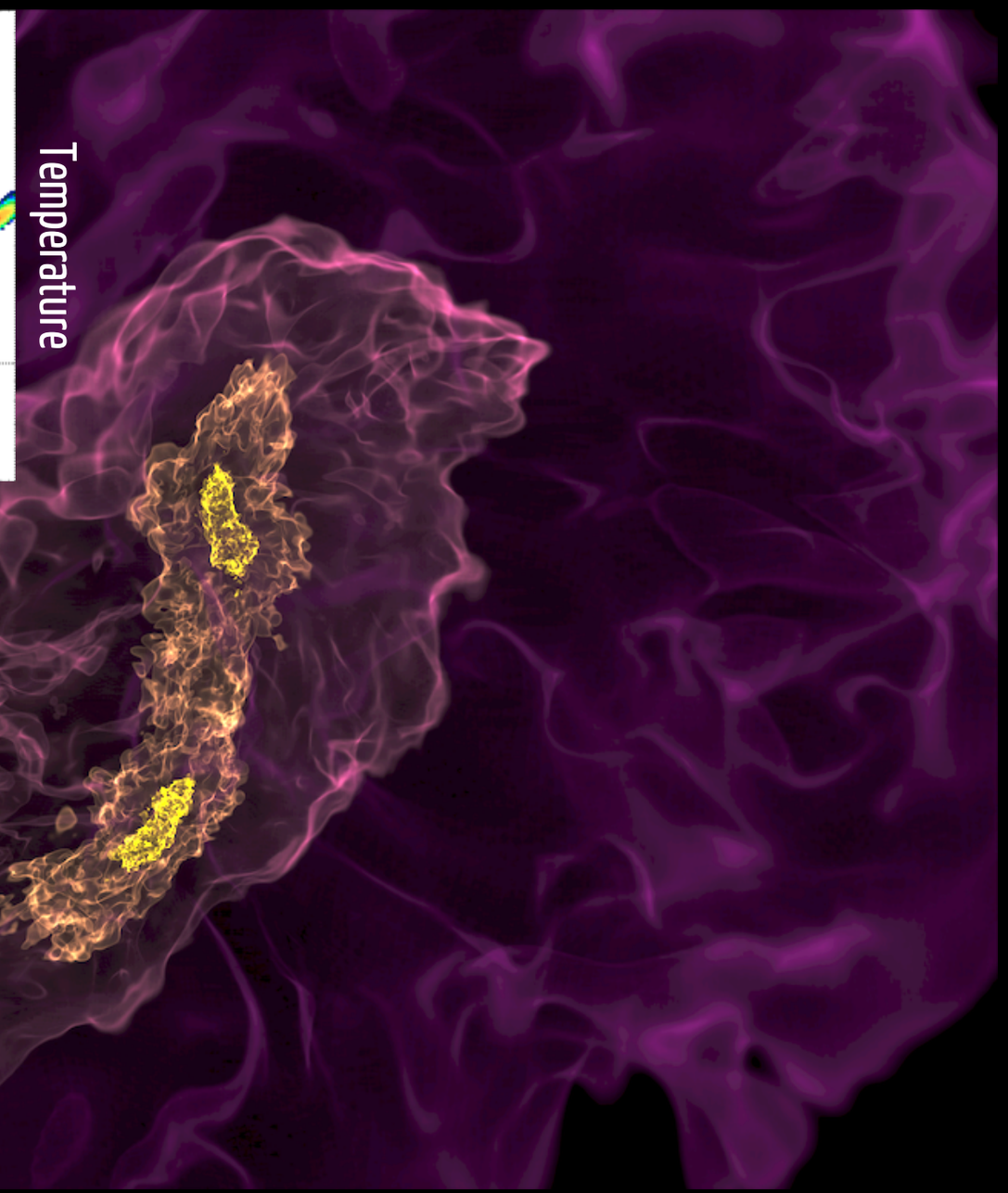
What is a visualization?

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."



