

Teaser Trailer

<https://skfb.ly/QHwx>

A Week of Astrophysical Visualizations

www.astroblend.com/ba2017

A Week of Astrophysical Visualizations

... again, beginning with some motivation
(aka super cool movies and pictures)

~~(1) Who am I?~~

(2) What are we doing?

(3) How are we gonna do it?

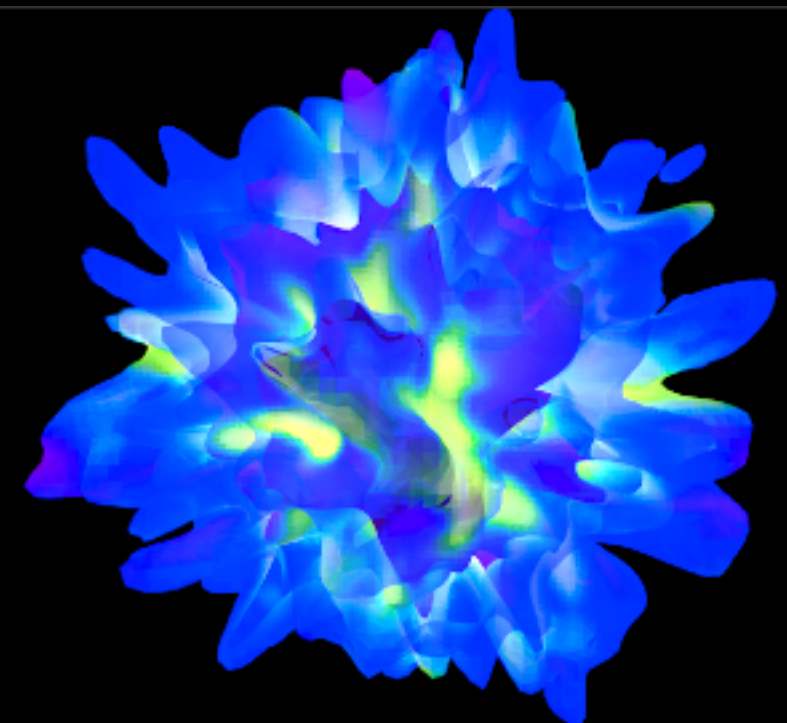
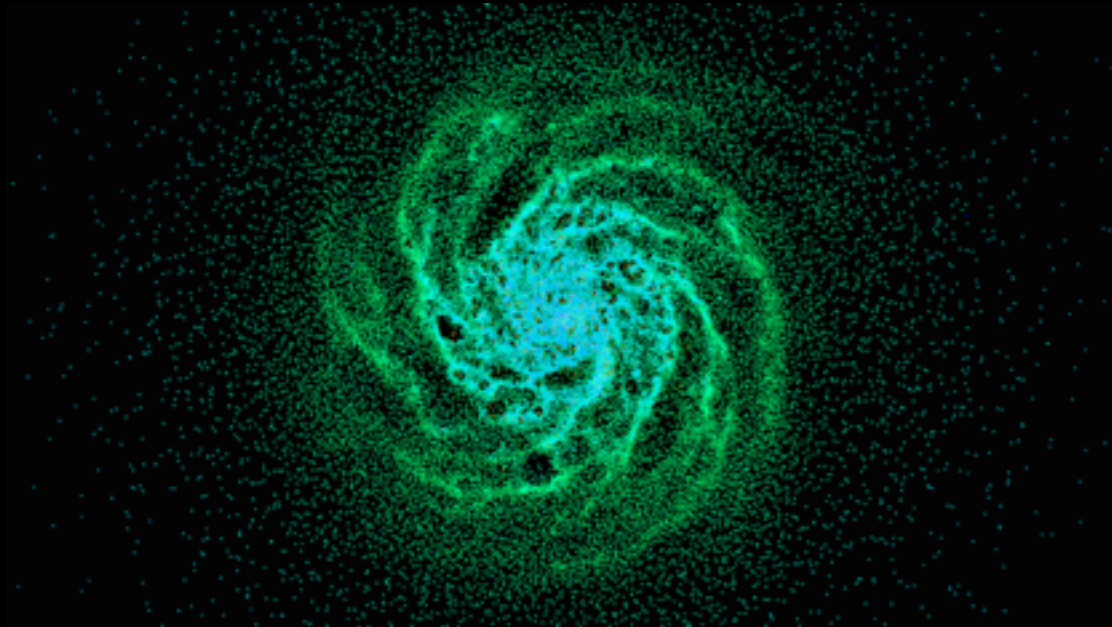
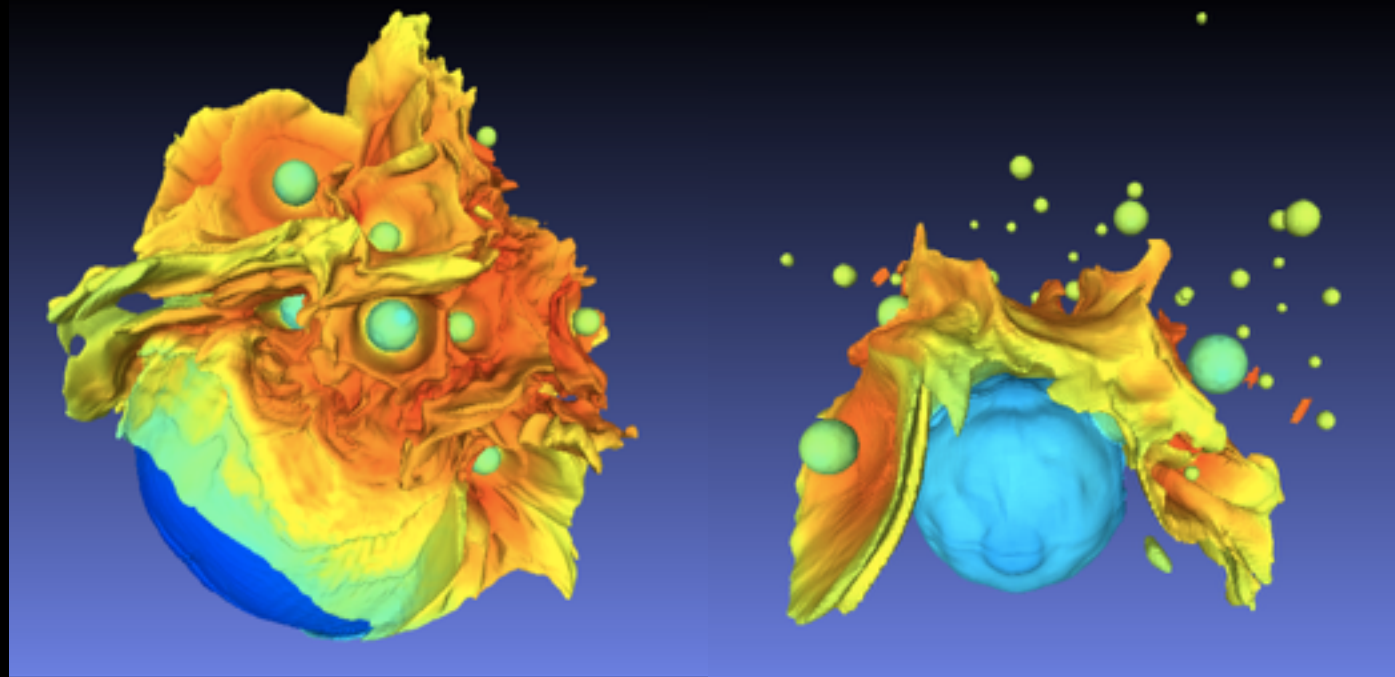
- Movies - in physical space, analysis plots
- 3D “stuff”
- Some VR

Yeah, but why?

