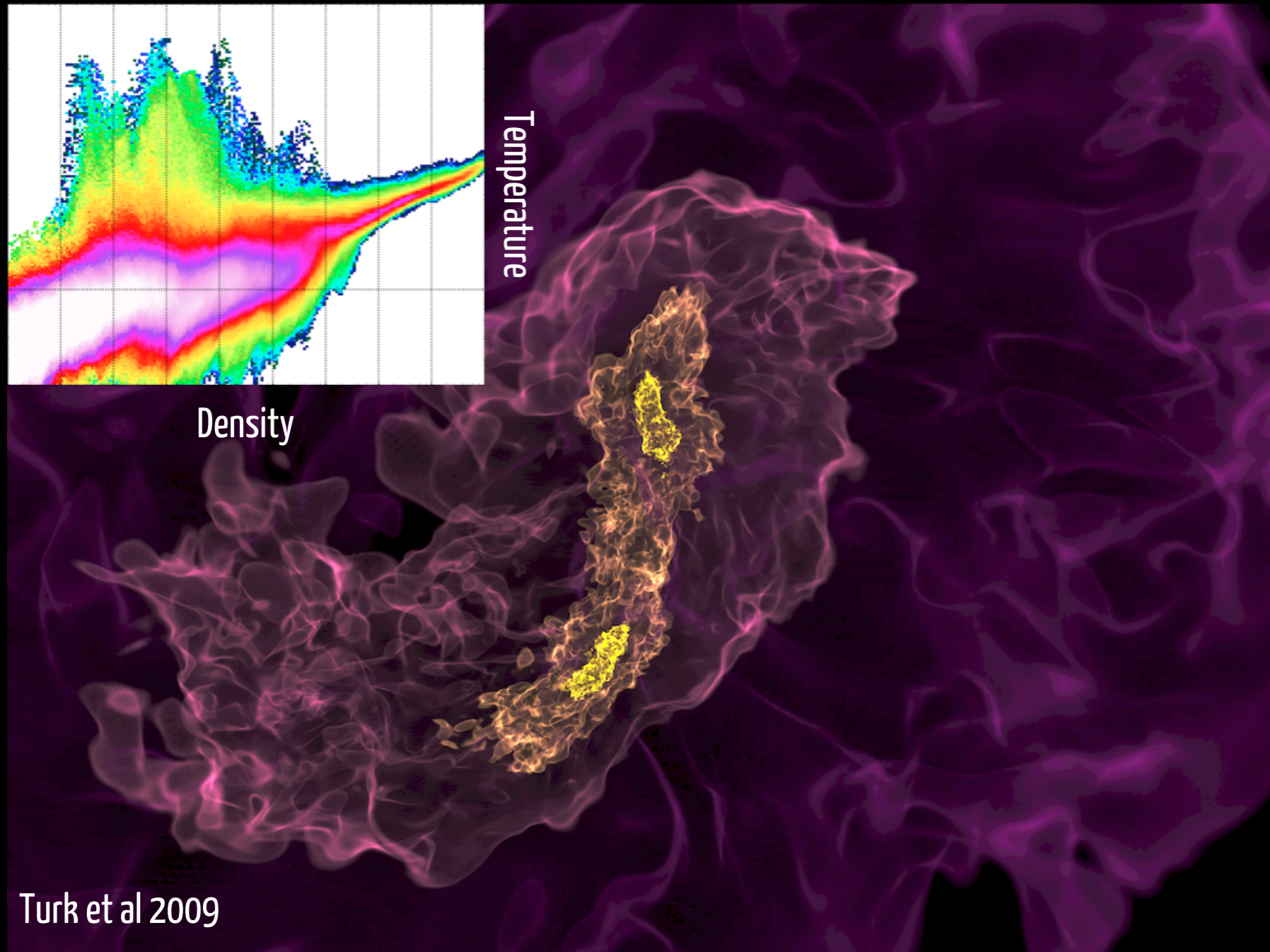


What is a visualization?

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.”

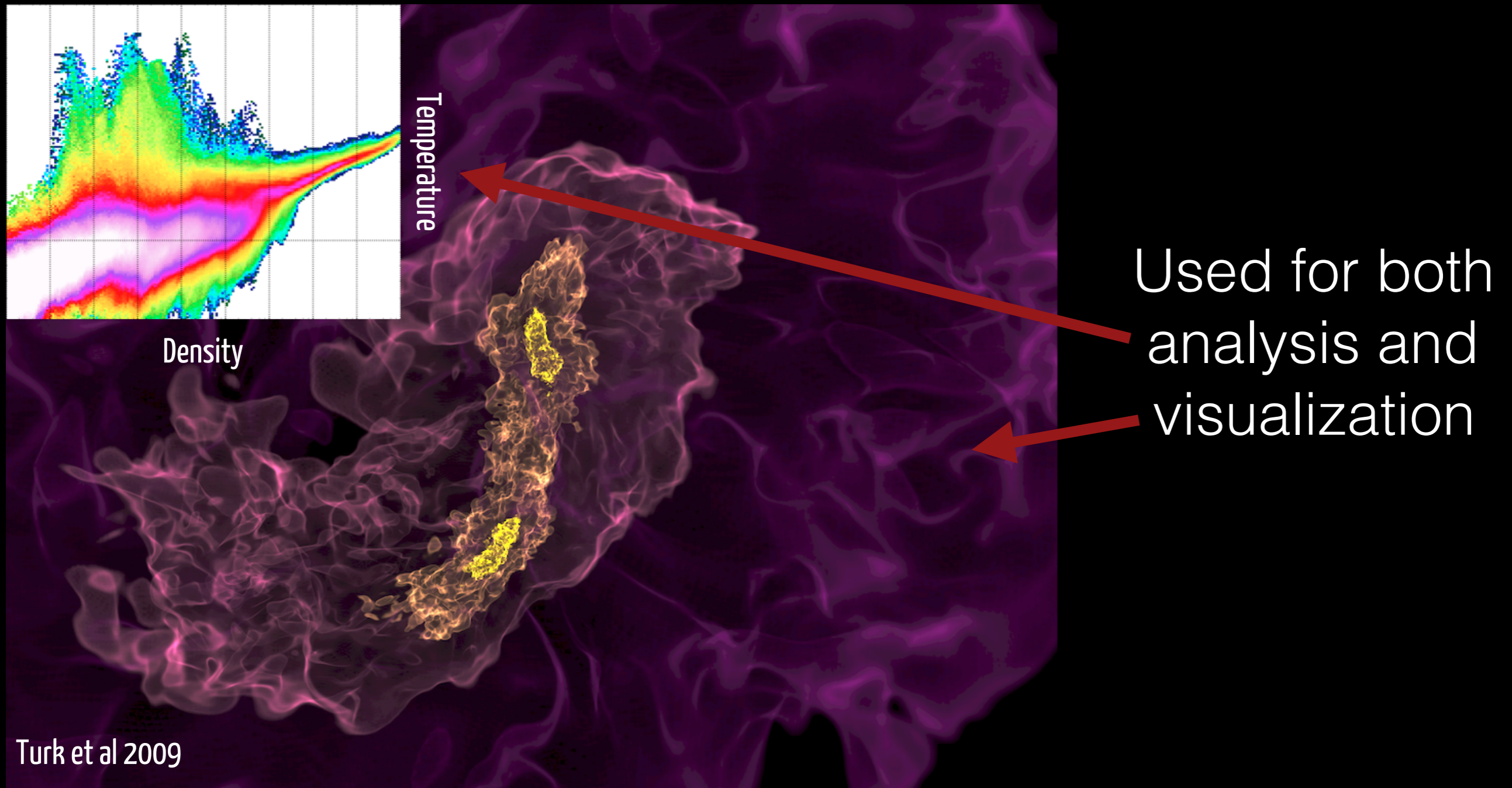


Simulation gas collapsing and forming two dense cores that will become some of the first stars in our Universe.

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What is a visualization?