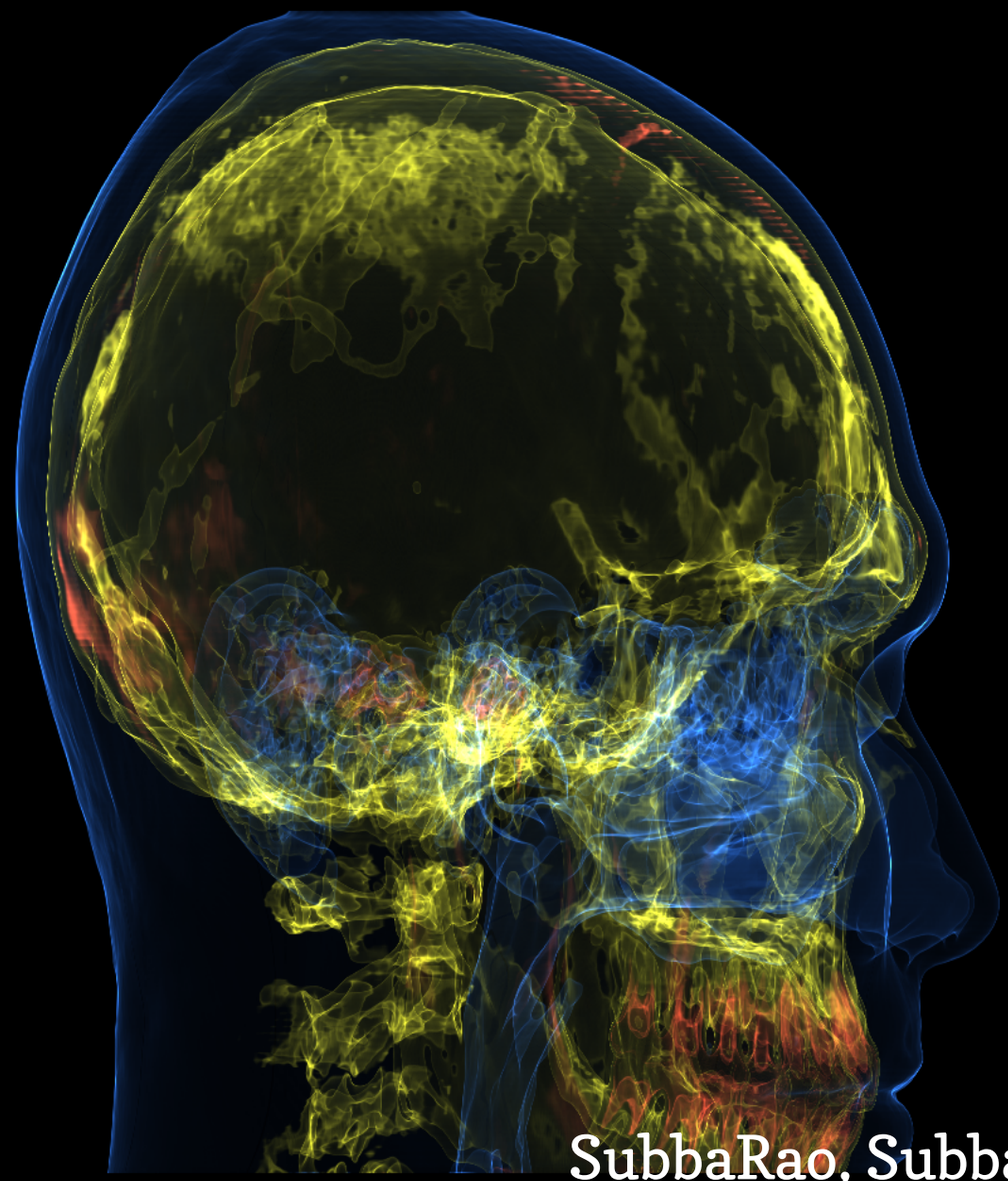


Turk et al 2009

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

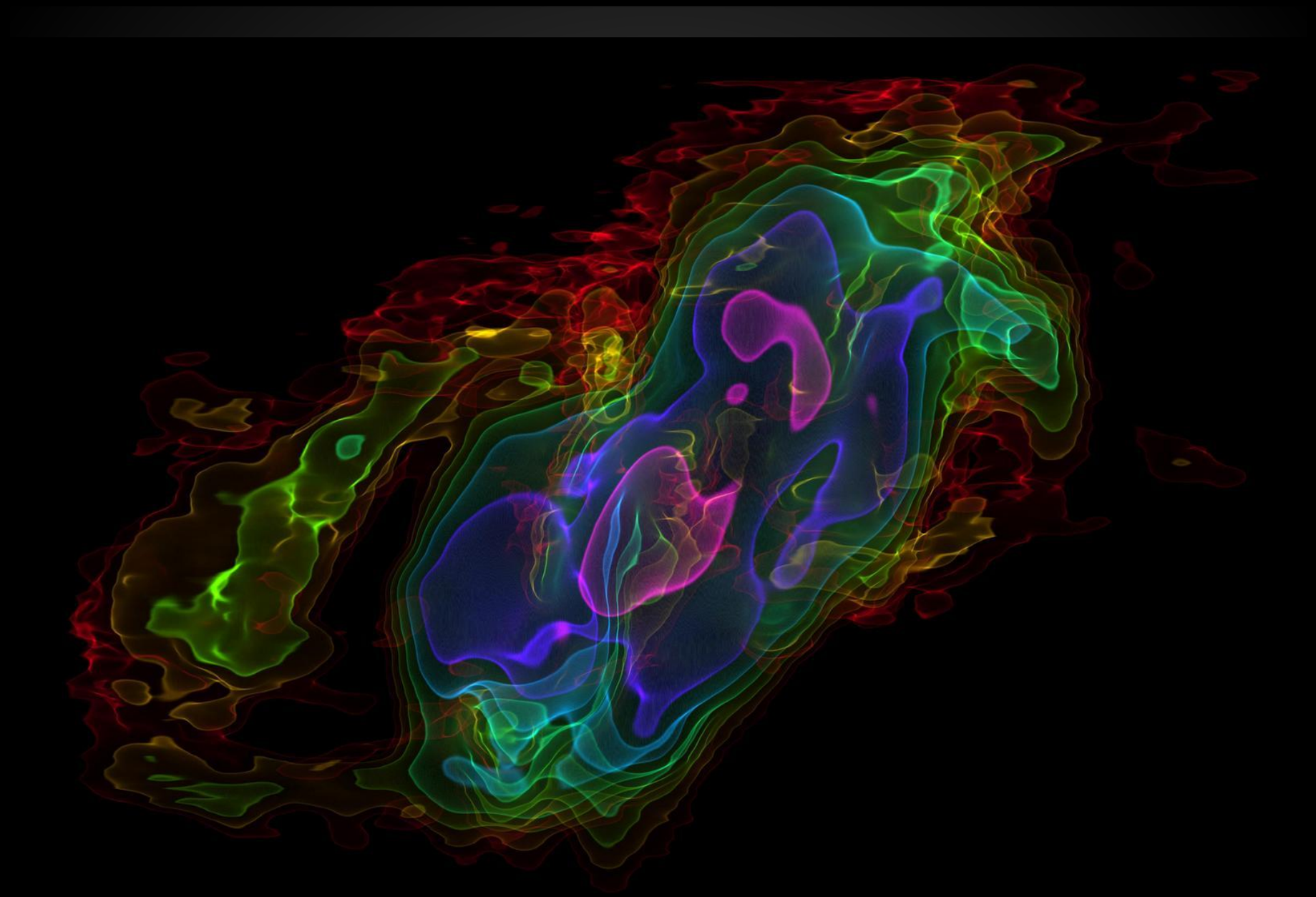
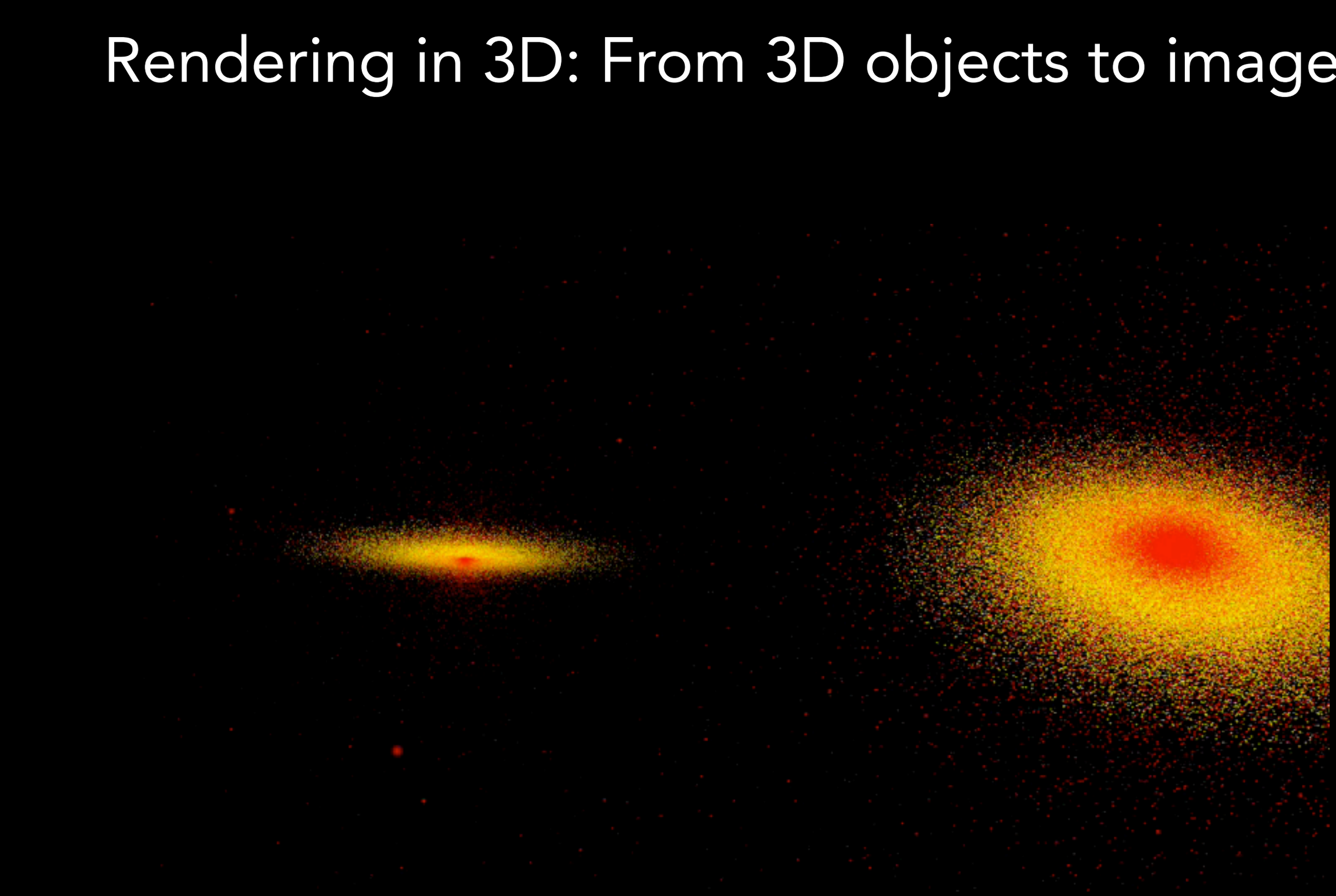


Image Credit: Erik Rosolowsky & ALMA

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.

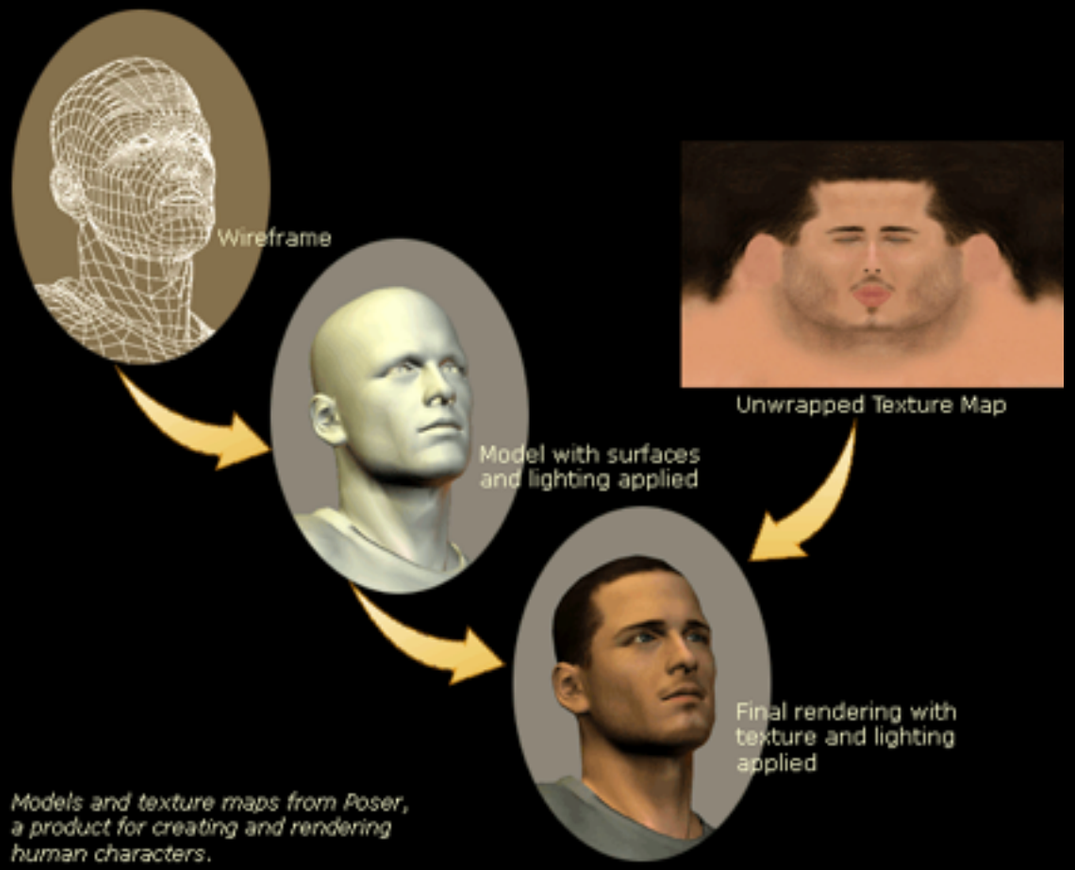
The way we will do this is by generating specific Geometry Files that 3D rendering software (Sketchfab, MeshLab, Blender, Maya, Houdini, etc) know how to read and process.