- Big data processing
- ownership of storytelling
- “WOW” factor
- Python! (+ FFmpeg)
- Sketchfab!
- Google Cardboard/Vive/Hololense!

Intro - Day 1, Viz

Everything for today is posted under day 1 of Viz of:
www.astroblend.com/ba2017



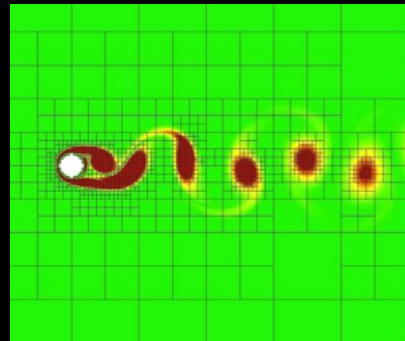
Intro - Day 1, Viz

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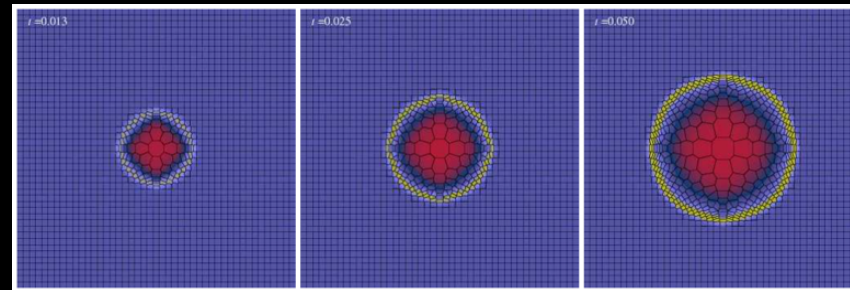
- * So far we have done the 2-Body problem:
 - * analytical vs. numerical
 - * importance of timestep
 - * how to check the accuracy of our simulations (conservation of E, L)
 - * order of solvers (Euler vs. Hermite)
 - * thought about how to deal with code that is getting more and more complex
- * Started doing some multi-body problems! (N-Body) - saw how hard it is to make a stable system, got some hints that Kepler systems are pretty stable and finally figured out ways to make our systems more stable! ... but then tried to DESTROY THEM... in 3D!
- * Some folks looked at Kepler systems, some folks started playing with merging galaxies
- * Also played with a smashing planets visualization: Super Planet Crash!

Workflow of a Typical Computational Astrophysicist

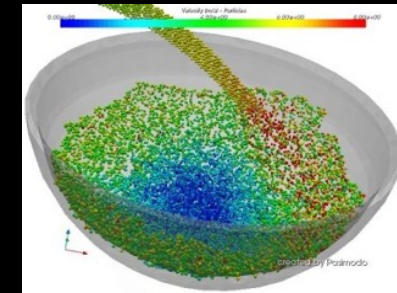
(AMR)



(Moving Mesh)



(SPH)



We only wanted to deal with gravitating objects - so we chose an N-Body code.

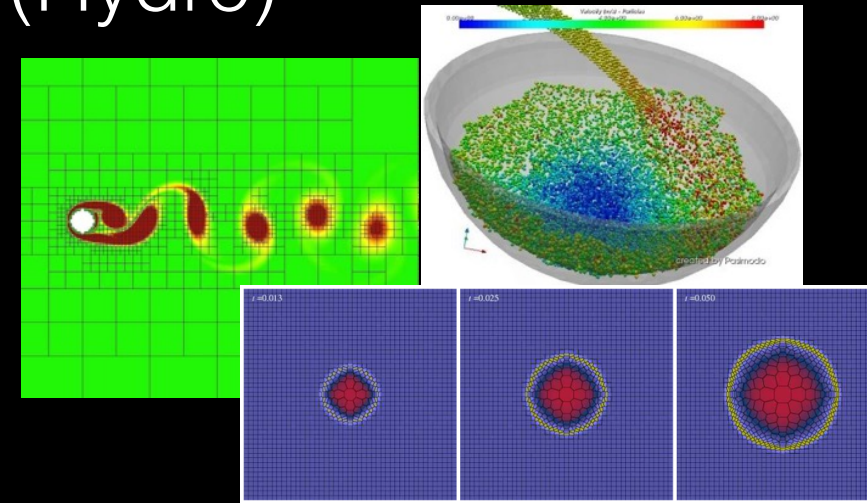


Workflow of a Typical Computational Astrophysicist

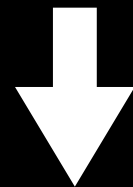
(N-Body)



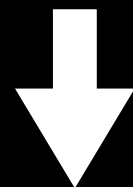
(Hydro)



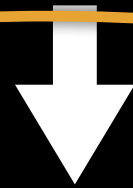
Pick a code for your physics problem.



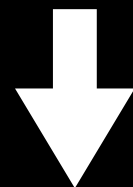
Add physics: (how stars form, supernovae feedback, how elements are created/destroyed, sources of material/heat external to your simulation domain...). In our case: only need to add gravity prescription!