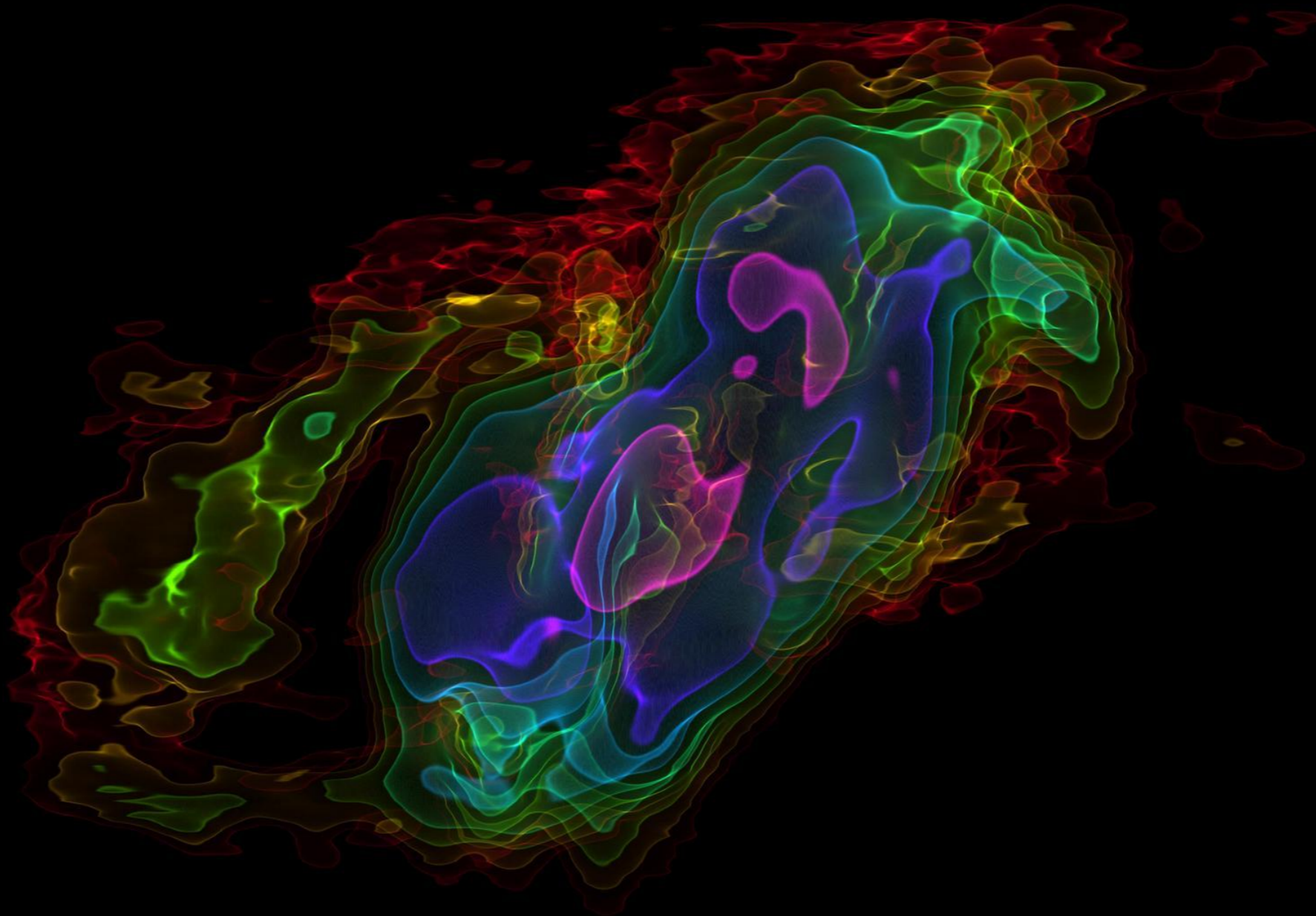
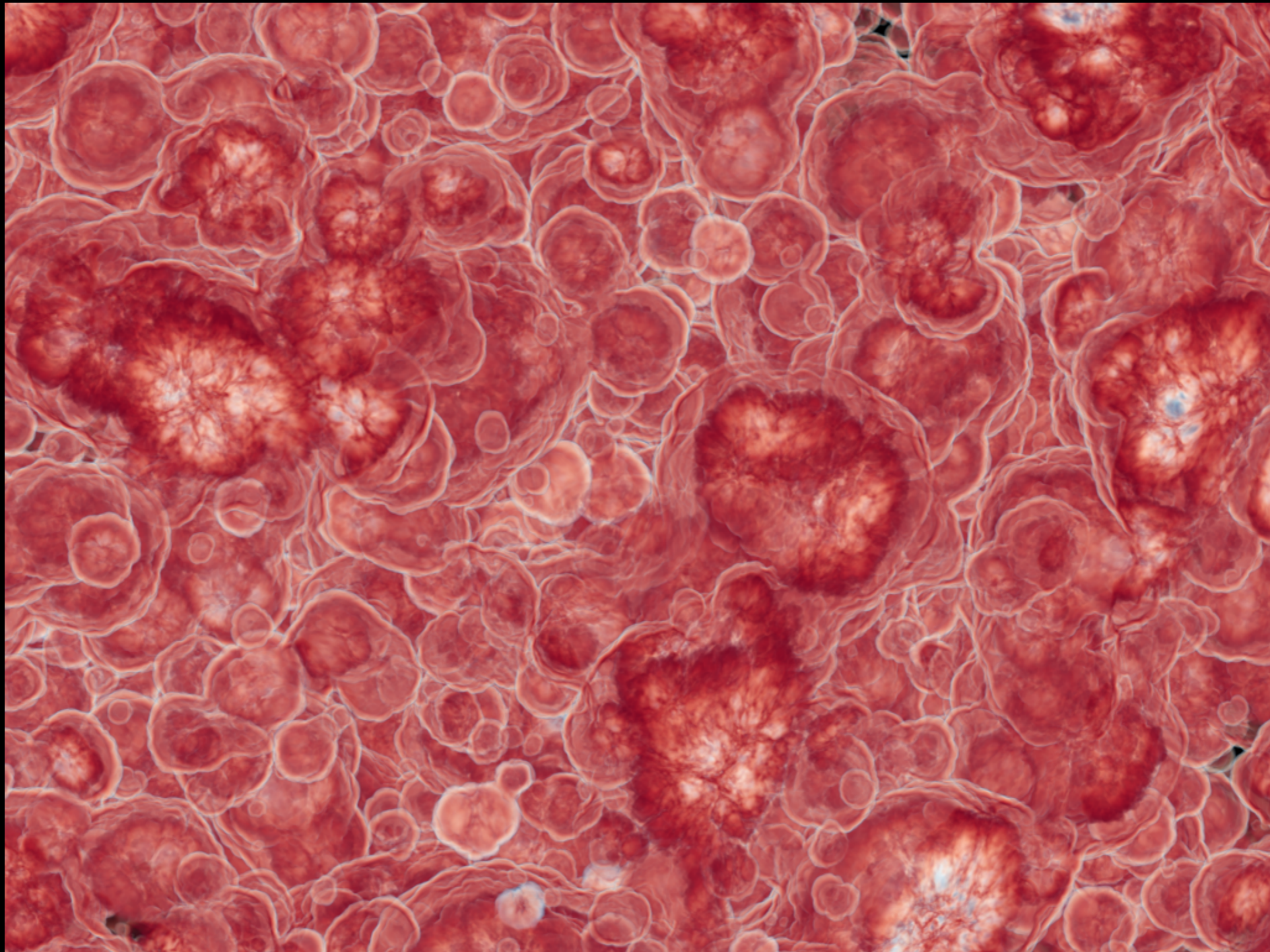


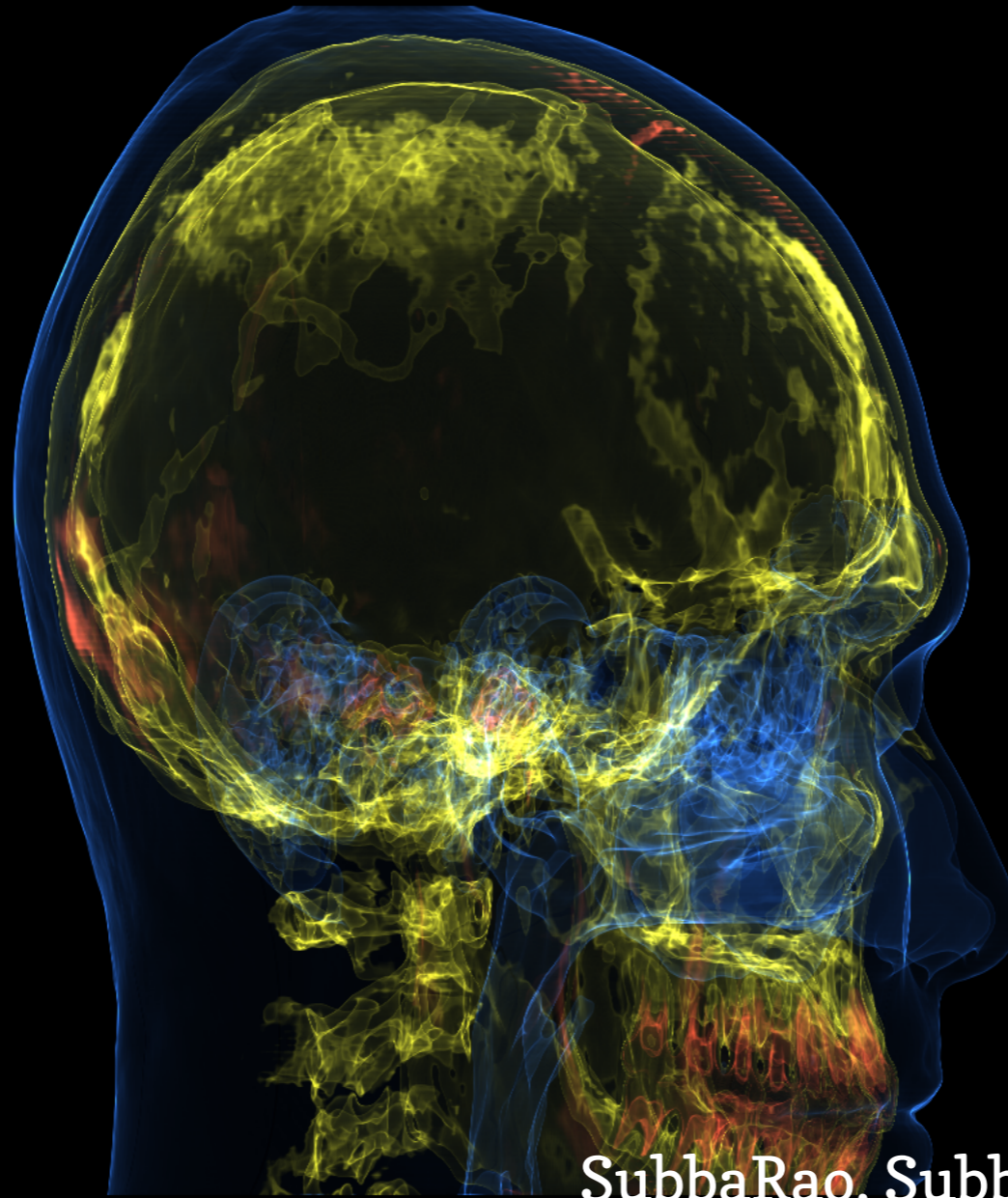
Image Credit: Erik Rosolowsky & ALMA

What is a visualization?



What is a visualization?