Software

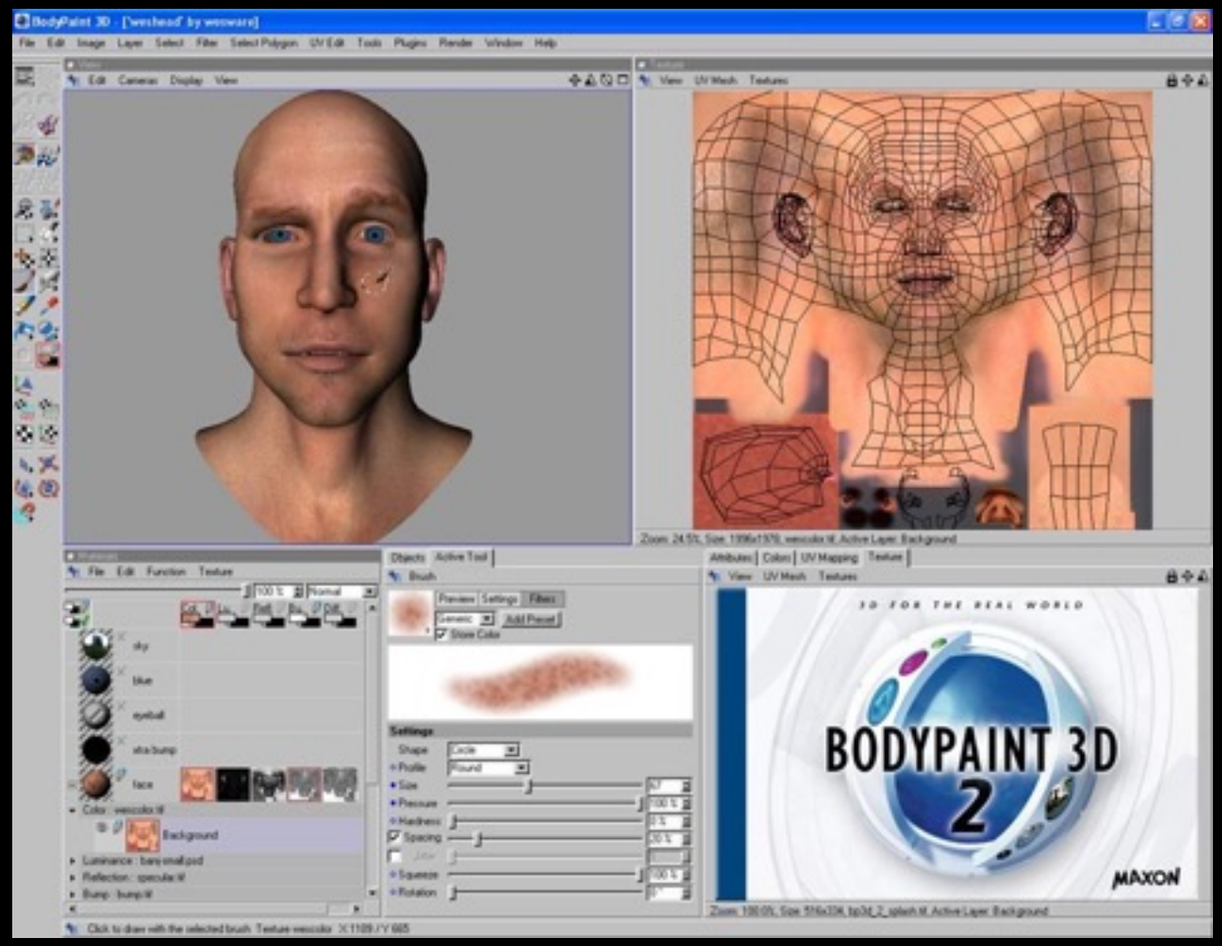
(1) Set up a Sketchfab account

(2) Download MeshLab

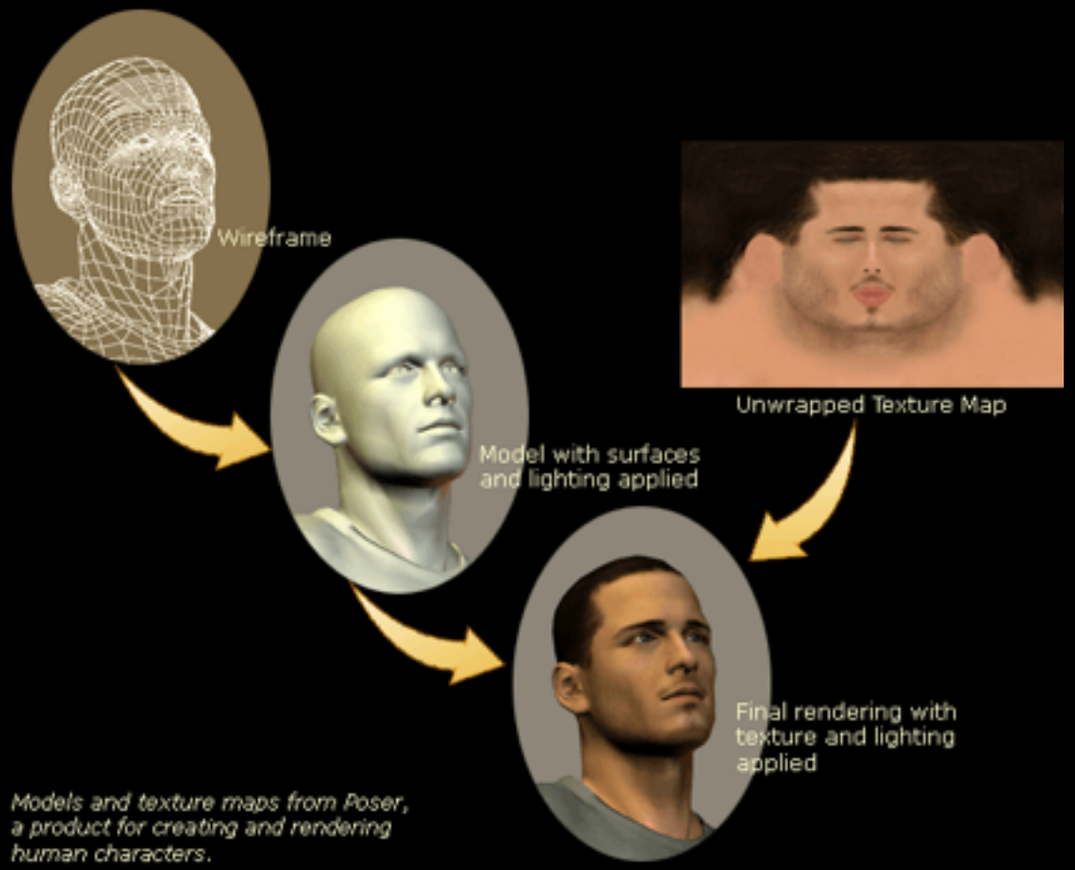
Planets - Texture Mapping



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



Planets - Texture Mapping



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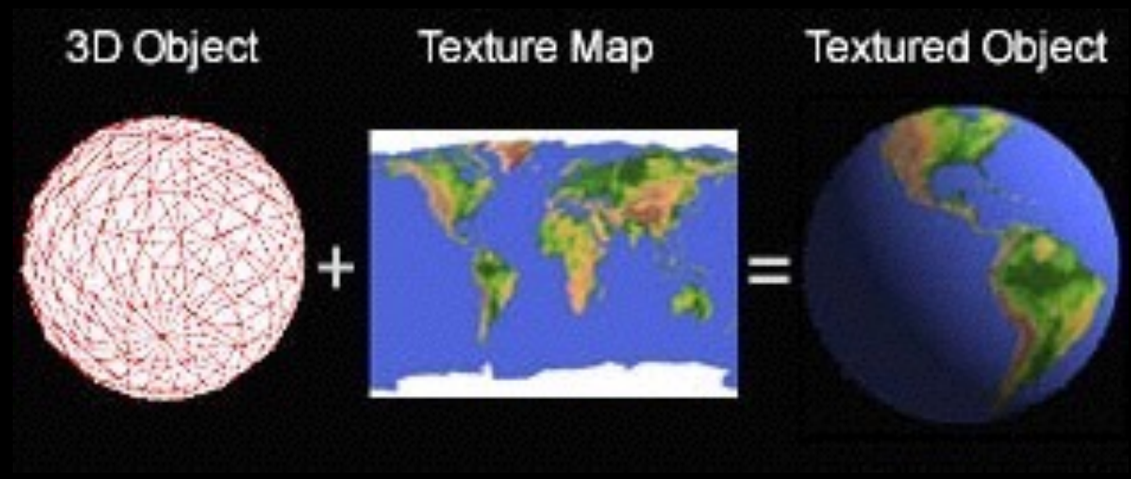

