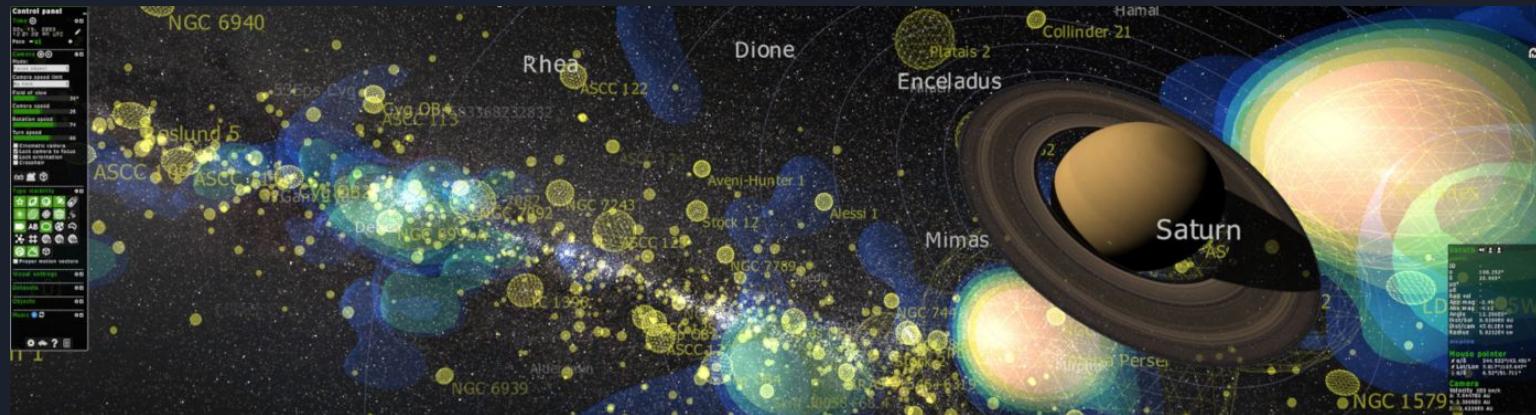




Gaia Sky

Real-time, 3D, astronomy visualisation software



The Team



MISSING

Name: Kothis Thanos,
Male (I assume)

Last seen
yesterday at the
student residence.
Probably went
fighting the
avengers

REWARD: 1\$

IF YOU HAVE ANY INFORMATION
CALL 555 5555

Made with PosterMyWall.com

Goal of the Project & Objectives



- Demonstration and explanation of science software installation and procedure
- Understanding and showing the use astronomy coordinate systems
- Understanding and showing a mix of galactic resources in the neighbourhood of our solar system
- Demonstration of the use of scripting
- Demonstration of the integration of other data sources that are available with Gaia
- Gain experience in the astronomy application
- Improve understanding of software support for research