NeuroDome



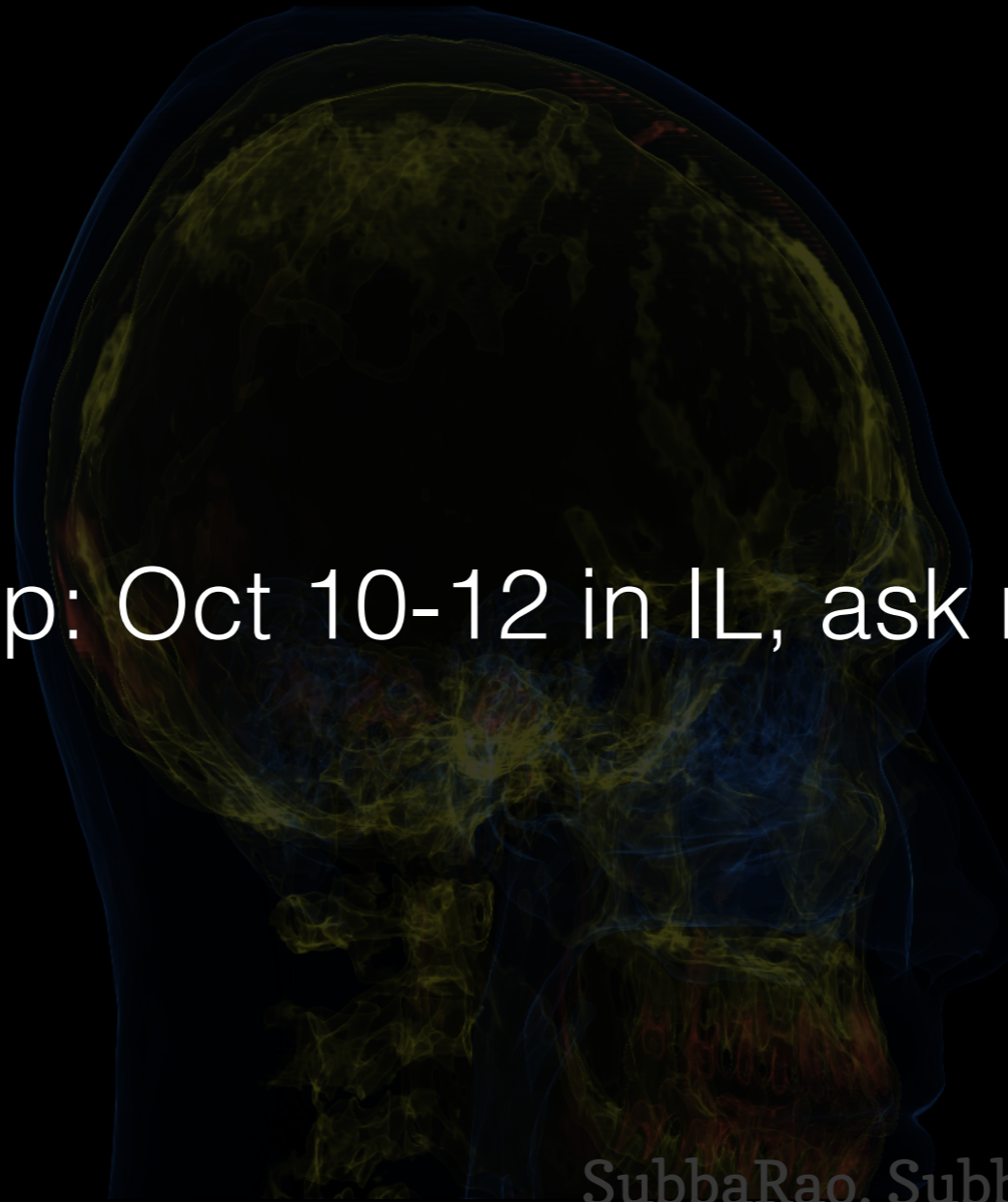
SubbaRao, SubbaRao & Fisher

What is a visualization?

Aside!

NeuroDome

yt users workshop: Oct 10-12 in IL, ask me about funding!



SubbaRao, SubbaRao & Fisher

Also - Pictures?

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
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- * 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

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

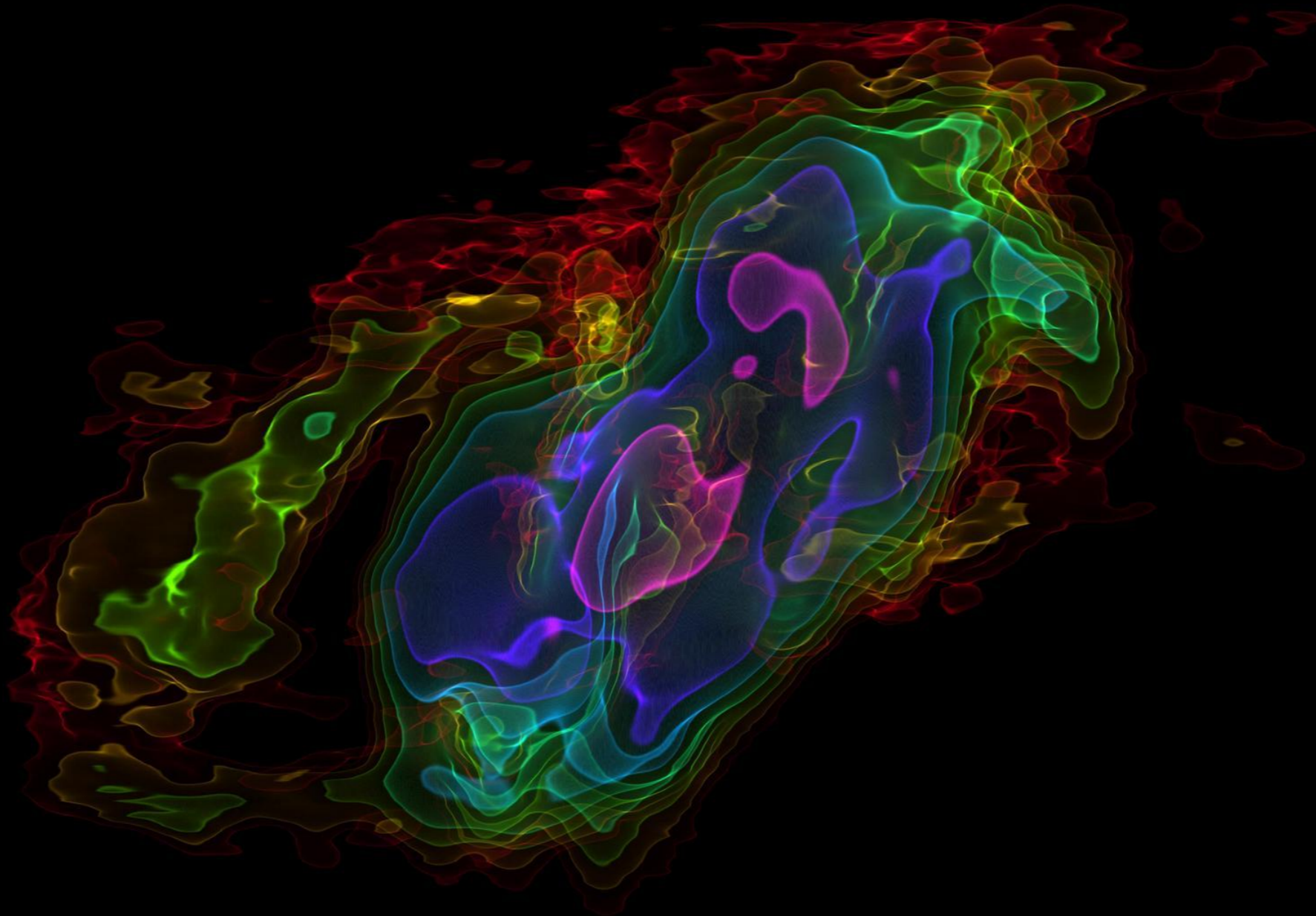
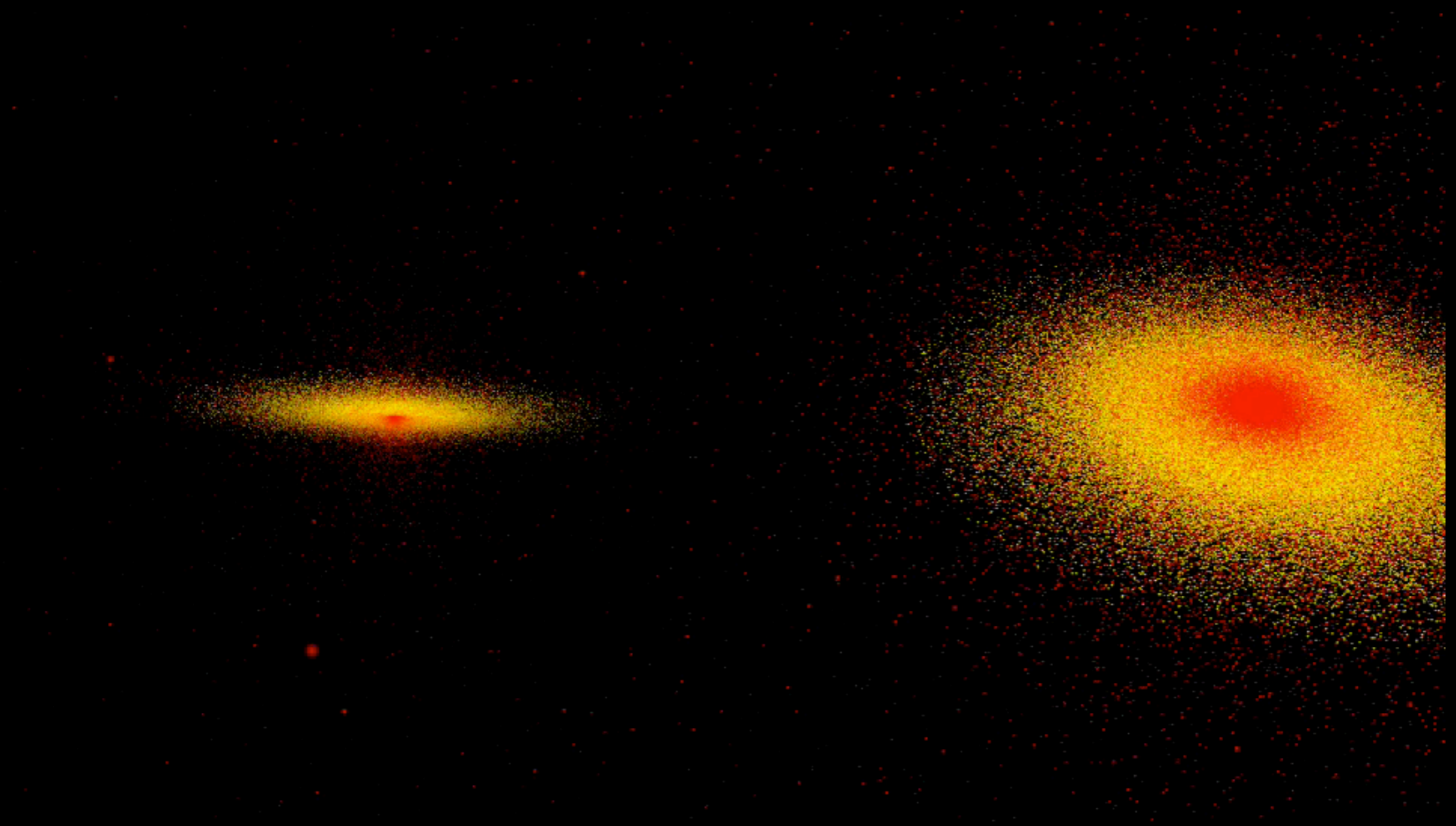