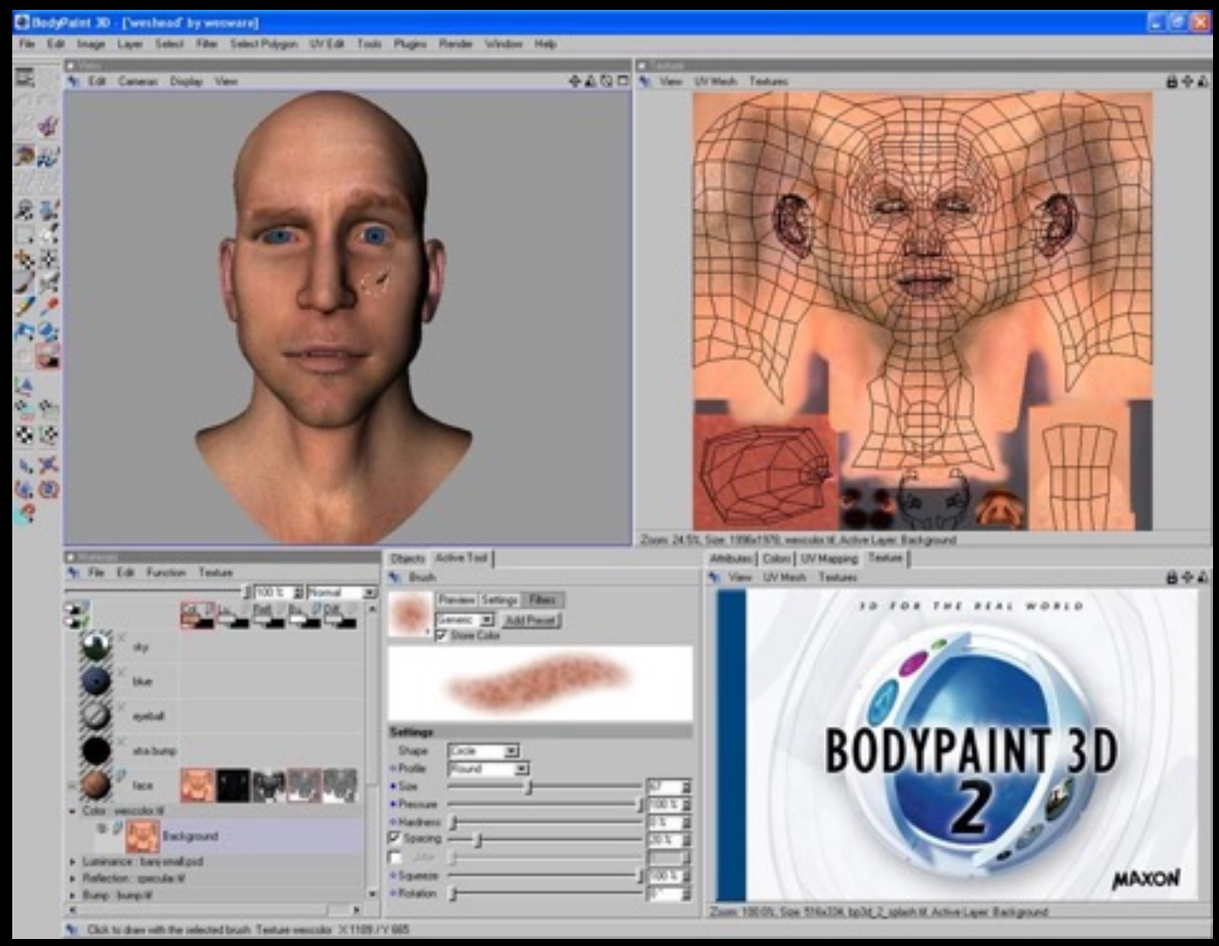

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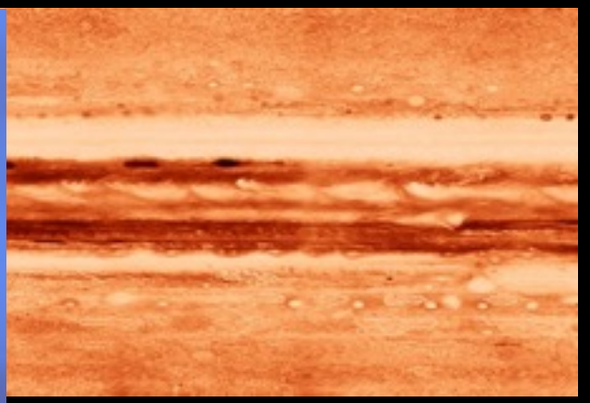
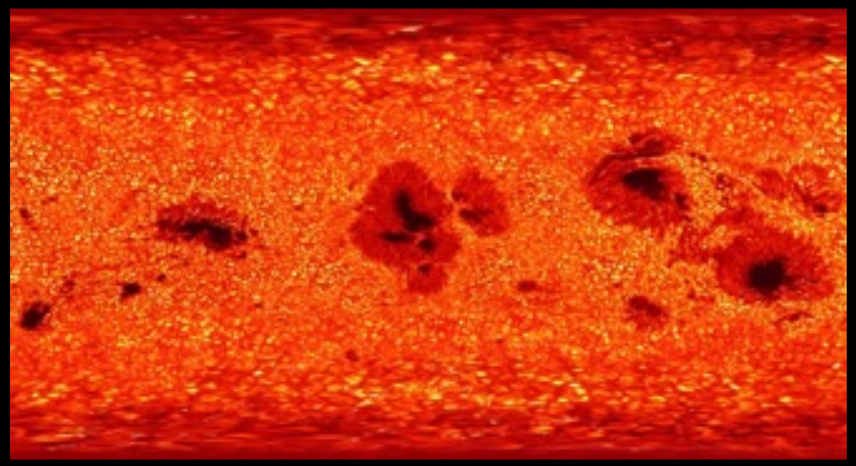
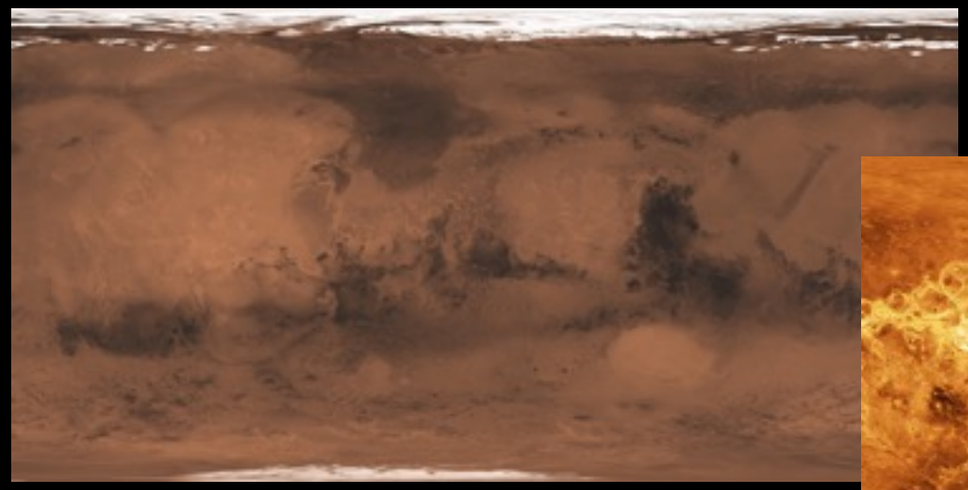
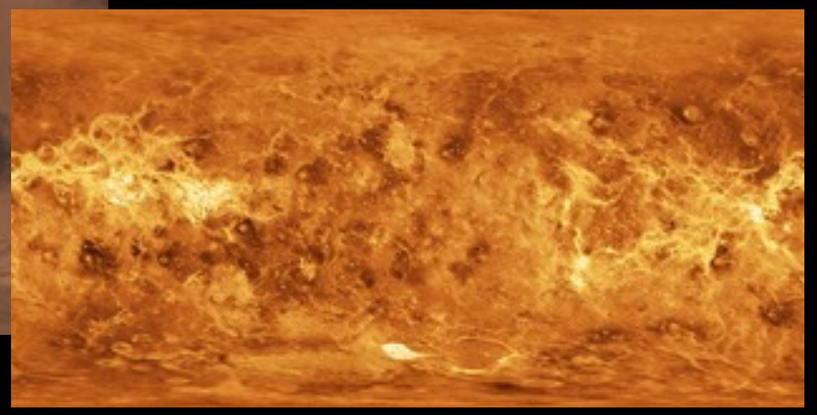








The OBJ File Format

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

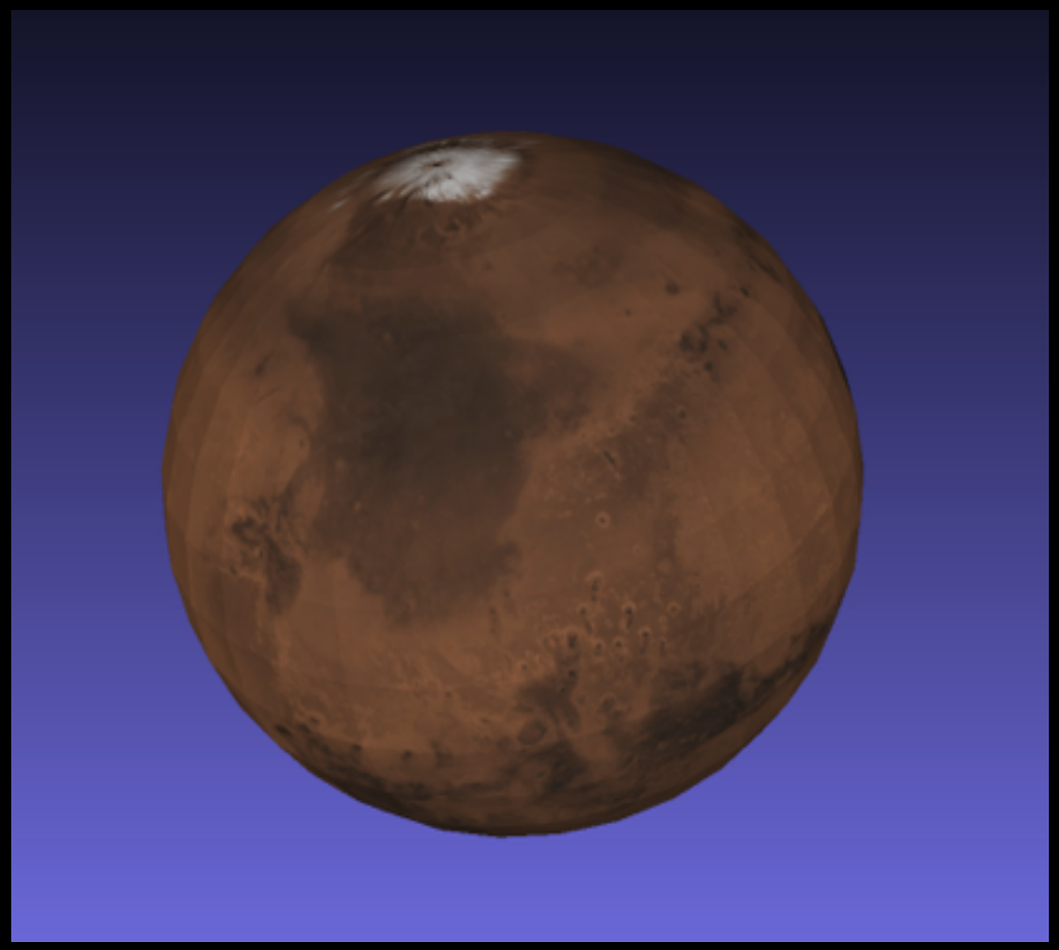
(1)