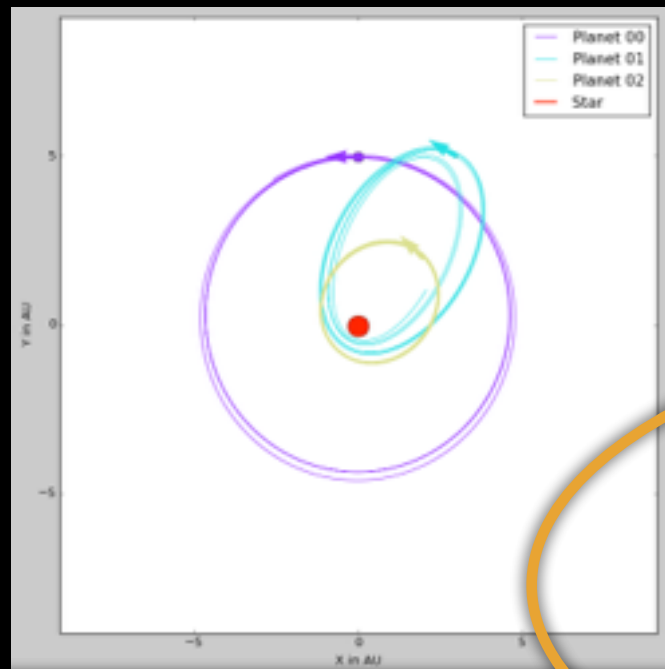
Send to supercomputer... and wait



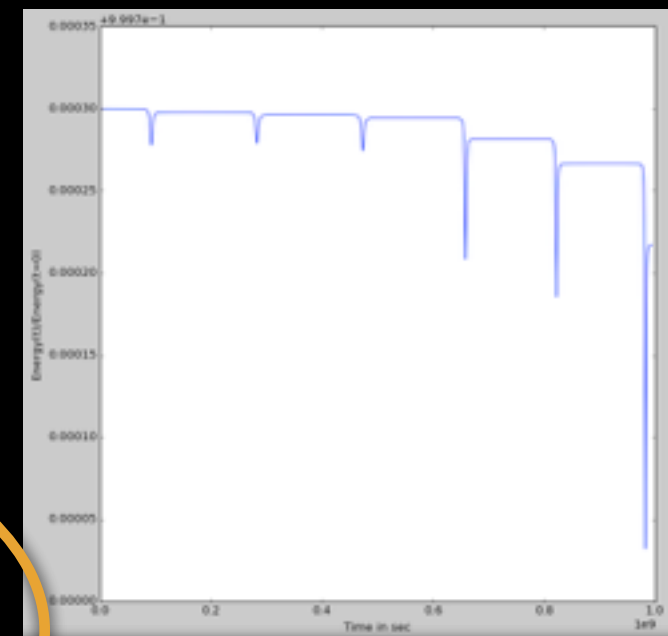
Visualize and Analyze



Make a super cool movie

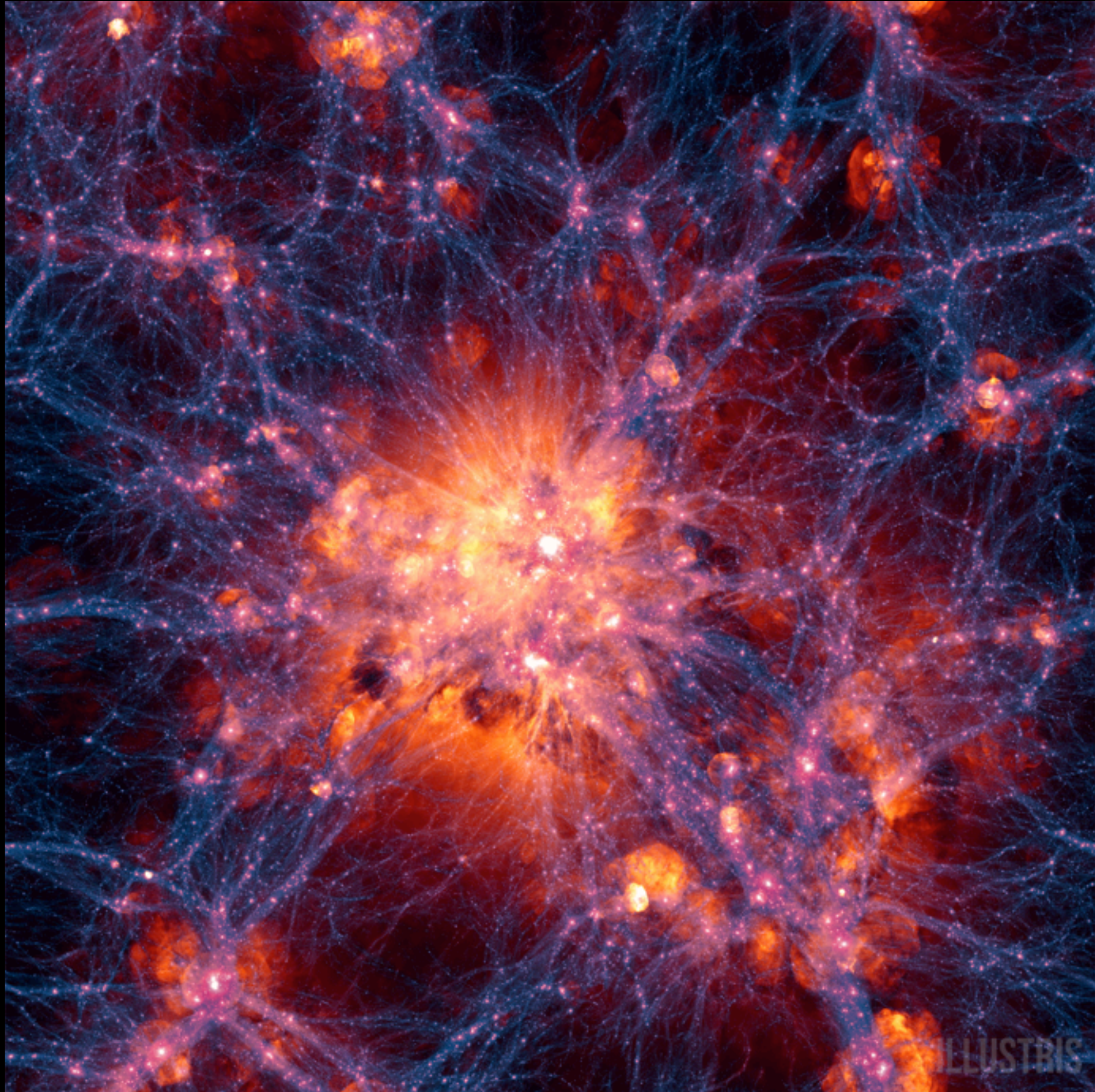


What does my simulation physically look like?

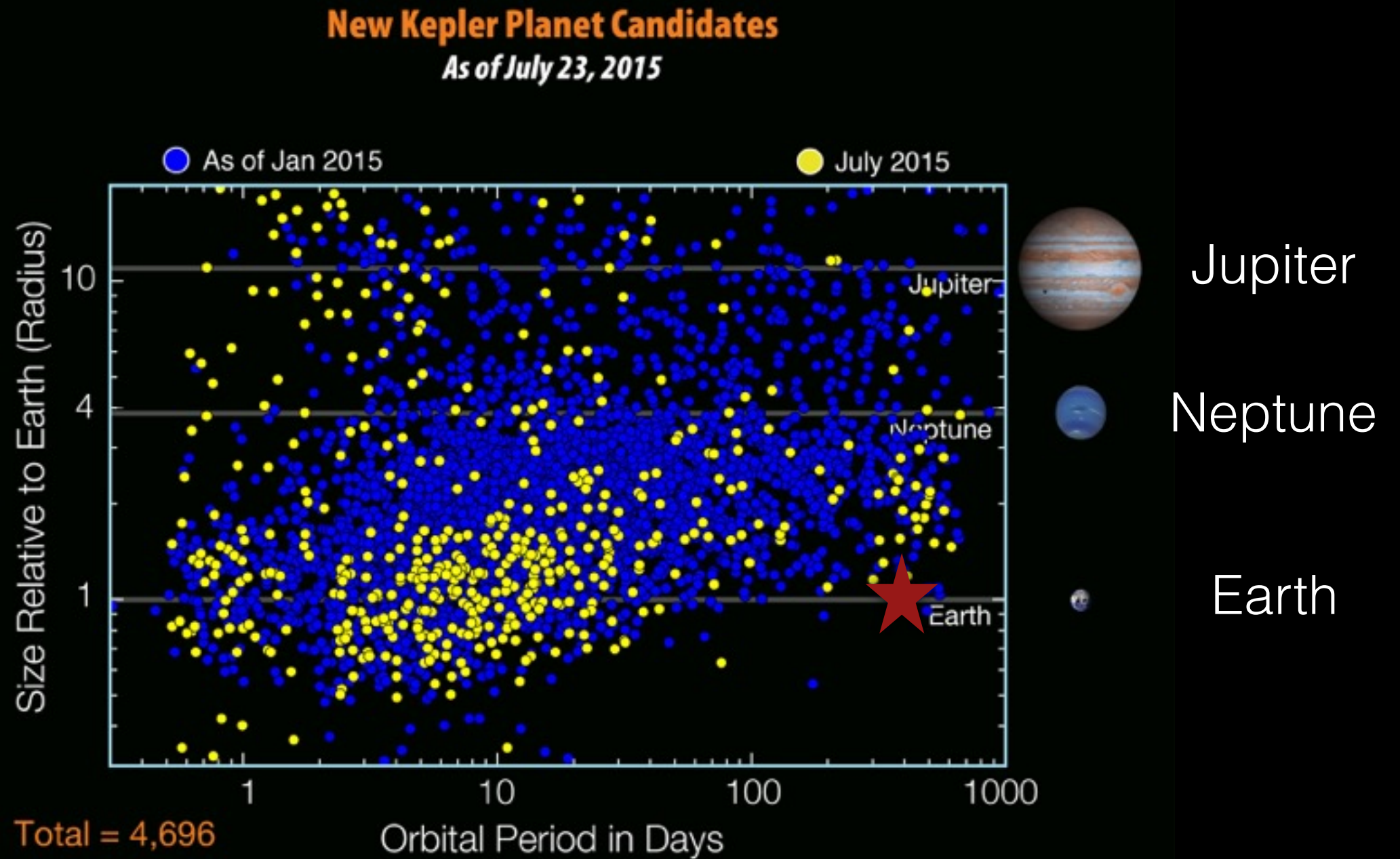


How close am I to simulating reality? What physics can I learn from my sim?