Personal Learning Objectives

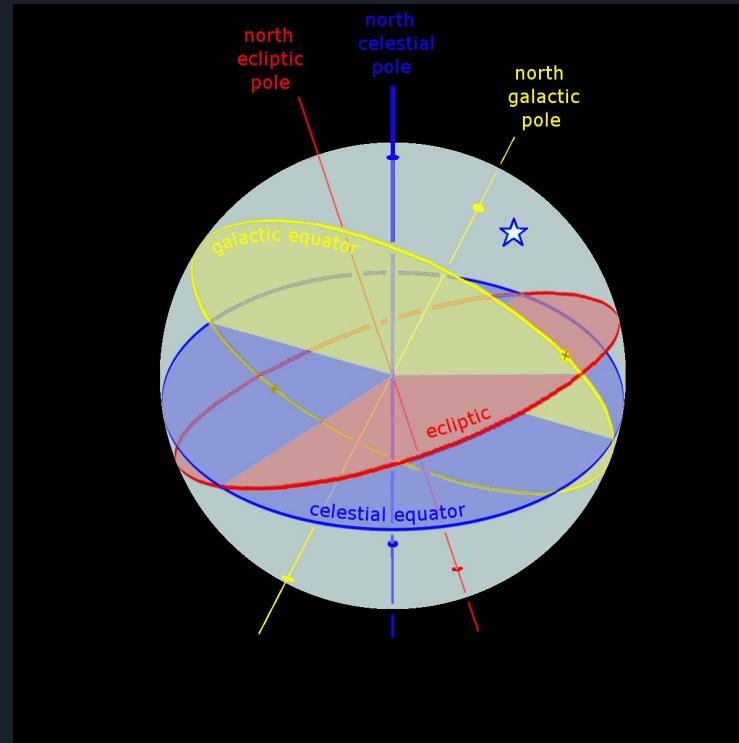
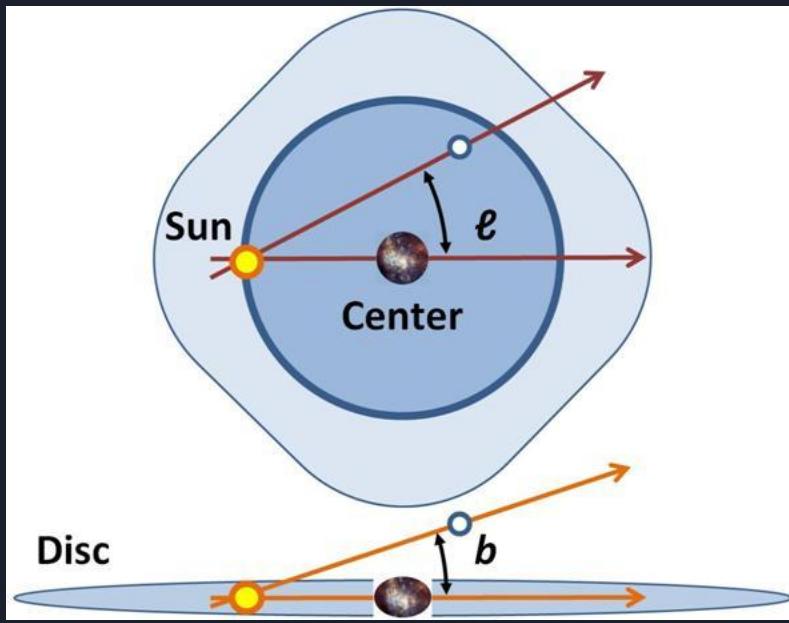
- Céline : I wanted to learn how the celestial coordinate system works and learn things about new tools → LaTeX
- Kostis : Understand more about how coordinates play a role in astronomy
- Moon : I wanted to experience the software used in science and wanted to plotting tool(gnuplot) and Linux OS system.
- Kevin : The meaning of life,... an answer to the ultimate question of life, the universe, and everything
Dutch secret potion / technologie / witchcraft to get tall
Dutch culture
- Nicolas : Improve my skills
- Lucas : I came here to learn new skills in relation to data visualization, and to discover Dutch culture



Coordinate Systems used in Gaia Sky

- Galactic coordinate system : Sun as its center
- Ecliptic coordinate system : Origin can be the center of either the Sun or Earth
- Equatorial coordinate system : Earth as its center