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

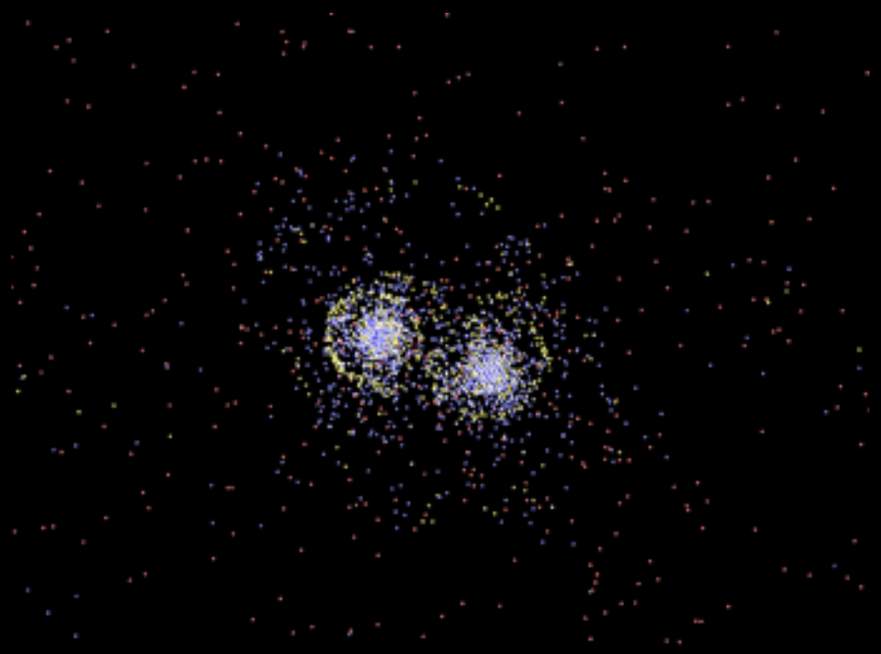
Companion material file (.mtl file) gives information for:

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



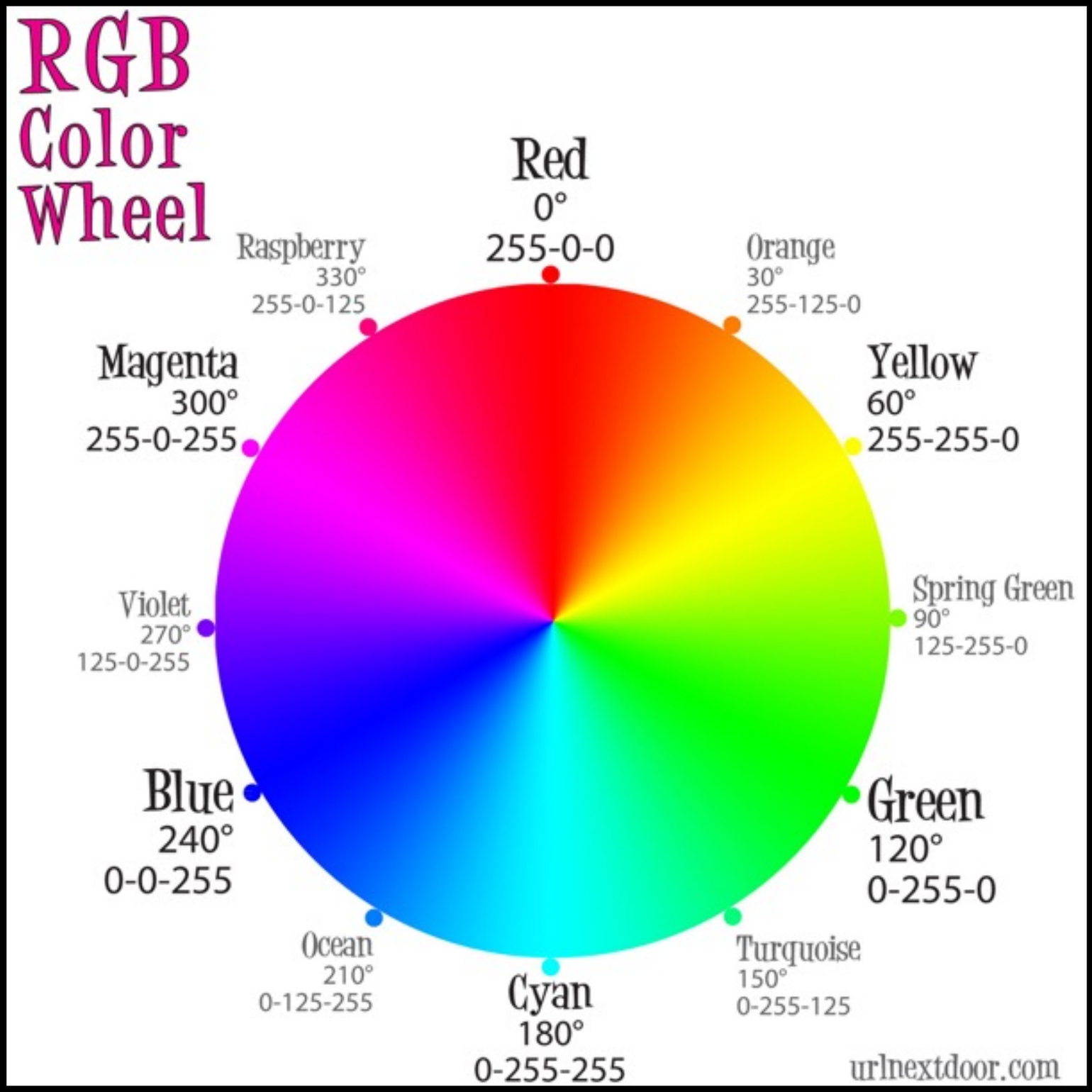
For each vertex representing each particle, the PLY file stores:

Vertex locations

Colors of each vertex

NOTE: these sorts of files can be uploaded Sketchfab only

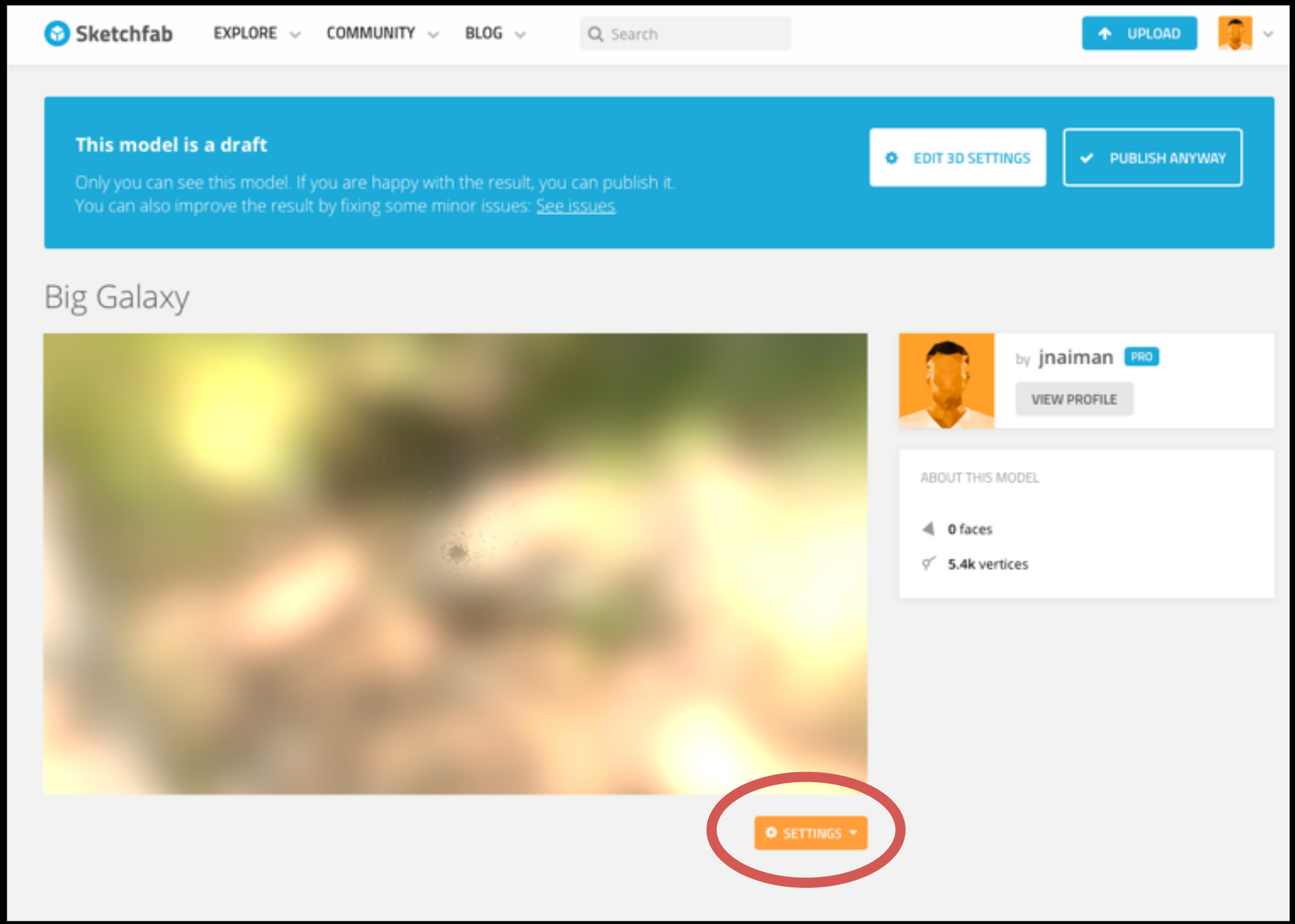
A note about RGB colors



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

First, start with static uploads

Hints for Sketchfab (esp for PLY files):