Image Credit: Erik Rosolowsky & ALMA

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

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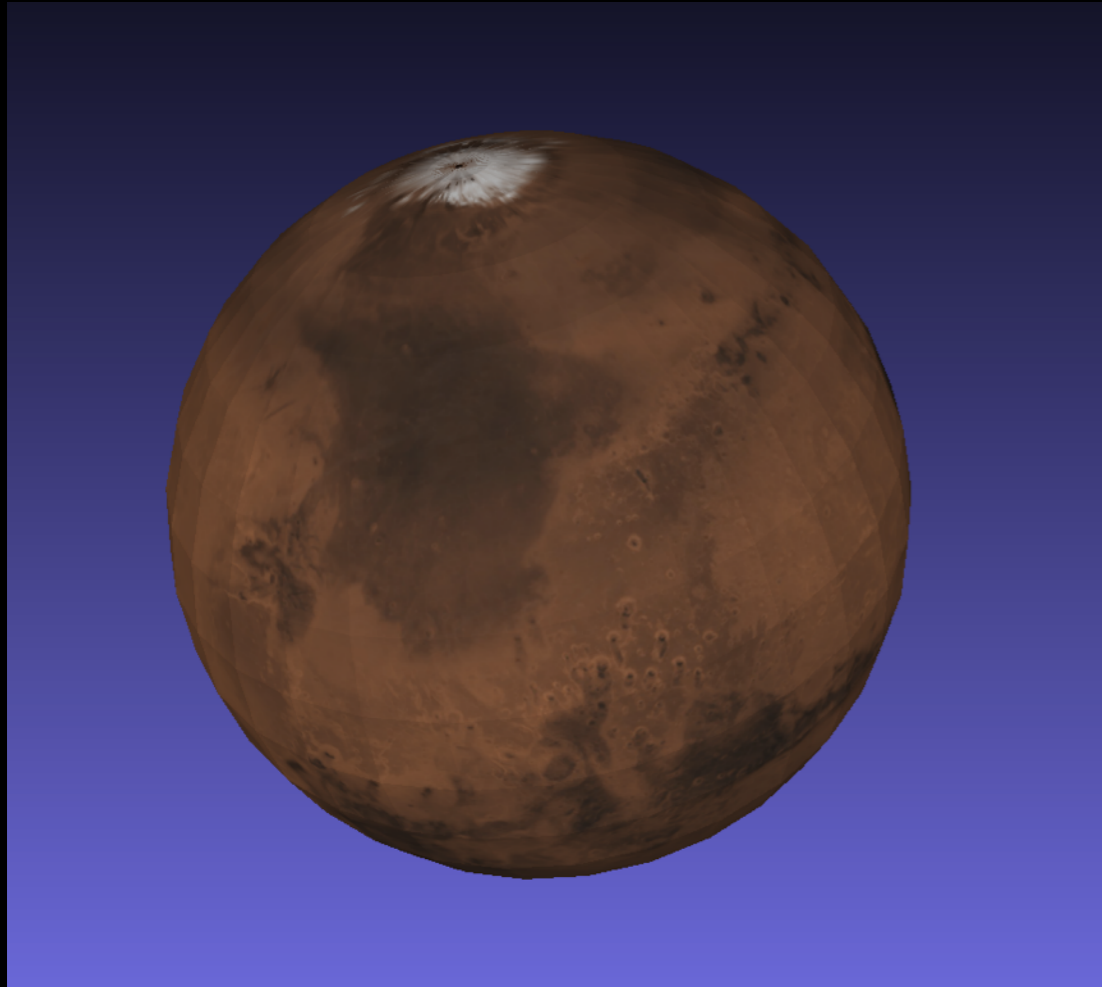
The way we will do this is by generating specific Geometry Files that 3D rendering software (Sketchfab, MeshLab, Blender, Maya, Houdini, etc) know how to read and process.

Software

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

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
```



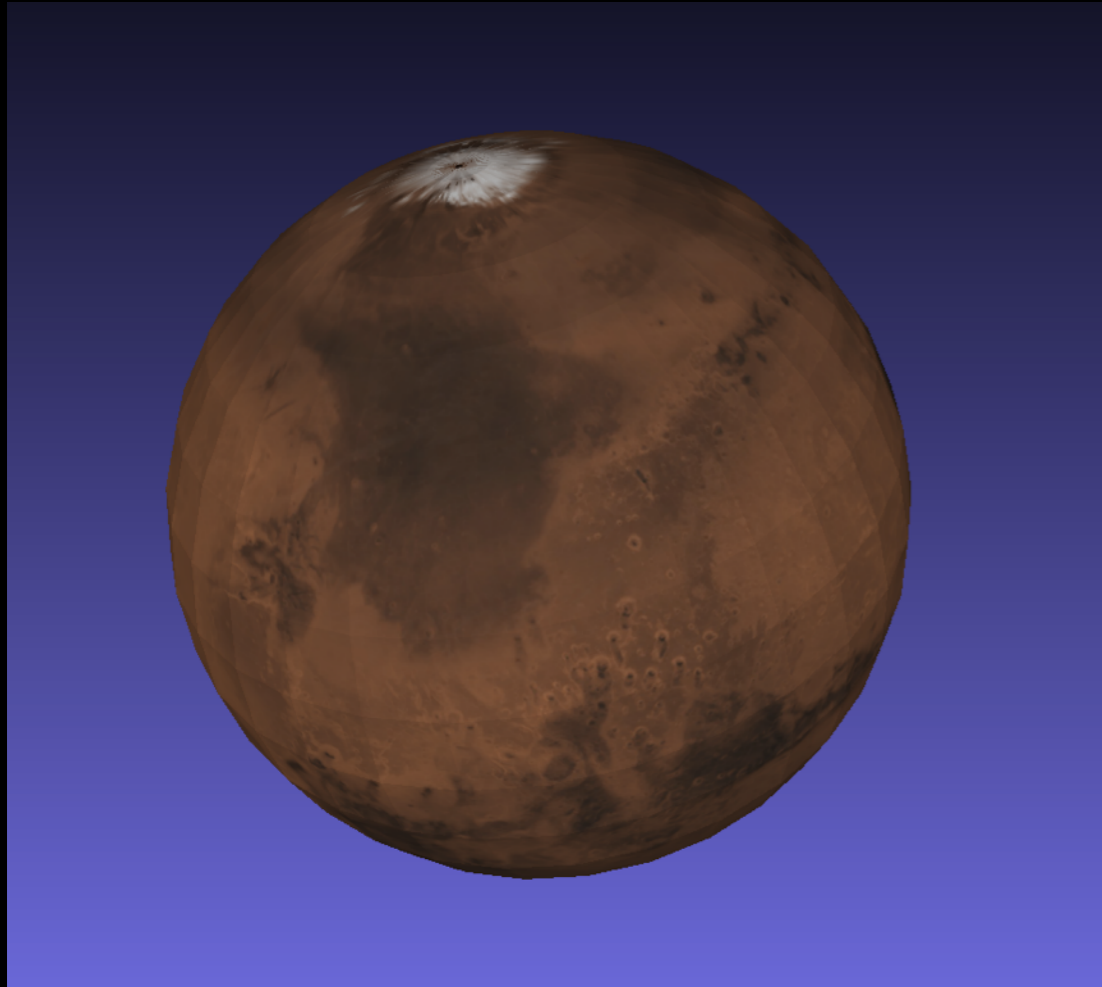
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MyPlanetSystem.mtl  green_sun.jpg      neptunemap_1000.jpg
MyPlanetSystem.obj  jupiter_1200.jpg  sun_texture1.jpg
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For each object (sphere) an OBJ file gives information for:

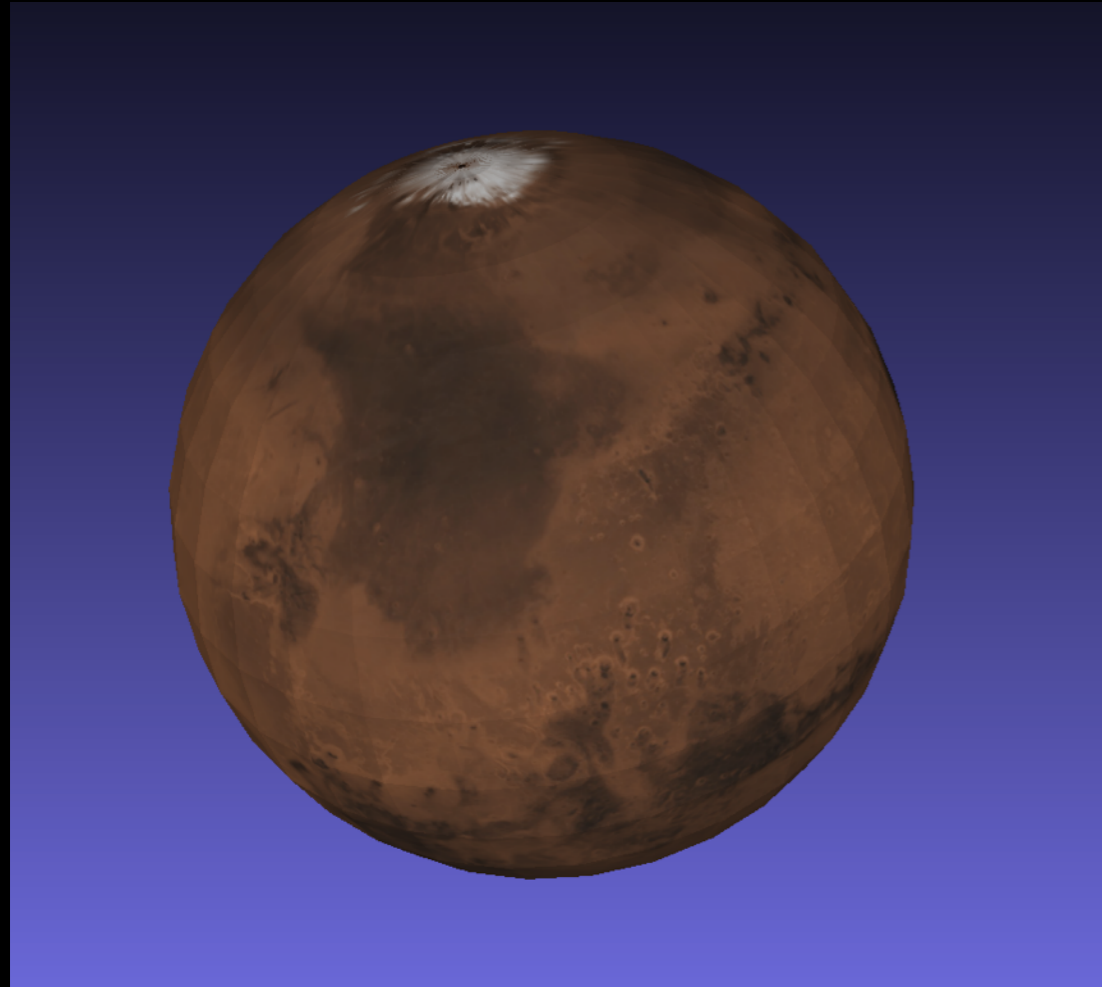
Vertex locations

Texture coordinates



The OBJ File Format