Galactic Coordinate System



Panneau de contrôle

Temps ◎
Jul 11 2019
6:57:46 PM UTC

Caméra    



Paramètres visuels •

Jeux de données

Objets

- ```
so{
Sol
Tethys
Titan
Uranus
Venus
Vesta
"Herbig 1
"S 242
```

### Mailles

- Dust 15% 
  - Dust 60% 
  - HII regions 

### ► III regions

### Constellations

Antlia

Apus  
 Aquarius

- Aquarius
- Aquila

Ara

**Tout sélectionner** **Tout désélectionner**

MusiqueG.com

Etat de la question à la fin de l'année 2010

卷二

1/61 18

8/18/11, 1

## Difficulties with the Data



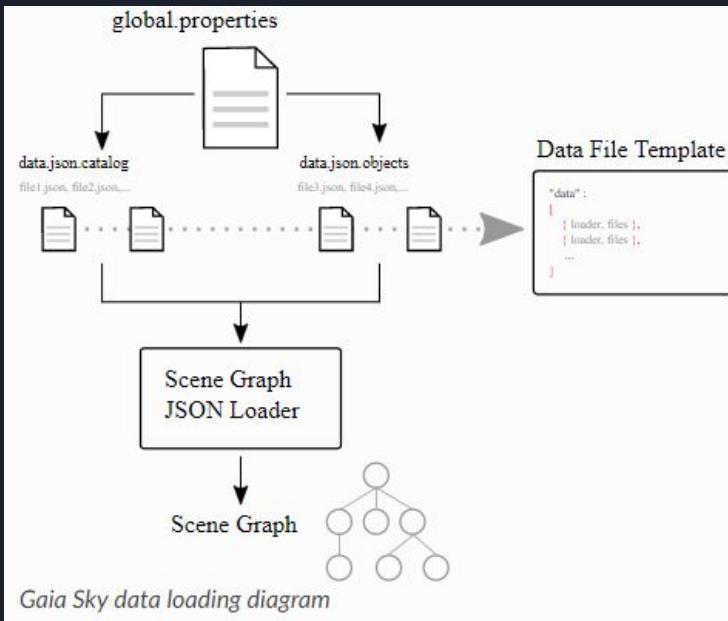
Gaia Archive  
“RAW Data”



Gaia Sky



# Difficulties with the Data



```
{
 "name" : "Earth",
 "wikiname" :"Earth",
 "color" : [0.13, 0.26, 0.89, 1.0],
 "size" : 6371.1,
 "ct" : "Planets",

 "absmag" : -2.78,
 "appmag" : -3.1,

 "parent" : "Sol",
 "impl" : "gaia.cu9.ari.gaiaorbit.scenegraph.Planet",
 "refplane" : "ecliptic",

 "locvamultiplier" : 3.0,
 "loctohoverfactor" : 8.0,

 "coordinates" : {
 "impl" : "gaia.cu9.ari.gaiaorbit.util.coord.vstop87.Earth"
 "orbitname" : "Earth orbit"
 },

 "rotation" : {
 "period" : 23.93447117,
 "axialtilt" : -23.43927111,
 "inclination" : 0.0,
 "meridianangle" : 180.0
 },

 "model" : {
 "args" : [true],
 "type" : "sphere",
 "params" : {
 "quality" : 100,
 "diameter" : 12800.0,
 "flip" : false
 },
 "texture" : {
 "base" : "specular",
 "normal" : "normal",
 "night" : "night"
 }
 },

 "cloud" : {
 "size" : 6390.0,
 "cloud" : "data/tex/base/earth-c"
 },

 "params" : {
 "size" : 6390.0,
 "cloud" : "data/tex/base/earth-c"
 }
}
```

# Difficulties with the Data



Gaia Archive



CDS

ASDC

ARI

AIP

Gaia archive = main point of access to the  
Gaia DR2 data,  
but the data is also served from partner data  
centres (CDS, ASDC, ARI and AIP)

# → HOW MANY STARS WILL THERE BE IN THE SECOND GAIA DATA RELEASE?



position & brightness on the sky

**1 692 919 135**

**14 099**  
Solar System  
objects

**550 737**  
variable sources

**radial velocity**  
**7 224 631**

surface temperature  
**161 497 595**

parallax and proper motion

**1 331 909 727**

**1 383 551 713**

blue colour

**1 381 964 755**

red colour

**radius & luminosity**  
**76 956 778**

**amount of dust along  
the line of sight**  
**87 733 672**

# Difficulties with the Data



Data can be extracted from the Gaia Archive by performing ADQL queries and downloading the corresponding results tables. The Gaia DR2 data set is also downloadable in compressed CSV-format, but the downloadable file set exceeds 550 GB.

These data are stored in a ADQL database , which is a SQL based query language.