What is a visualization?



What is a visualization?



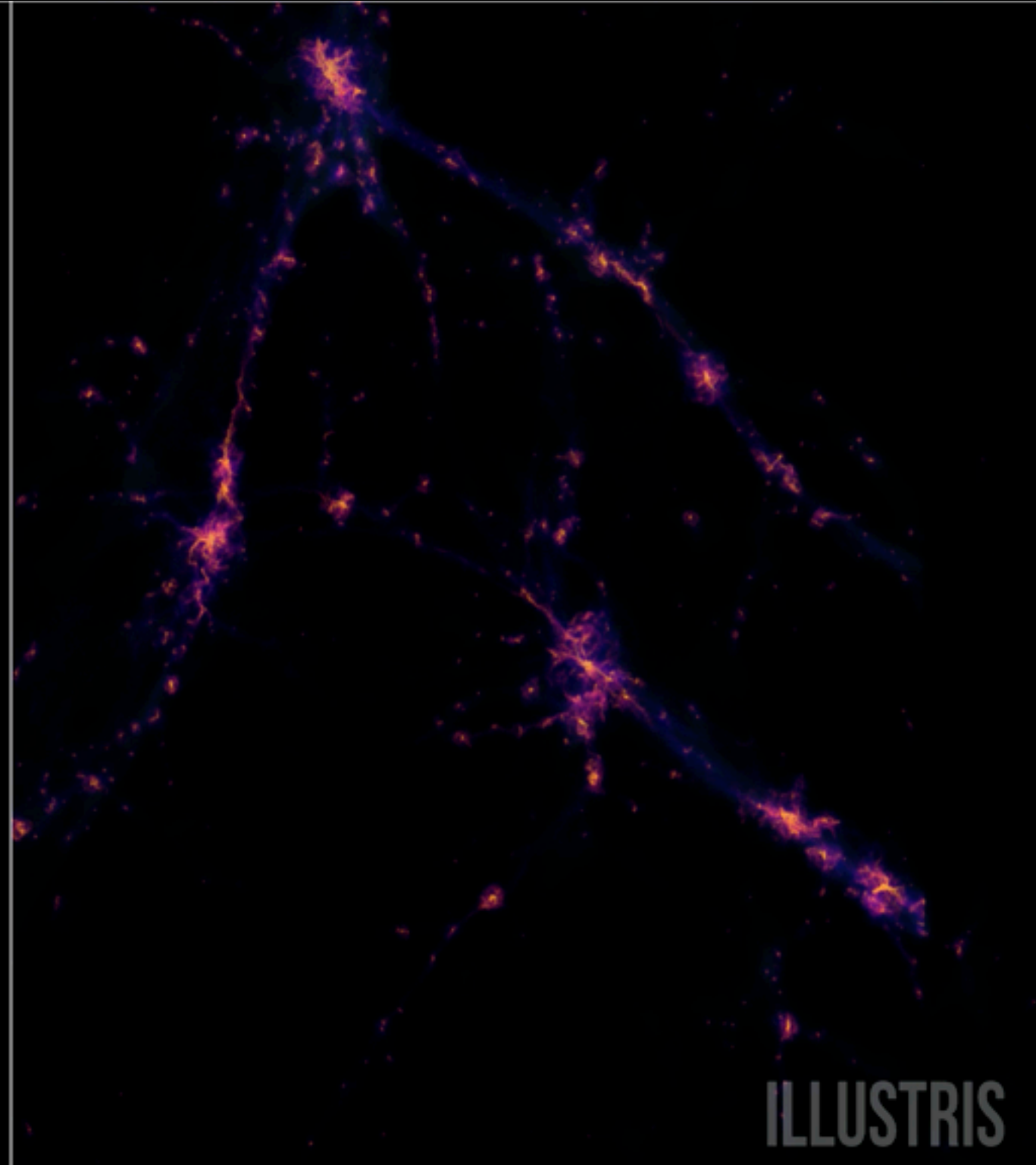
What is a visualization?