Click on 3D settings

First, start with static uploads

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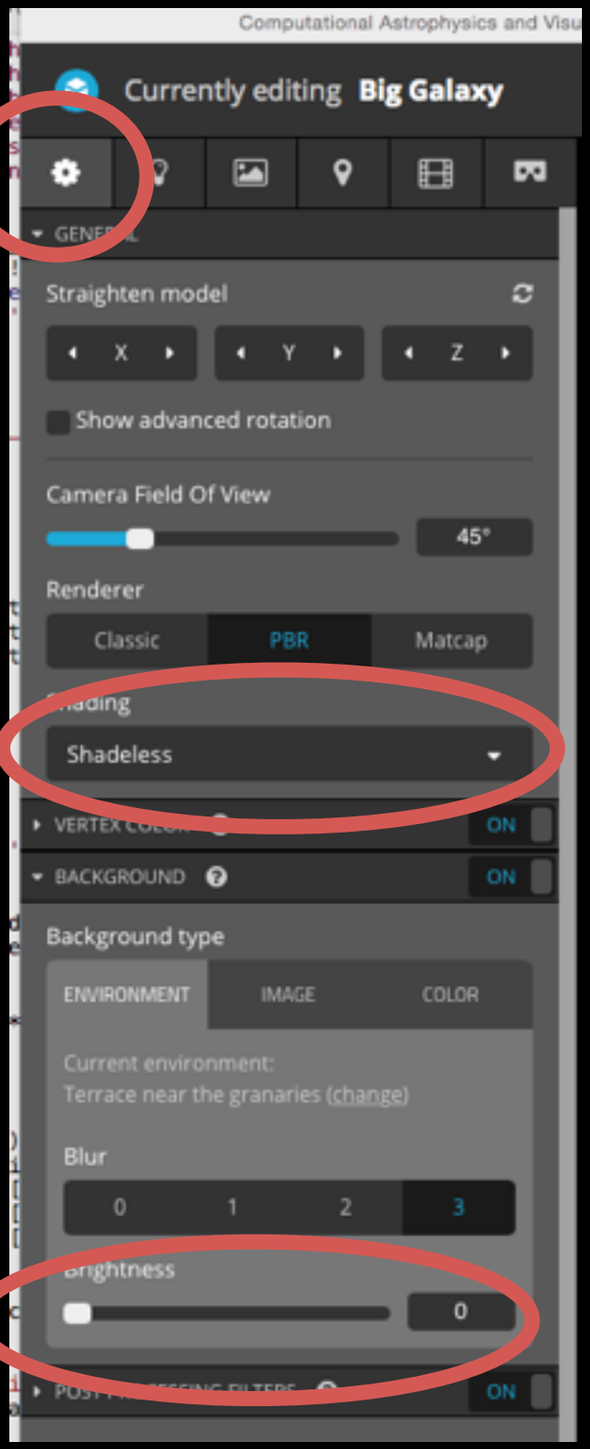