Gaia Archive

# Difficulties with the Data



Gaia Archive

Position File

Name  Name  Equatorial

Target in  Circle  Box

Name  for All  Radius 5  arc sec

Search in: gaiadr2.gaia\_source

Extra conditions

+ Add condition Filter: If all conditions

ra = dec Remove

dec = Remove

Display columns

|                                                           |                                                   |                                                    |                                                          |                                                       |
|-----------------------------------------------------------|---------------------------------------------------|----------------------------------------------------|----------------------------------------------------------|-------------------------------------------------------|
| <input type="checkbox"/> solution_id                      | <input type="checkbox"/> designation              | <input checked="" type="checkbox"/> source_id      | <input type="checkbox"/> random_index                    | <input type="checkbox"/> ref_epoch                    |
| <input checked="" type="checkbox"/> ra                    | <input checked="" type="checkbox"/> ra_error      | <input checked="" type="checkbox"/> dec            | <input checked="" type="checkbox"/> dec_error            | <input checked="" type="checkbox"/> parallax          |
| <input checked="" type="checkbox"/> parallax_error        | <input type="checkbox"/> parallax_over_error      | <input type="checkbox"/> pmra                      | <input type="checkbox"/> pmra_error                      | <input type="checkbox"/> pmdec                        |
| <input type="checkbox"/> pmdec_error                      | <input type="checkbox"/> ra_dec_corr              | <input type="checkbox"/> ra_parallax_corr          | <input type="checkbox"/> ra_pmra_corr                    | <input type="checkbox"/> ra_pmdec_corr                |
| <input type="checkbox"/> dec_parallax_corr                | <input type="checkbox"/> dec_pmra_corr            | <input type="checkbox"/> dec_pmdec_corr            | <input type="checkbox"/> parallax_pmra_corr              | <input type="checkbox"/> parallax_pmdec_corr          |
| <input type="checkbox"/> pmra_pmdec_corr                  | <input type="checkbox"/> astrometric_n_obs_al     | <input type="checkbox"/> astrometric_n_obs_ac      | <input type="checkbox"/> astrometric_n_good_obs_al       | <input type="checkbox"/> astrometric_n_bad_obs_al     |
| <input type="checkbox"/> astrometric_gof_al               | <input type="checkbox"/> astrometric_chi2_al      | <input type="checkbox"/> astrometric_excess_noise  | <input type="checkbox"/> astrometric_excess_noise_sig    | <input type="checkbox"/> astrometric_params_solved    |
| <input type="checkbox"/> astrometric_primary_flag         | <input type="checkbox"/> astrometric_weight_al    | <input type="checkbox"/> astrometric_pseudo_colour | <input type="checkbox"/> astrometric_pseudo_colour_error | <input type="checkbox"/> mean_varpi_factor_al         |
| <input type="checkbox"/> astrometric_matched_observations | <input type="checkbox"/> visibility_periods_used  | <input type="checkbox"/> astrometric_sigma5d_max   | <input type="checkbox"/> frame_rotator_object_type       | <input type="checkbox"/> matched_observations         |
| <input type="checkbox"/> duplicated_source                | <input type="checkbox"/> phot_g_n_obs             | <input type="checkbox"/> phot_g_mean_flux          | <input type="checkbox"/> phot_g_mean_flux_error          | <input type="checkbox"/> phot_g_mean_flux_over_error  |
| <input checked="" type="checkbox"/> phot_g_mean_mag       | <input type="checkbox"/> phot_bp_n_obs            | <input type="checkbox"/> phot_bp_mean_flux         | <input type="checkbox"/> phot_bp_mean_flux_error         | <input type="checkbox"/> phot_bp_mean_flux_over_error |
| <input type="checkbox"/> phot_bp_mean_mag                 | <input type="checkbox"/> phot_rp_n_obs            | <input type="checkbox"/> phot_rp_mean_flux         | <input type="checkbox"/> phot_rp_mean_flux_error         | <input type="checkbox"/> phot_rp_mean_flux_over_error |
| <input type="checkbox"/> phot_rp_mean_mag                 | <input type="checkbox"/> phot_bp_rp_excess_factor | <input type="checkbox"/> phot_pc_mode              | <input checked="" type="checkbox"/> phot_rp              | <input type="checkbox"/> bp_g                         |