$z=4.00$

$\log_{10}(M_*)=10.4$

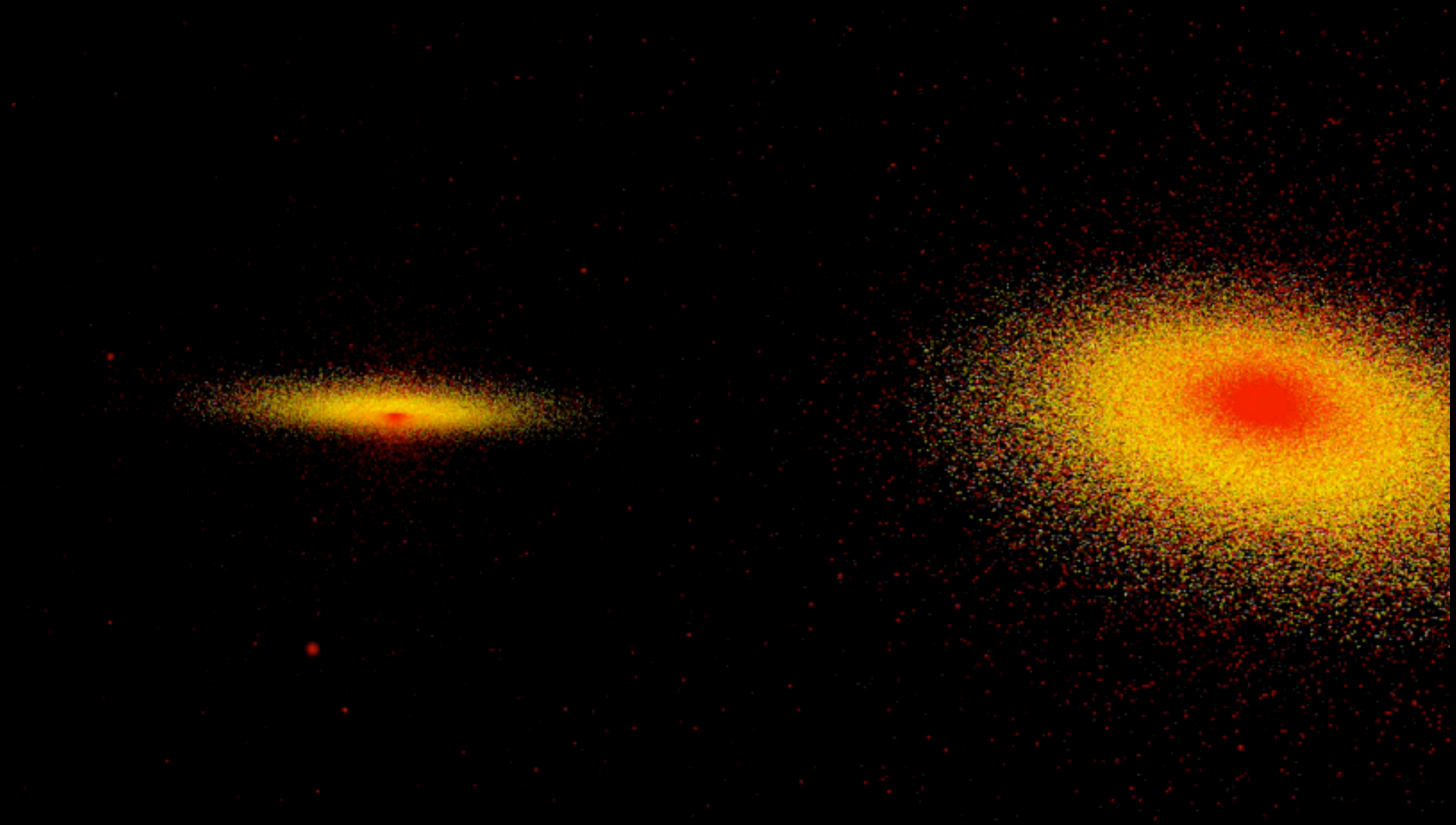
SFR=80.0

$sSFR=3.07\text{Gyr}^{-1}$



ILLUSTRIS

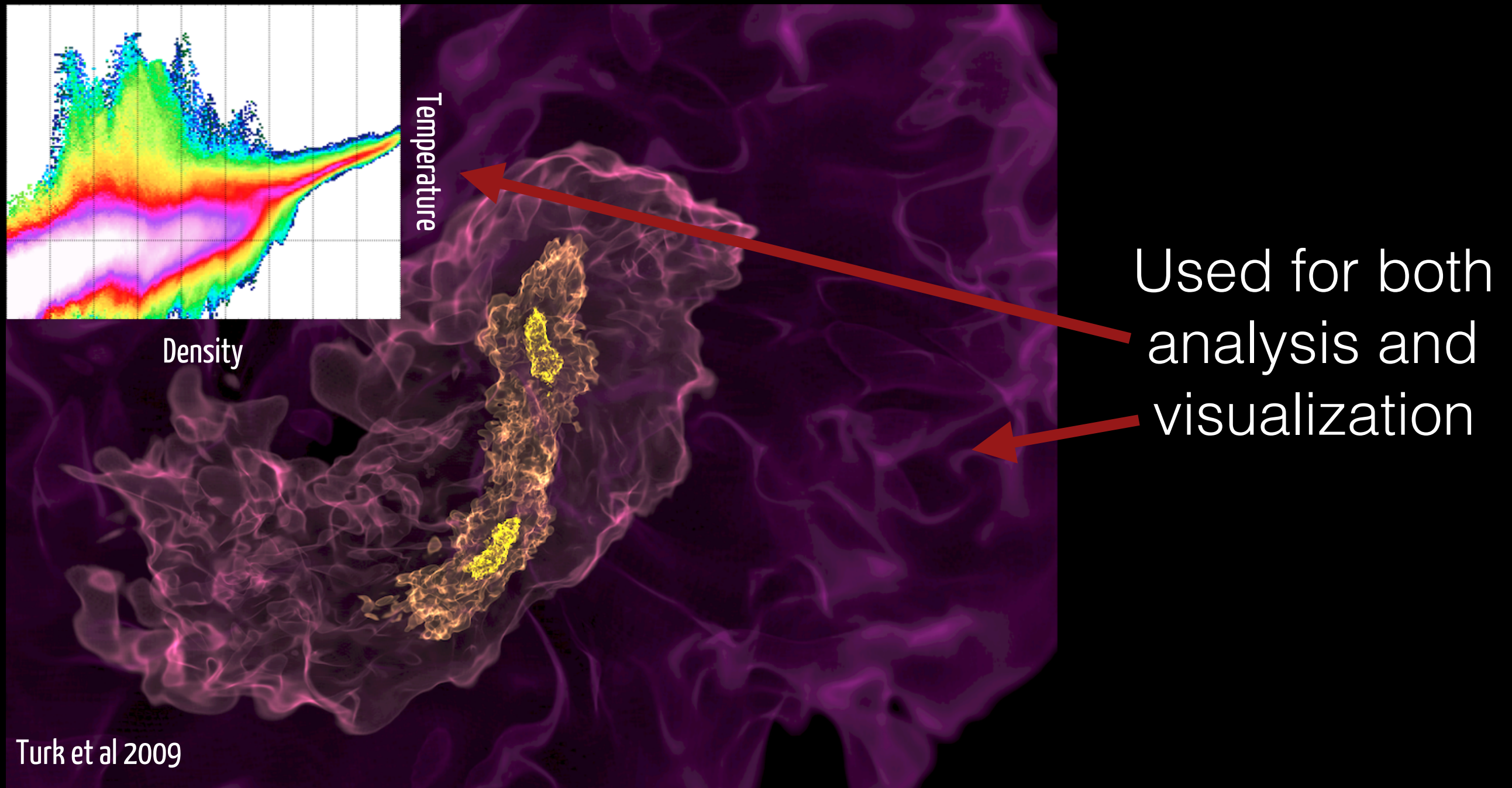
What is a visualization?



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.”



What is a visualization?