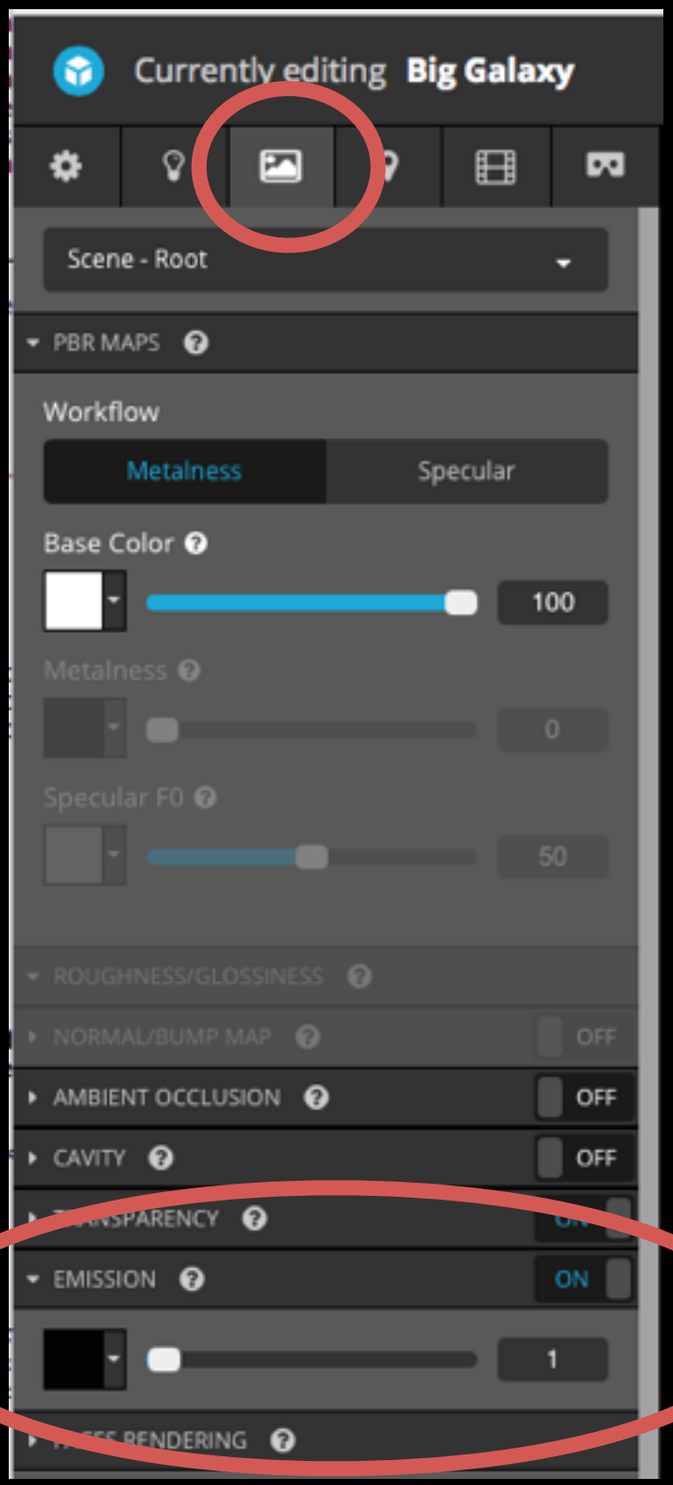

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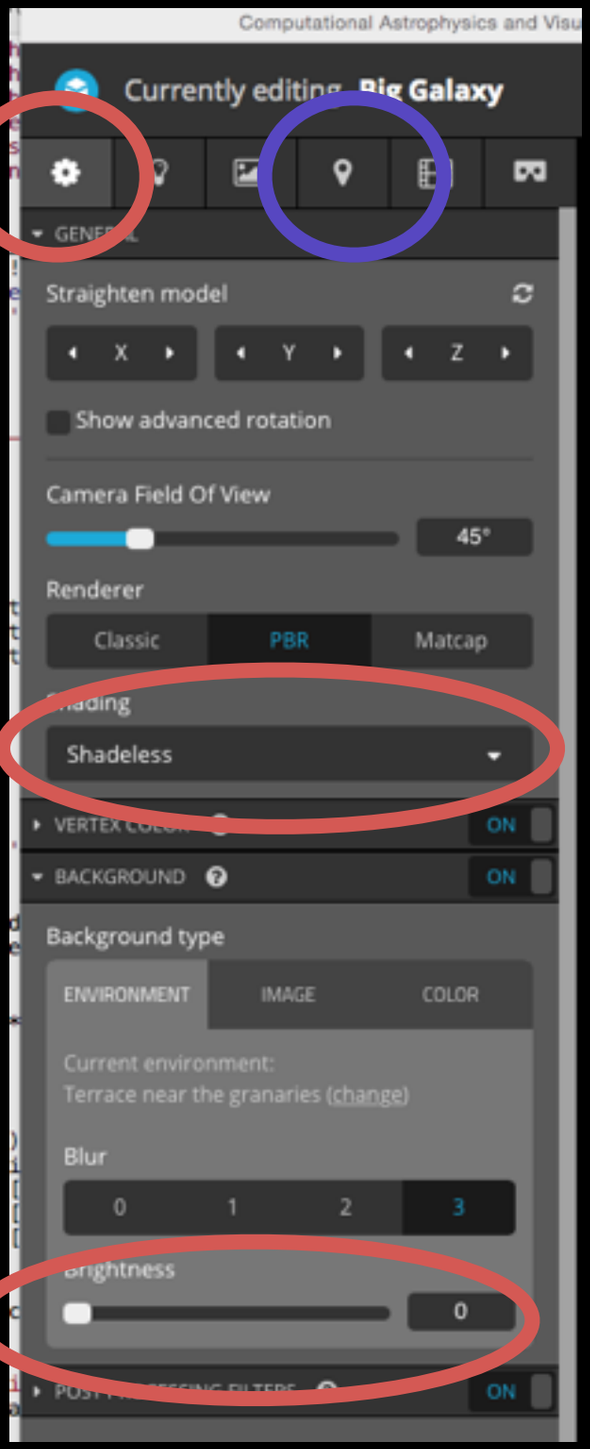
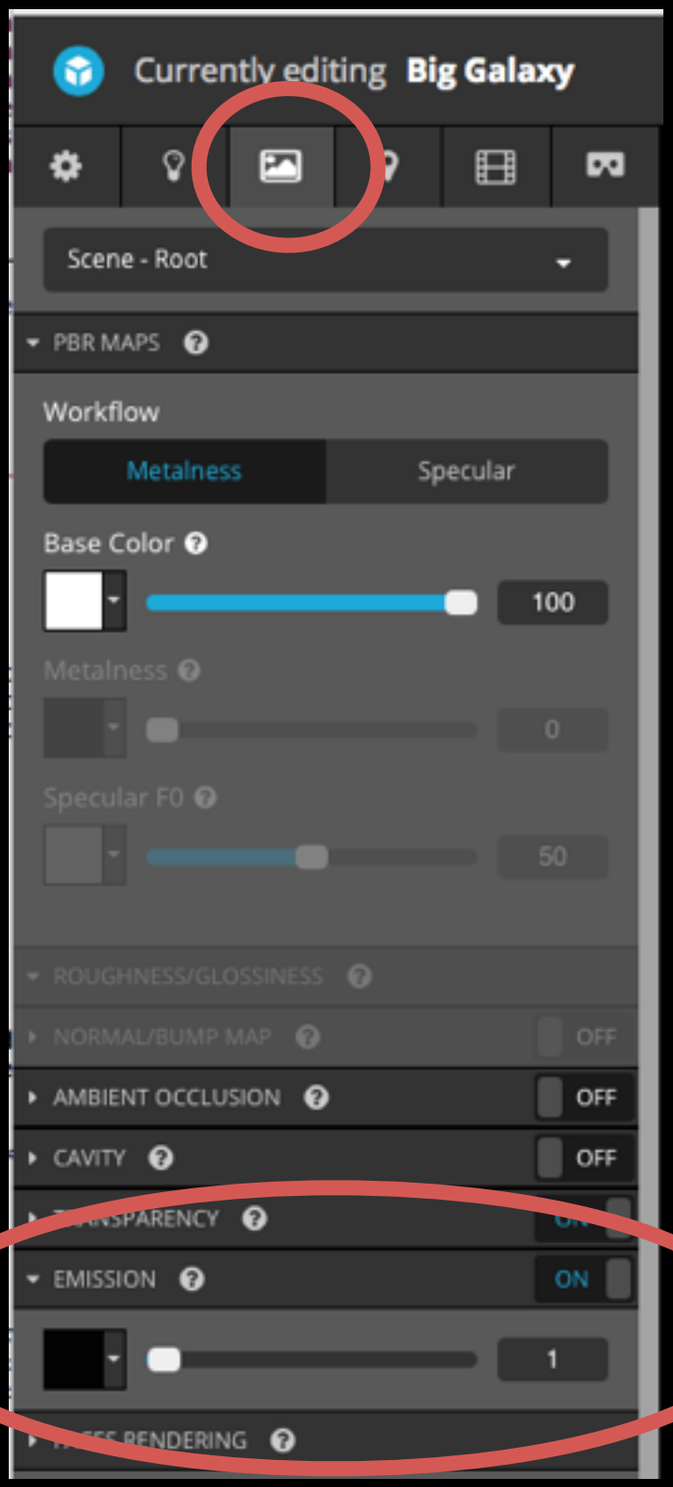
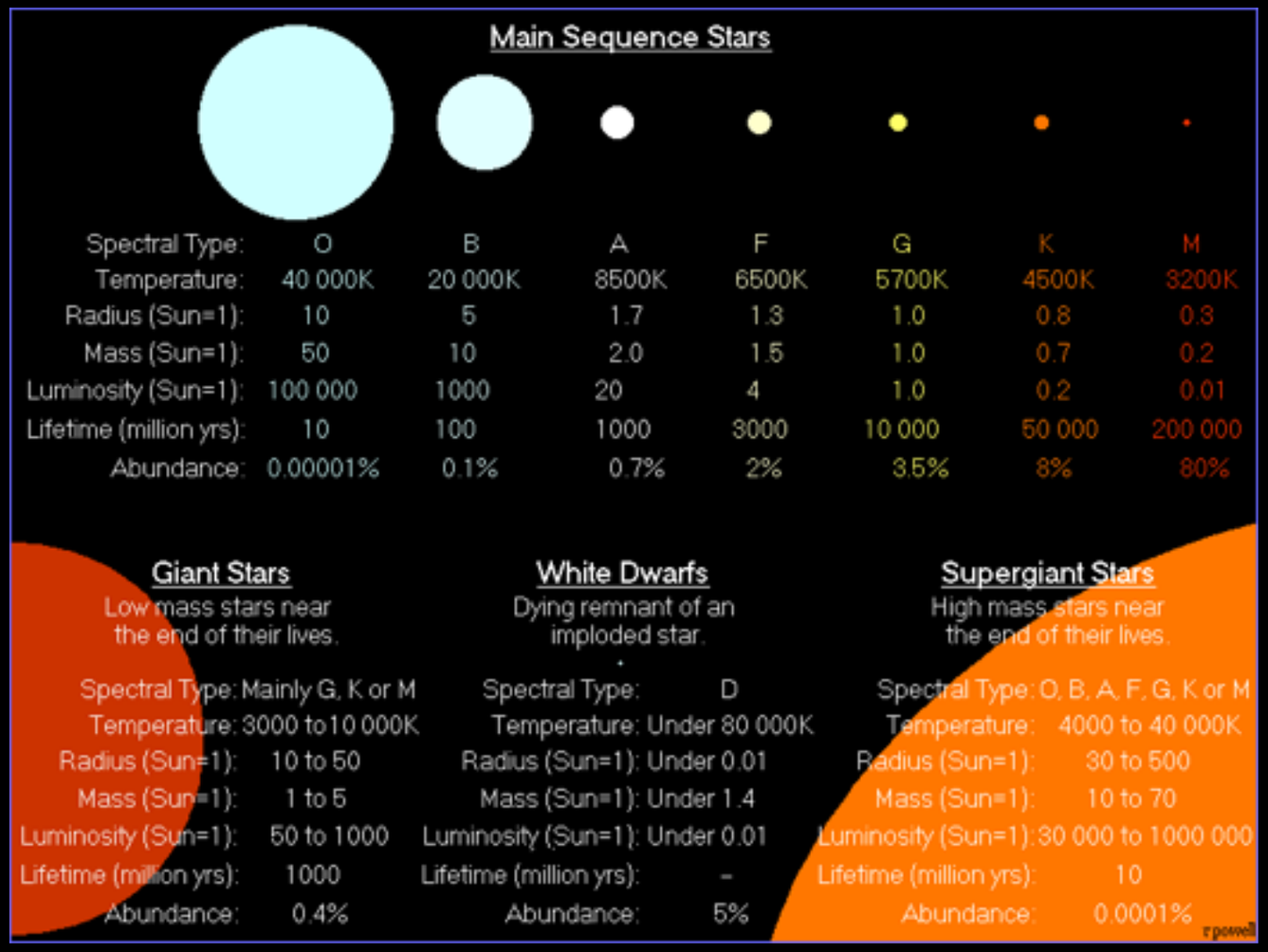