# Difficulties with the Data



Gaia Archive

Basic Advanced (ADQL) Query Results

gaia

Job name:

Ctrl+Space for query autocomplete

1 SELECT TOP 500  
2 gaia\_source.source\_id,gaia\_source.ra,gaia\_source.ra\_error,gaia\_source.dec,gaia\_source.dec\_error,gaia\_source.parallax,gaia\_source.parallax\_error,gaia\_source.phot\_g\_mean\_mag,  
3 gaia\_source.bp\_rp,gaia\_source.radial\_velocity,gaia\_source.radial\_velocity\_error,gaia\_source.phot\_variable\_flag,gaia\_source.teff\_val,gaia\_source.a\_g\_val  
4 FROM galadr2.gaia\_source |

Reset Form Submit Query

No results found

| Status              | Job | Creation date | Num. rows | Size |
|---------------------|-----|---------------|-----------|------|
| gaiadr2.gaia_source |     |               |           |      |
| gaiadr2.ruwe        |     |               |           |      |

Why get Gaia Archive data (raw) ?

=> To compare Gaia Sky database with the original database

How ?

=> Take account the time for the coordinates

# Scripting / Coding Backend

```
64 public Attitude getAttitudeNative(final long t) throws RuntimeException {
65
66 //TODO: fix it in a better way
67 int left = AttitudeUtils.findIndexVar(t, tNs, splineOrder 0) - 2;
68 System.out.println("[DEBUG] left=" + left);
69 if (left < 0 || left > nt - 2) {
70 long time = t;
71 String msg = "t < tBeg or >= tEnd, t = " + time
72 + ", tBeg = " + getStartTime() + ", tEnd = "
73 + getStopTime();
74 throw new RuntimeException(msg);
75 }
76 double qDxL = 0.5 * (qX[left] * rateZ[left] - qZ[left] * rateY[left] + qW[left]
77 * rateX[left]);
78 double qDyL = 0.5 * (-qX[left] * rateZ[left] + qZ[left] * rateX[left] + qW[left]
79 * rateY[left]);
80 double qDzL = 0.5 * (qX[left] * rateY[left] - qY[left] * rateX[left] + qW[left]
81 * rateZ[left]);
82 double qDwL = 0.5 * (-qX[left] * rateX[left] - qY[left] * rateY[left] - qZ[left]
83 * rateZ[left]);
84 double qDxL1 = 0.5 * (qY[left + 1] * rateZ[left + 1] - qZ[left + 1]
85 * rateY[left + 1] + qW[left + 1] * rateX[left + 1]);
86 double qDyL1 = 0.5 * (-qX[left + 1] * rateZ[left + 1] + qZ[left + 1] * rateX[left + 1]
87 * rateY[left + 1] + qW[left + 1] * rateY[left + 1]);
88 double qDzL1 = 0.5 * (qX[left + 1] * rateY[left + 1] - qY[left + 1] * rateX[left + 1]
89 * rateZ[left + 1]);
90 double qDwL1 = 0.5 * (-qX[left + 1] * rateX[left + 1] - qY[left + 1] * rateY[left + 1]
91 * rateZ[left + 1] + qZ[left + 1] * rateZ[left + 1]);
92 double timeUnit = 86400e9;
93 double x0 = 0.0;
94 double x1 = (tNs[left + 1] - tNs[left]) / timeUnit;
95 double x = (t - tNs[left]) / timeUnit;
96
97
98 double incX[] = Interpolator.linear(x, x0, qX[left], x1,
99 qX[left + 1]);
100 double incY[] = Interpolator.linear(x, x0, qY[left], x1,
101 qY[left + 1]);
102 double incZ[] = Interpolator.linear(x, x0, qZ[left], x1,
103 qZ[left + 1]);
104 double incW[] = Interpolator.linear(x, x0, qW[left], x1,
105 qW[left + 1]);
106
107 Quaternionnd qInt = new Quaternionnd(intX[0], intY[0], intZ[0], intW[0]);
108 double fact = 1.0 / Math.sqrt(qInt.len2());
109