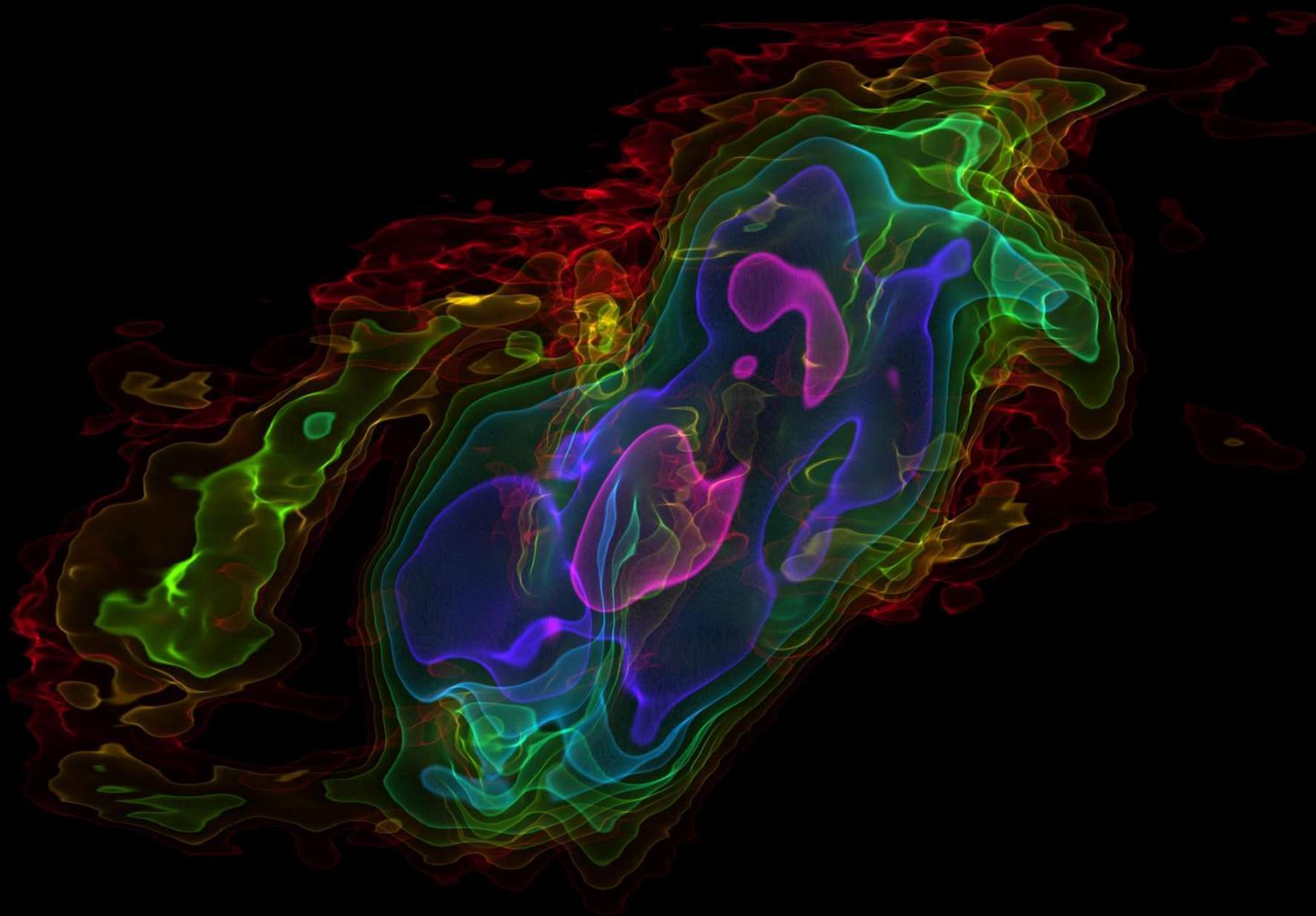
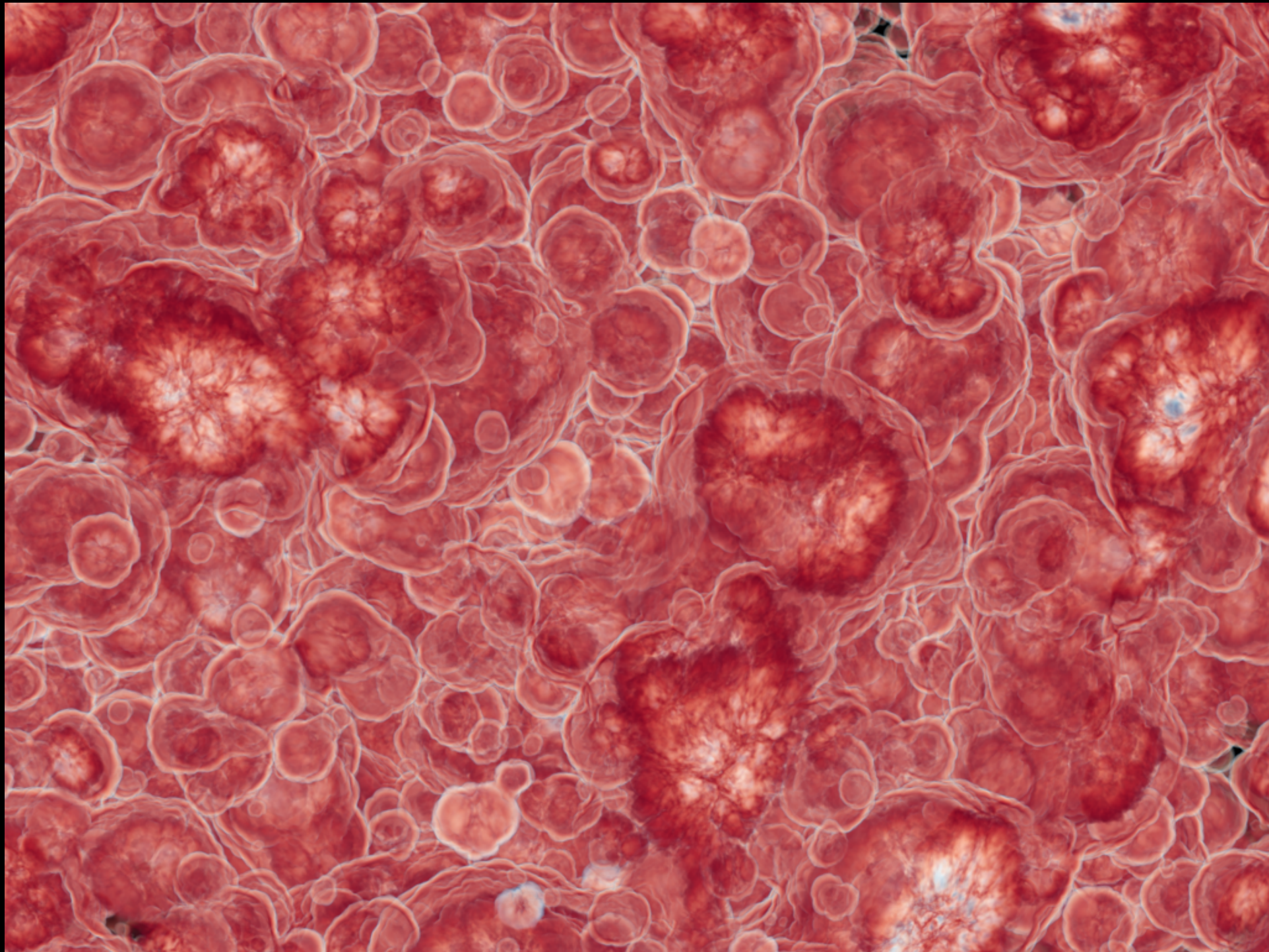