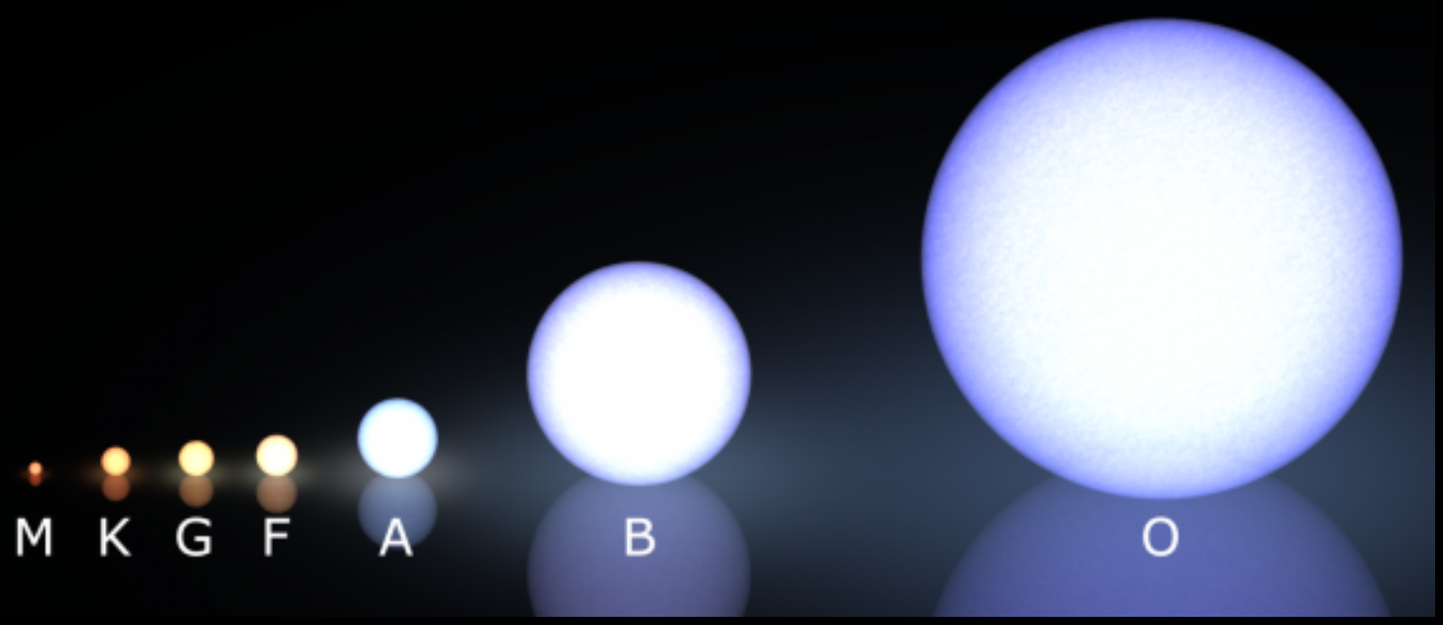
Annotations to your model



The OBJ File Format - Planets

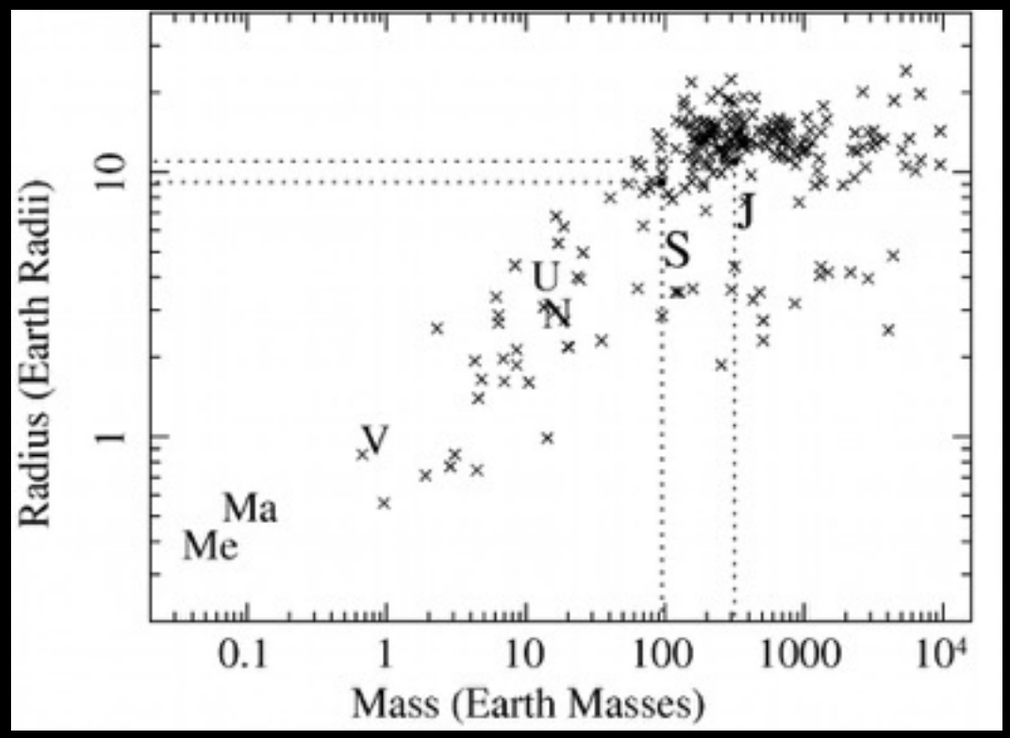
Extra things to consider for stars in planet viz's:



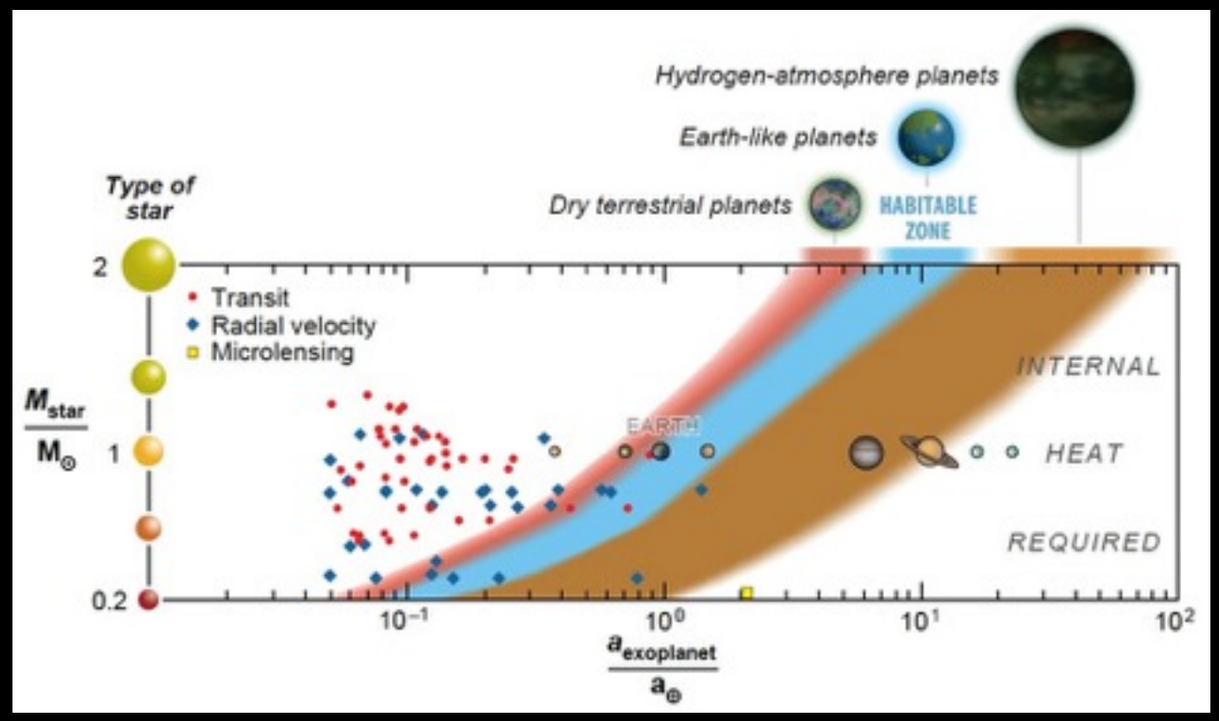


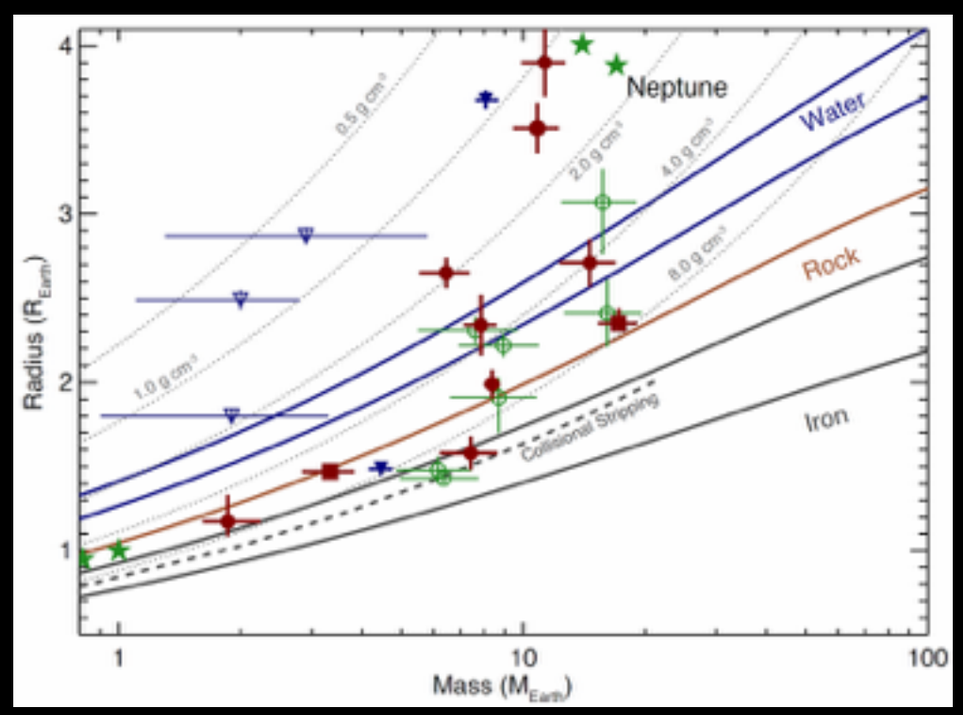
The OBJ File Format - Planets

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



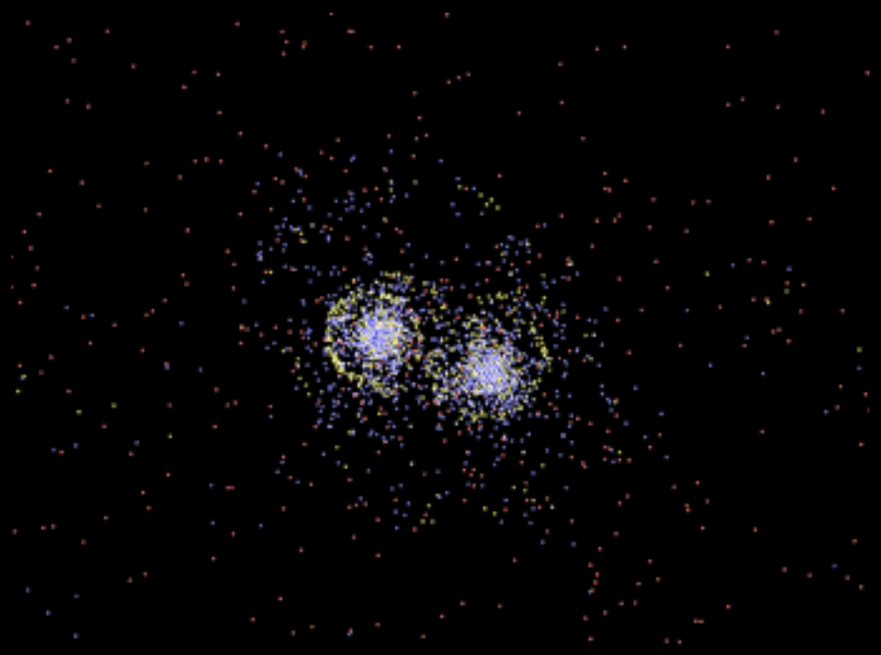
Radii tend to get bigger with mass





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?