```
Jills-MacBook-Pro:MyPlanetSystem jillnaiman1$ ls
MyPlanetSystem.mtl  green_sun.jpg      neptunemap_1000.jpg
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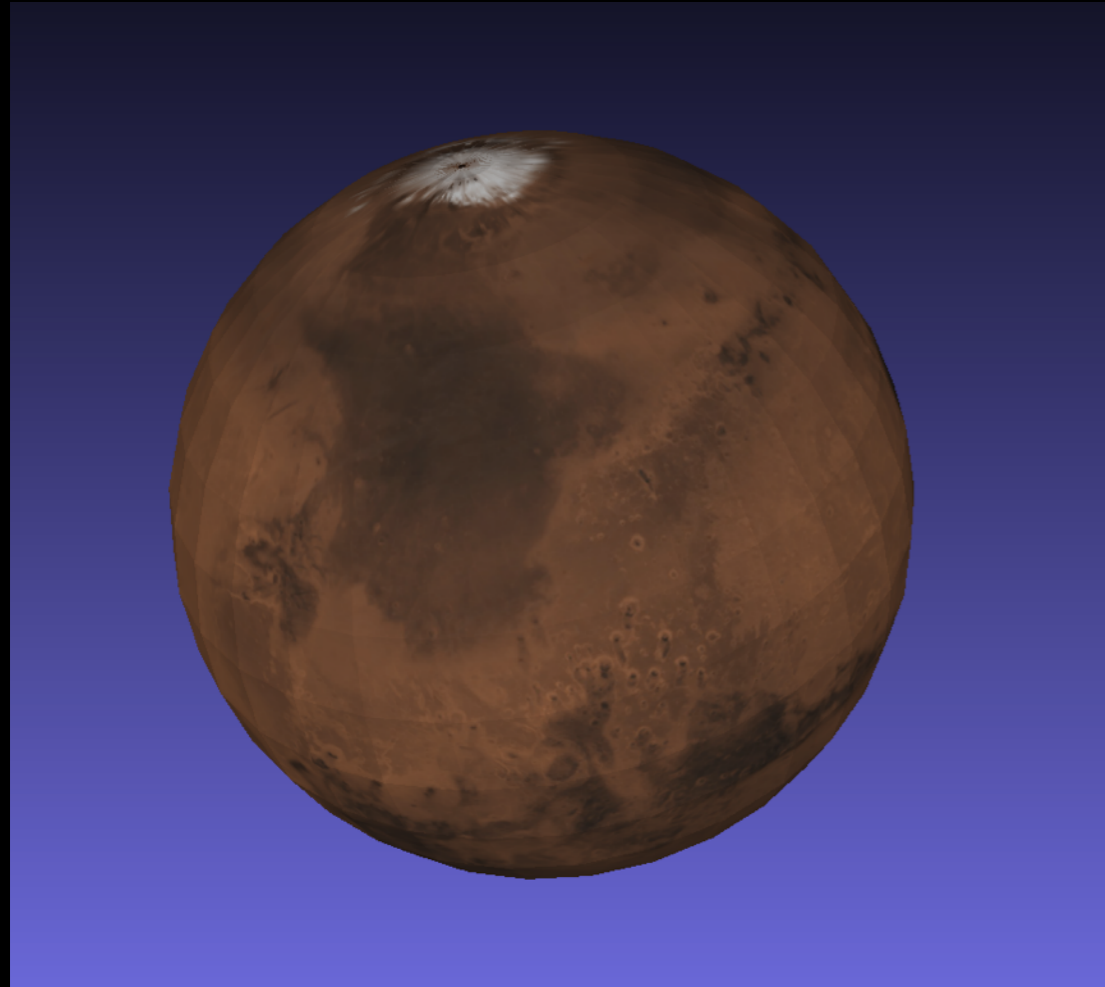
Companion material file (.mtl file) gives information for:

Colors of faces

Names of mapped textures

The OBJ File Format

```
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MyPlanetSystem.mtl  green_sun.jpg      neptunemap_1000.jpg
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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 you must zip together the .obj, .mtl, and texture files

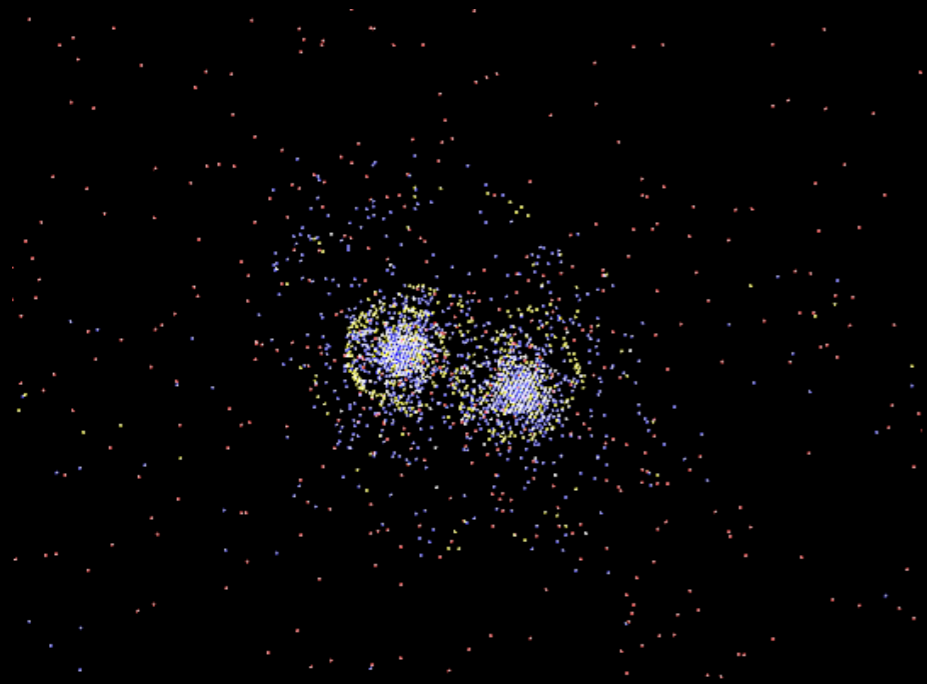
For MeshLab: select Render -> Color -> Per Mesh to see textures

The PLY File Format

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

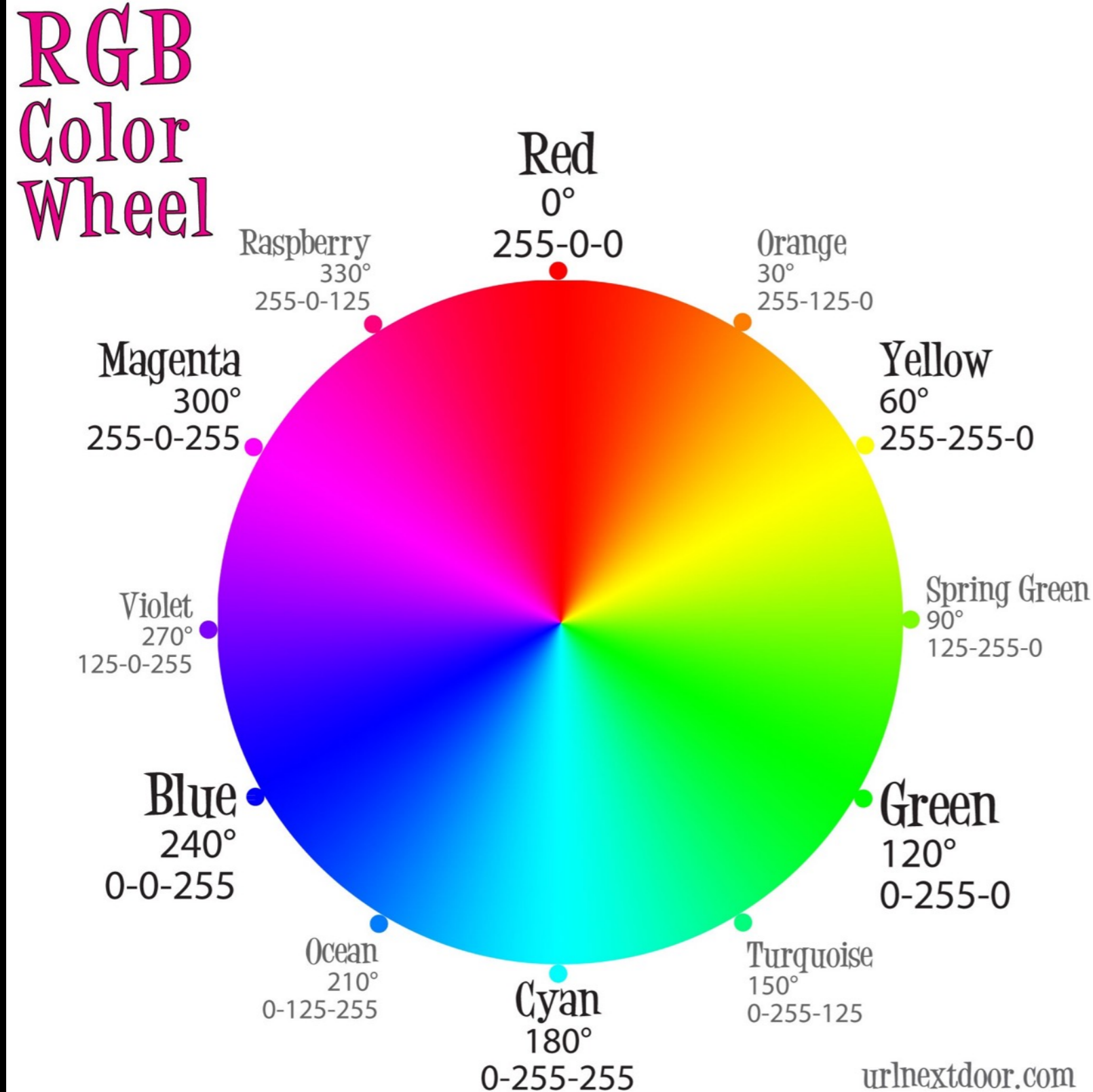
Vertex locations

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

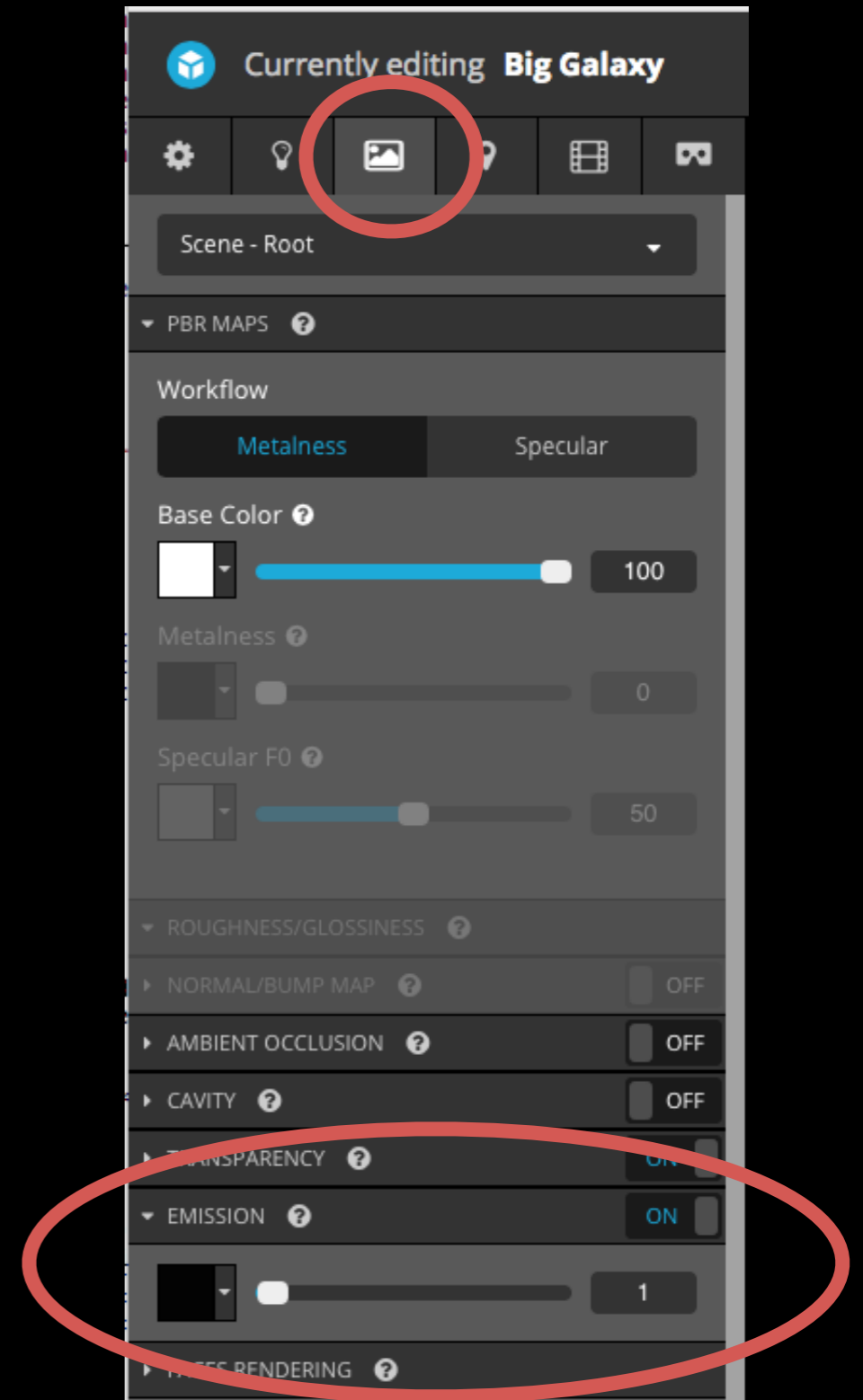
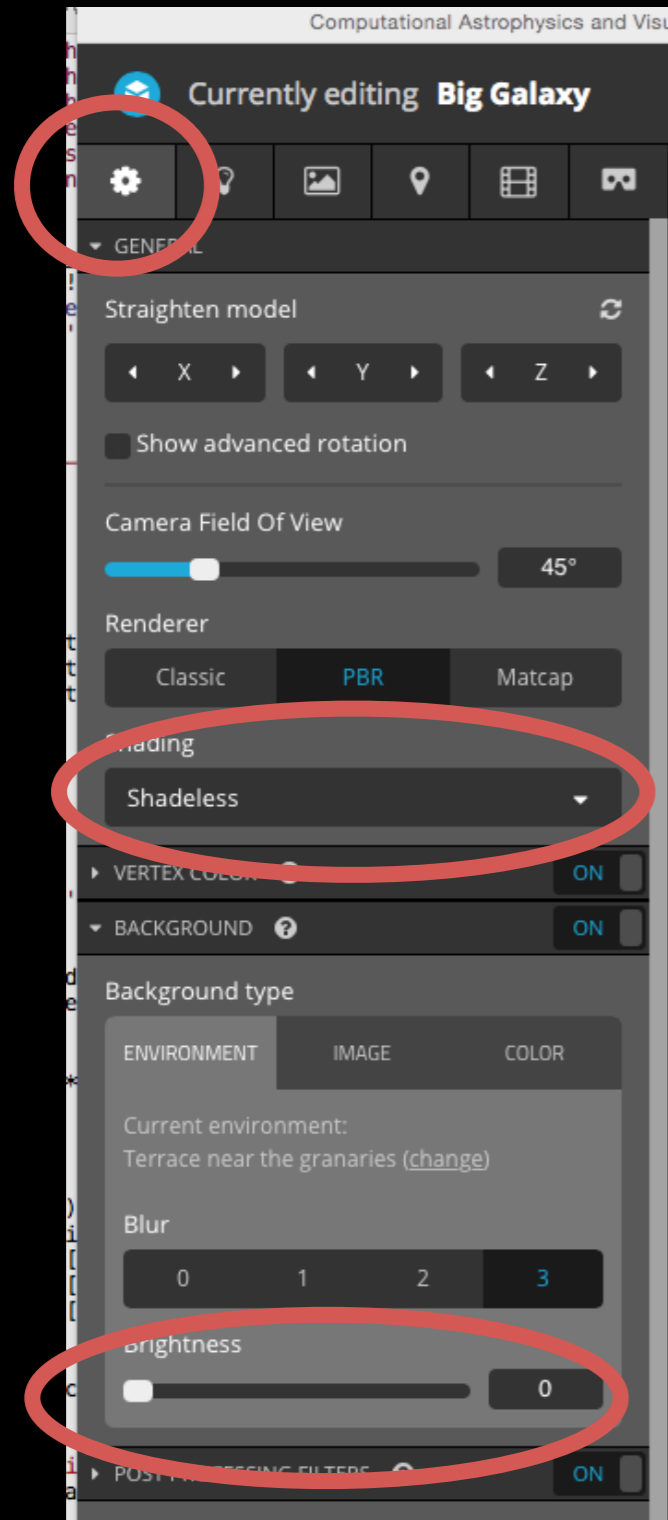
- 0 faces