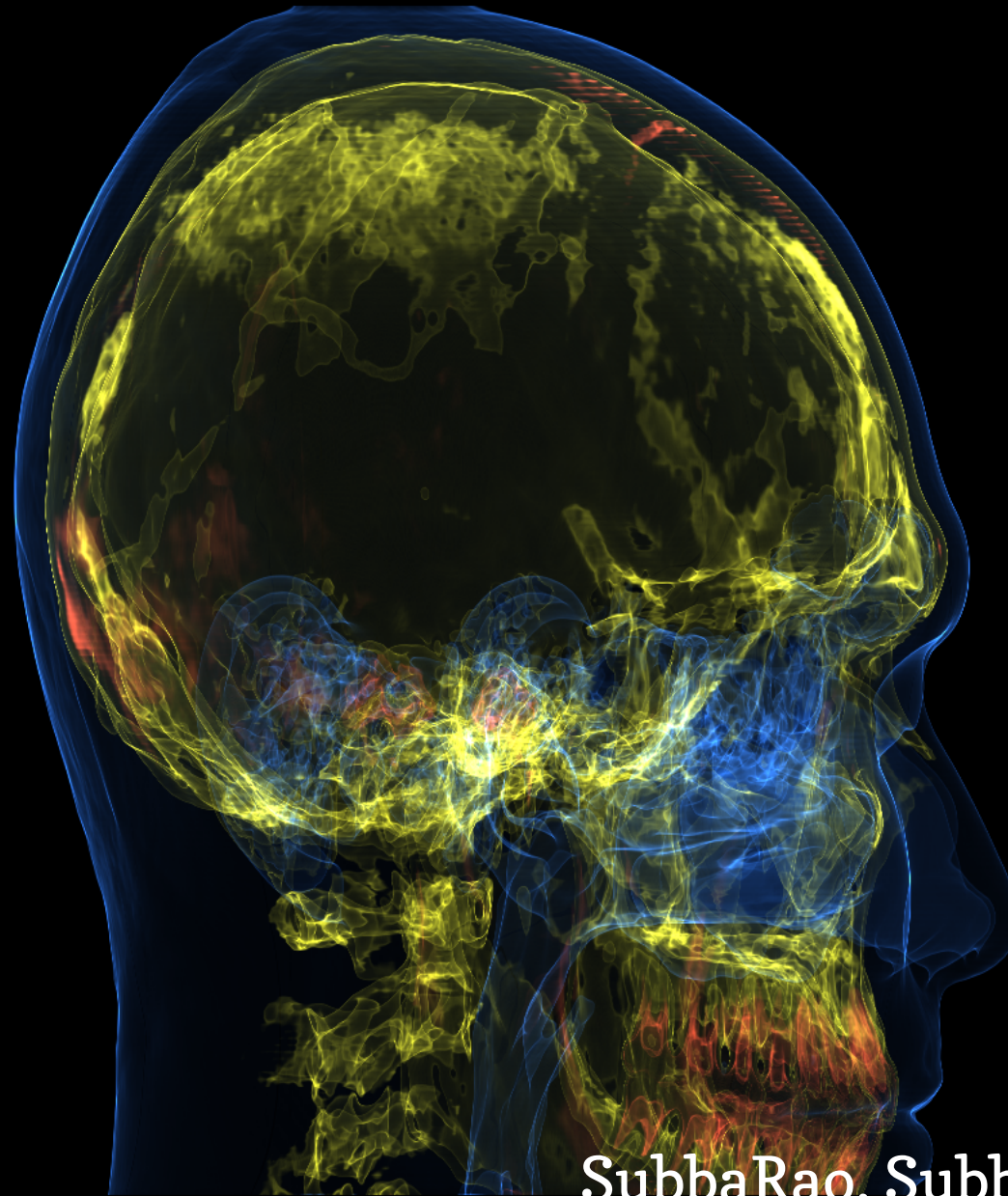
Image Credit: Erik Rosolowsky & ALMA

What is a visualization?



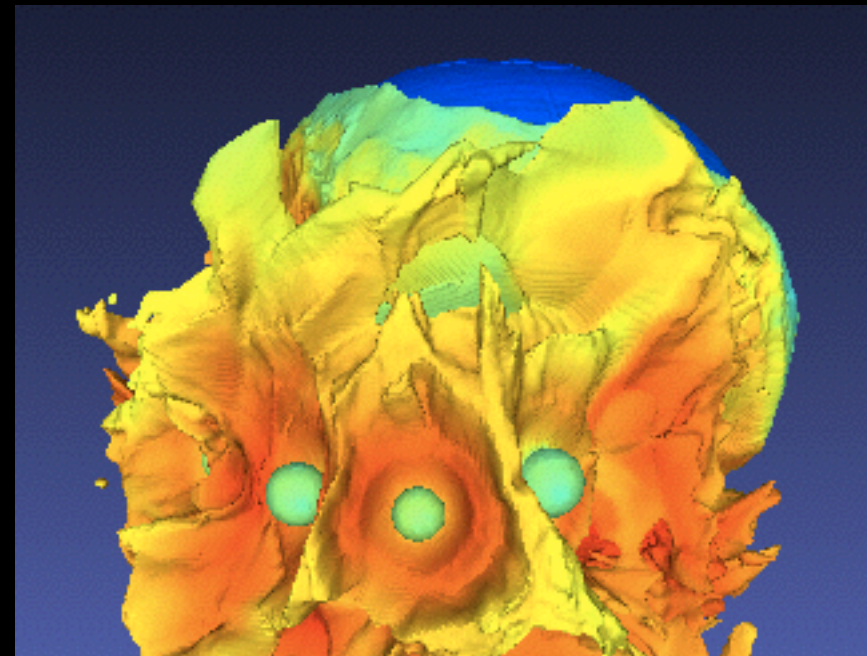
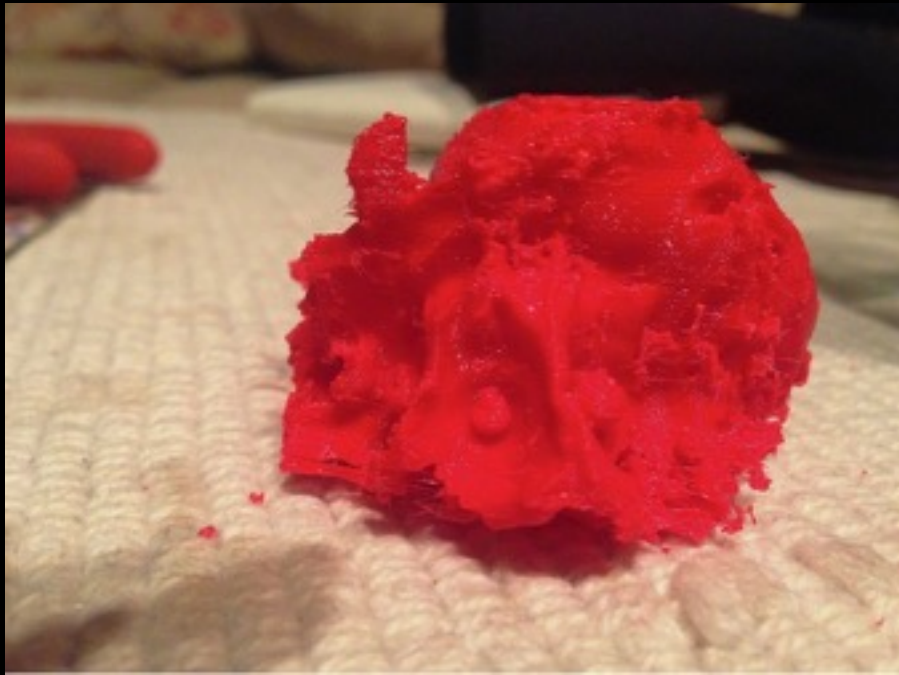
What is a visualization?

NeuroDome



SubbaRao, SubbaRao & Fisher

What is a visualization?

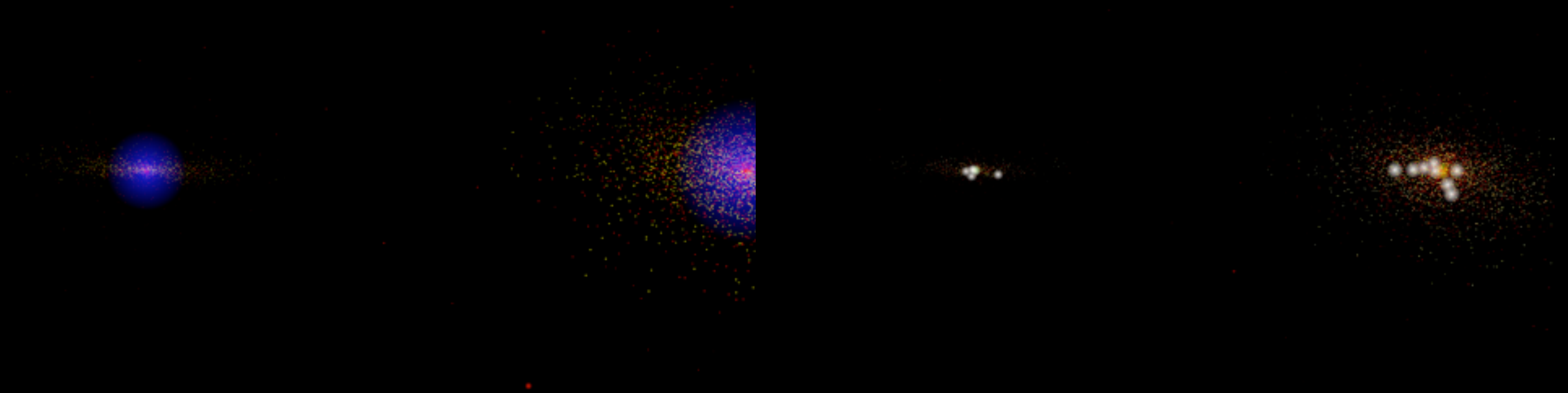


What is a visualization?