- 5.4k vertices

SETTINGS

Click on 3D settings

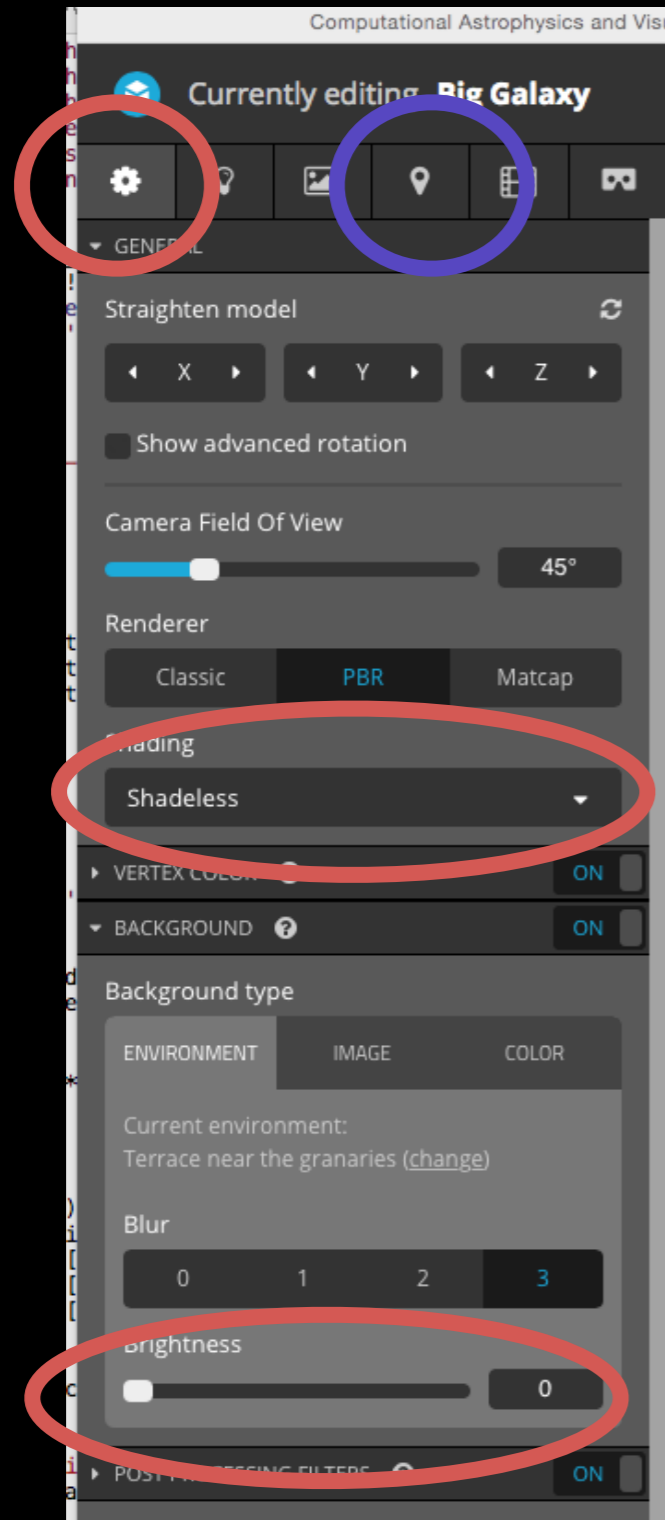
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Hints for Sketchfab (esp for PLY files):

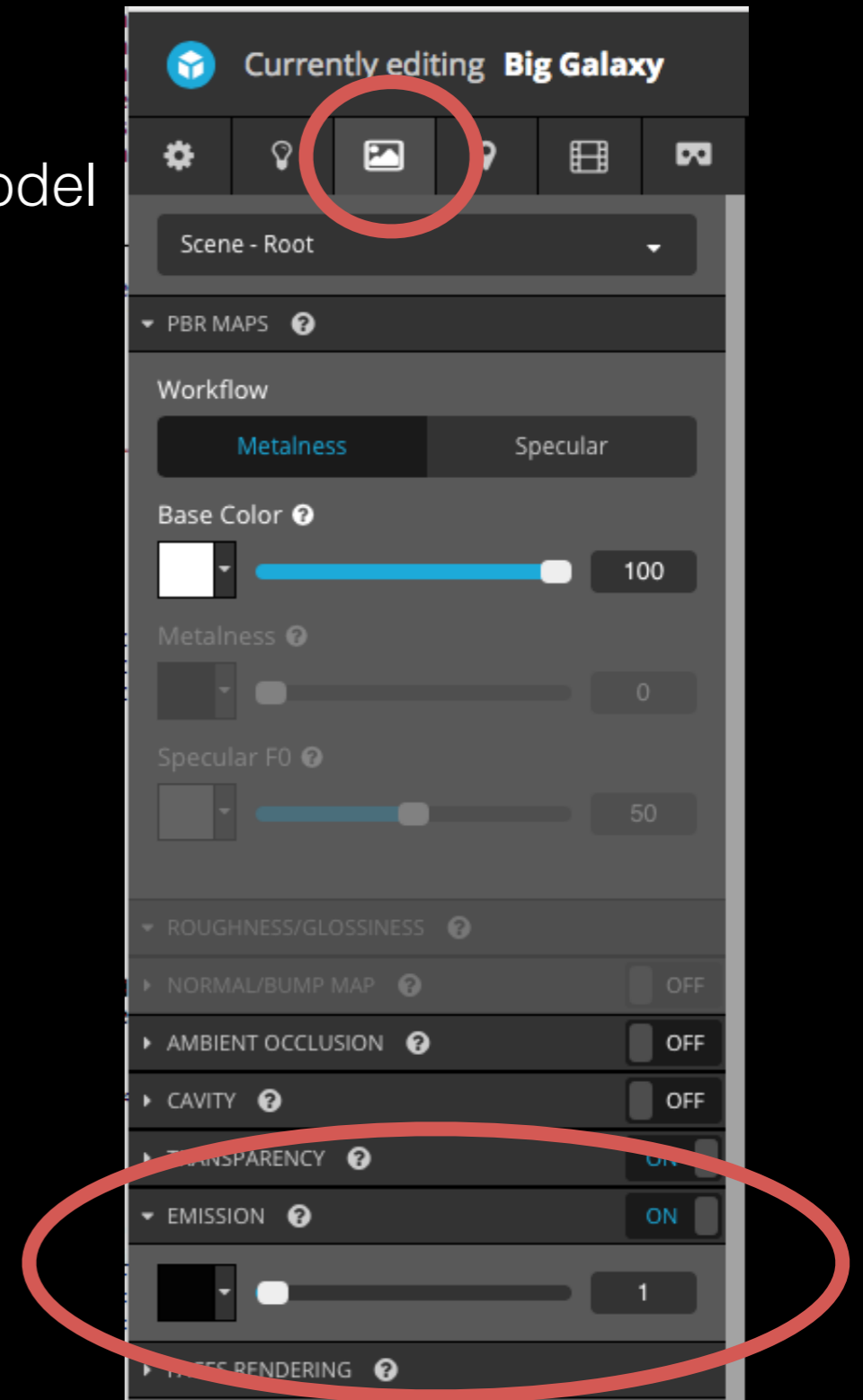


First, start with static uploads

Hints for Sketchfab (esp for PLY files):



Annotations to your model

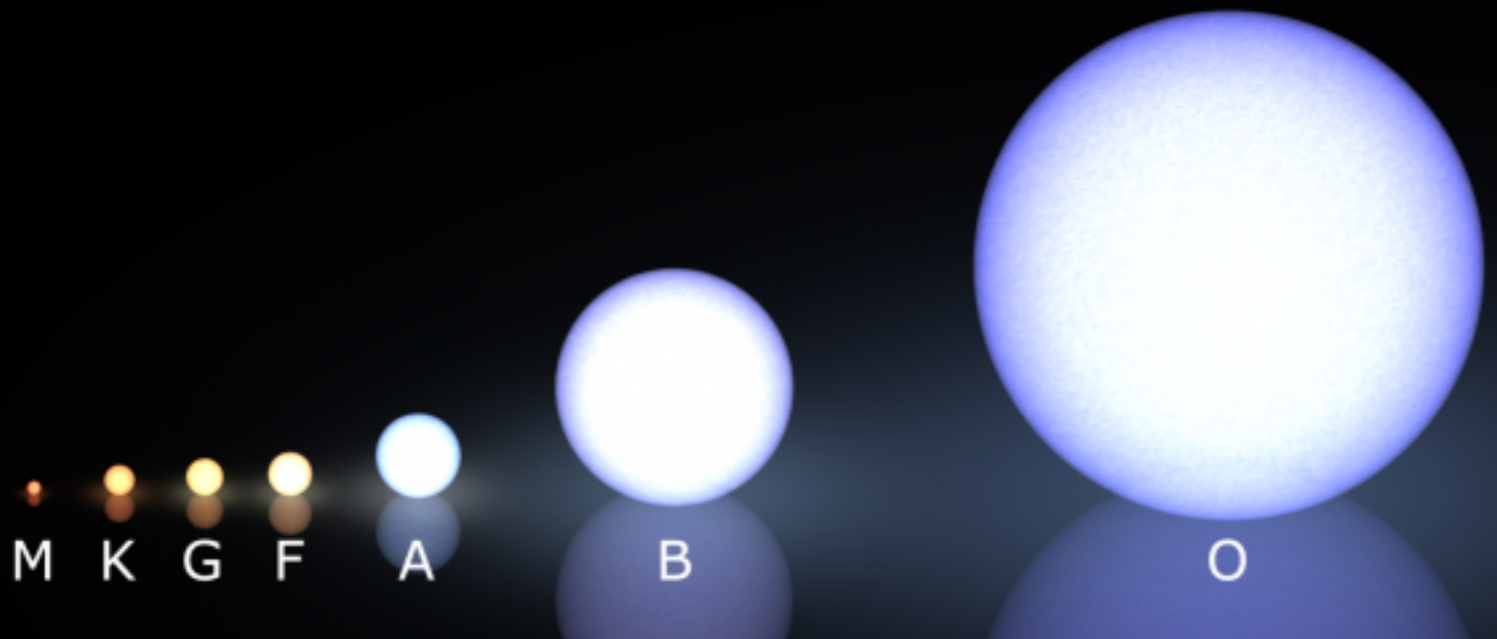


The OBJ File Format - Planets

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

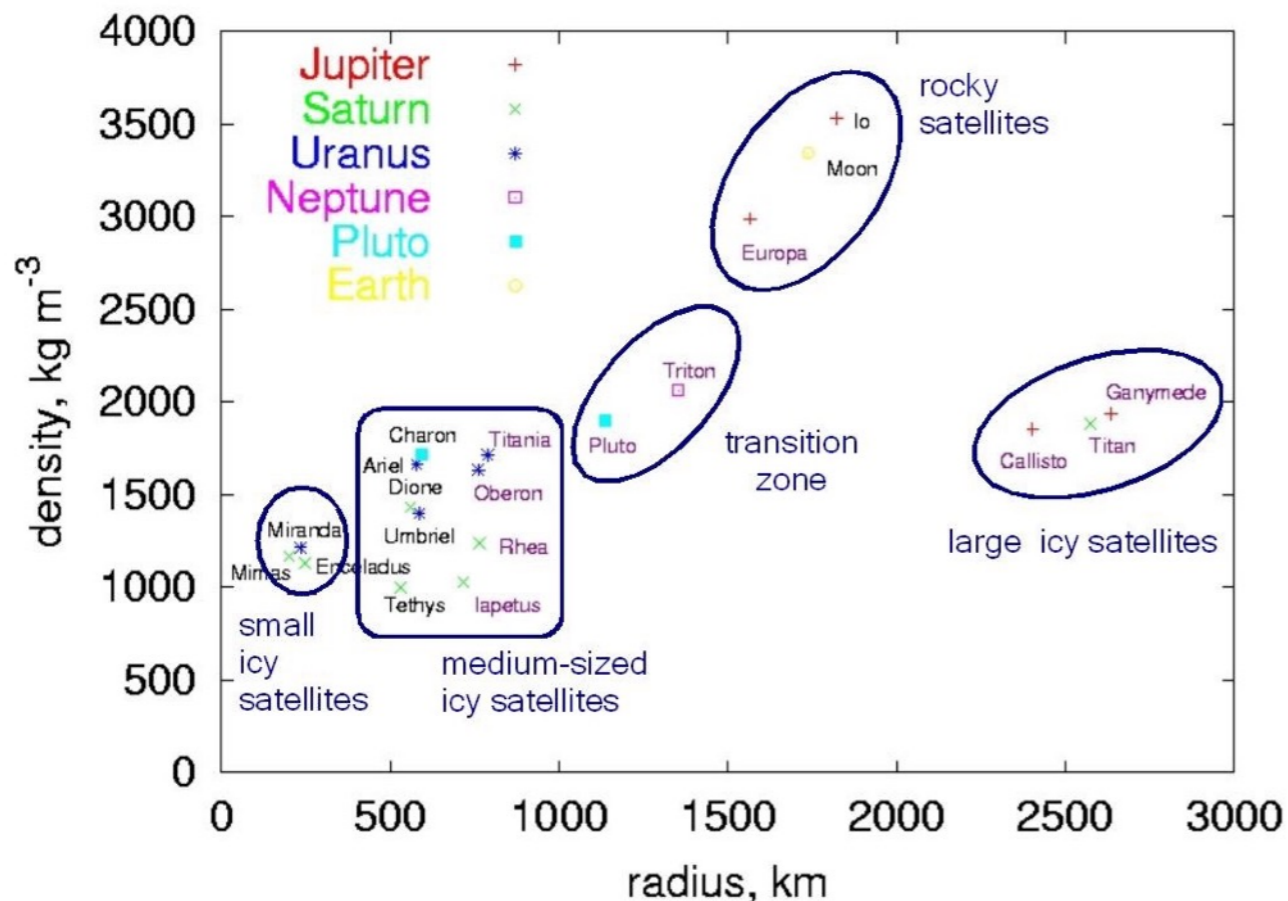
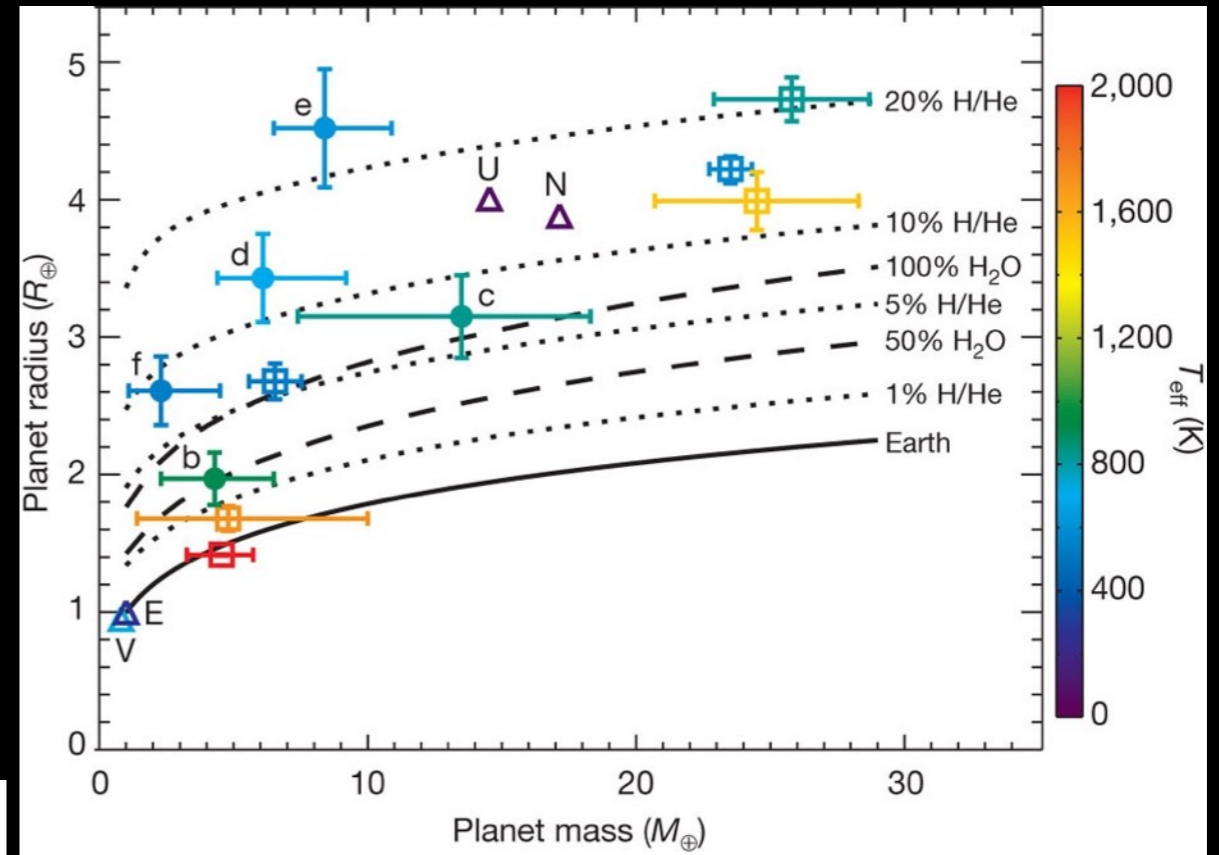
| <u>Main Sequence Stars</u> | | | | | | | |
|----------------------------|----------|---------|-------|-------|--------|--------|---------|
| | O | B | A | F | G | K | M |
| Spectral Type: | O | B | A | F | G | K | M |