Test Run of AstroBlend
3D Galaxy Model + FLASH Dwarf Galaxy Model
www.astroblend.com

What do scientists gain from visualization?



- ◆ Visualizations of galaxy mergers by transfer students during a python bootcamp
- ◆ Students had no (or minor) experience with programming and science

What do scientists gain from visualization?

Galaxy merger simulations; investigating new star formation

Sebastian Gomez ; Mark Johnson

Simulations:

- A simulation of two galaxies merging
- Increased the size of black holes for better visualization of black hole merger.
- Increased the size of new stars to visualize the stage of highest star formation.

Conclusion: The simulations showed that the two black holes merged while also depicting a significant increase in star formation.

Playing with Blender:

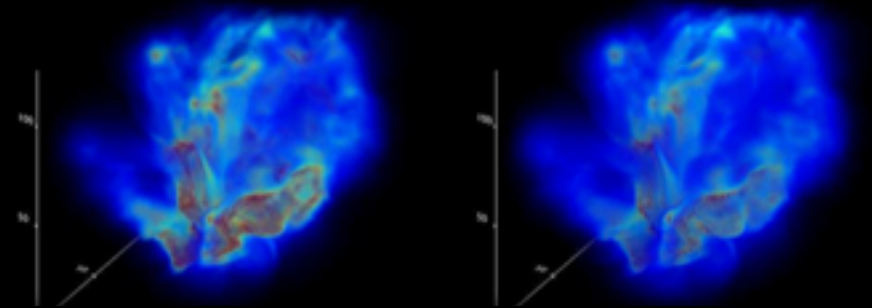
- object sizes
- object colors
- camera angles
- omitting objects
- Gas
- Halo
- Old stars (disk)
- Old stars (Bulge)
- New stars
- Black Holes

Many other astronomers working in Viz! (Here are just a few)

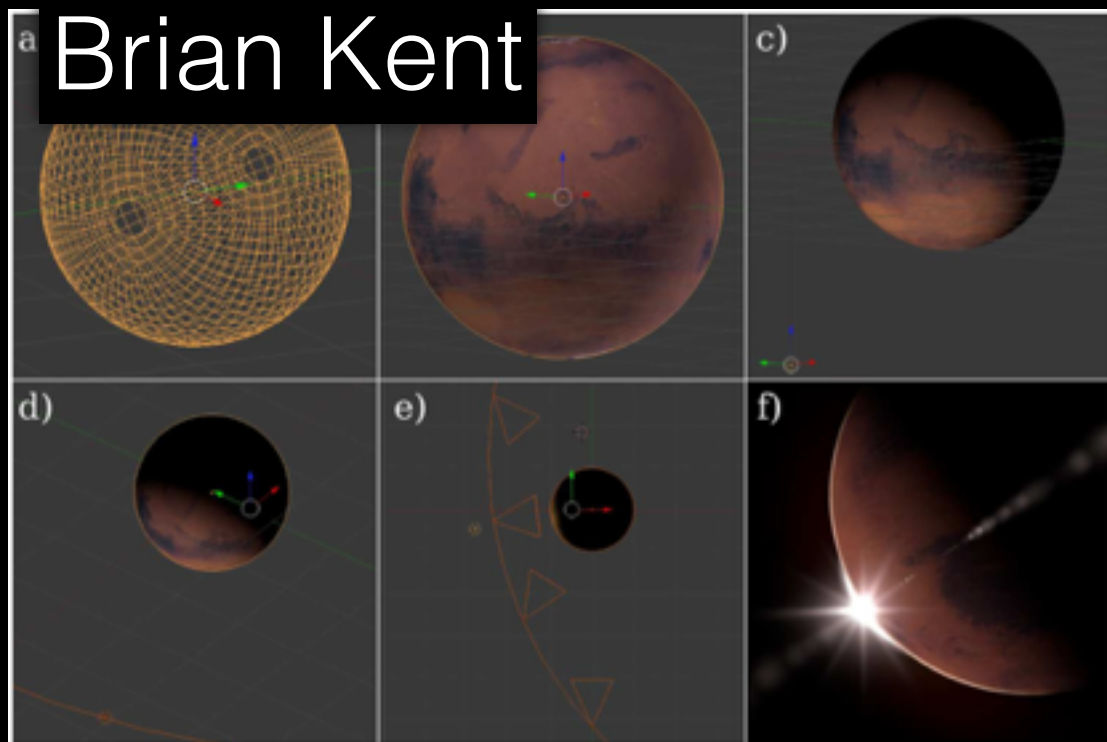


<http://skysrv.pha.jhu.edu/~miguel/visualization.html>

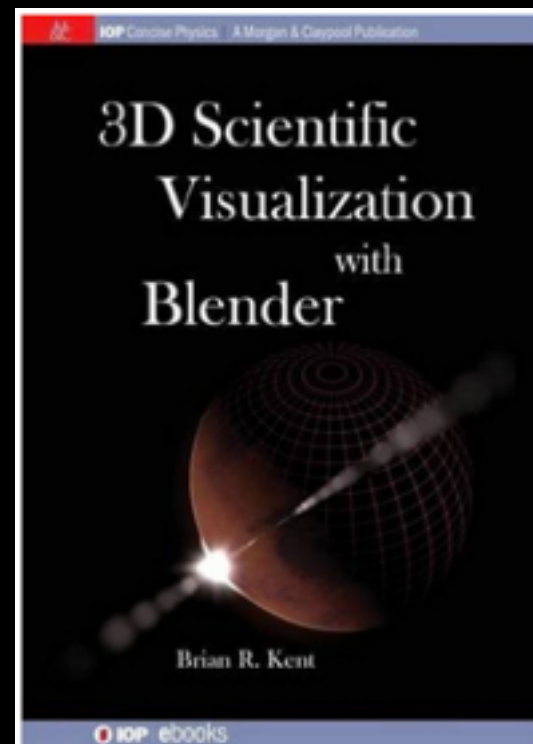
Rhysy Taylor



FRELLED - volume rendering
<http://www.rhysy.net/frelled.html>



Brian Kent



<http://www.cv.nrao.edu/~bkent/blender/index.html>

Some links!

- ◆ www.ytini.com
- ◆ www.astroblend.com
- ◆ <http://yt-project.org/>
- ◆ <http://www.cv.nrao.edu/~bkent/blender/>
- ◆ <http://www.nationaldataservice.org/>
- ◆ <http://www.ncsa.illinois.edu/>

Outline of Week

- ◆ Day 1: Movies!
- ◆ Day 2: 3D interactive movies/things
- ◆ Day 3: More 3D interactive movies/things, VR
- ◆ Day 4: Glue/Hololense Demo and Gallery Exhibition

Tell me of code!

****website - new outline****

Tell me of code!

****go over fake planets part 1 & 2****