| Temperature: | 40 000K | 20 000K | 8500K | 6500K | 5700K | 4500K | 3200K |
| Radius (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% |

| <u>Giant Stars</u> | <u>White Dwarfs</u> | <u>Supergiant Stars</u> |
|---|------------------------------------|--|
| 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 1000 000 |
| Lifetime (million yrs): 1000 | Lifetime (million yrs): - | Lifetime (million yrs): 10 |
| Abundance: 0.4% | Abundance: 5% | Abundance: 0.0001% |

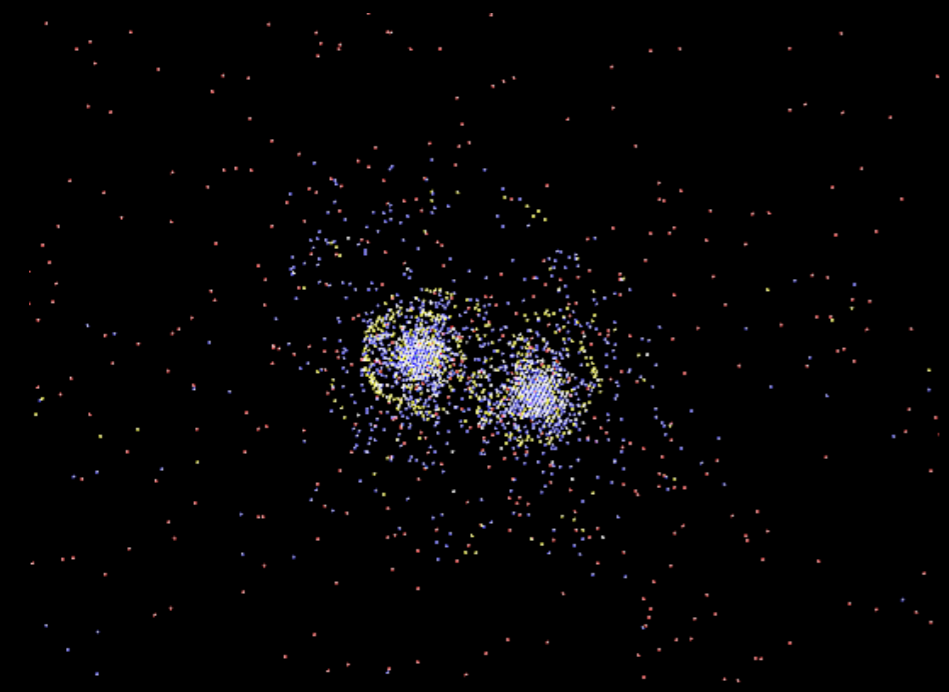


The OBJ File Format - Planets

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



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?

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