110 return new ConcreteAttitude(t, qInt.nor(),
111 new Quaternionnd(x * incX[0] * fact, y * incY[1] * fact, z * incZ[1] * fact,
112 w * incW[1] * fact, withZeroSigmaCov: false);
113 }
```

```
1 from gala.cu9.ari.galaorbit.script import EventScriptingInterface
2
3 gs = EventScriptingInterface.instance()
4 starBrightness=gs.getStarBrightness();
5 def focusOn(obj, rotationSpeed, distance):
6 gs.setCameraFocus(obj)
7 gs.goToObject(obj,distance);
8 msg = "Orbit focus on "+obj;
9 gs.setHeadlineMessage(msg);
10 gs.setSimulationPace(rotationSpeed);
11 gs.startSimulationTime();
12 gs.sleep(8);
13 return;
14
15 def interface(isOn):
16 if isOn == True:
17 gs.stopSimulationTime();
18 gs.setStarBrightness(starBrightness);
19 gs.setCameraFocus("Sol");
20 gs.setCinematicCamera(False);
21 gs.clearAllMessages();
22 gs.maximizeInterfaceWindow();
23 gs.enableInput();
24 elif isOn == False:
25 gs.setStarBrightness(0);
26 gs.goToObject("Sol", 0.005, 5);
27 gs.disableInput();
28 gs.cameraStop();
29 gs.minimizeInterfaceWindow();
30 gs.setVisibility("element.labels", True);
31 gs.setCinematicCamera(True);
32
33 return;
34
35 interface(False);
36
37 focusOn(obj="Sol", rotationSpeed=999999, distance=0.005);
38 focusOn(obj="Mercury", rotationSpeed=999999, distance=0.0005);
39 focusOn(obj="Venus", rotationSpeed=999999, distance=0.0008);
40 focusOn(obj="Earth", rotationSpeed=999999, distance=0.0008);
41 focusOn(obj="Mars", rotationSpeed=999999, distance=0.0009);
42 focusOn(obj="Jupiter", rotationSpeed=999999, distance=0.0005);
43 focusOn(obj="Saturn", rotationSpeed=99999990, distance=0.0005);
44 focusOn(obj="Uranus", rotationSpeed=99999990, distance=0.0005);
45 focusOn(obj="Neptune", rotationSpeed=99999990, distance=0.0003);
46 focusOn(obj="Pluto", rotationSpeed=99999990, distance=0.00005);
47
48 interface(True);
```



# Some demonstrations

<https://github.com/SoftwareForScience/summerschool2019-gaia>

# 3D Object

# 3D Object

<http://www.blendswap.com/>

## SEARCH BLENDS

millenium falcon

Search

Show Fan Art   License: Any license   Engine: Any Engine   Sort: Download Count

Millennium Falcon (High Poly) by JohnsonMartin

Millennium Falcon - Cycles by JohnsonMartin

SpaceX Falcon 9 Reusable by JohnsonMartin

124 67 10314   27 9 762   3 7 445

Page 1 of 1, showing 3 out of 3 total.

## MILLENNIUM FALCON - CYCLES



JohnsonMartin

277 comments  
184 points  
50 blends

### Site Stats

August 18, 2014

762 Downloads

27 Likes

Blender 2.71

Render: Internal

License CC-BY



You must log in to be able to download, collect and follow this blend.

This is not by any means accurate. But all the main parts should be in the right places. the bottom is just a mirror of the top which is not accurate.

The model should render close to the preview image. But I did use an image texture instead of a noise texture for rendering it. So if you want better quilt replace the noise with a image texture. Also I used an HDR for rendering which is not included.

Latest Change on 2014/08/18, 16:37:25

PREMIUM  
FREE  
FONTS & GRAPHICS

Advertise Here

# 3D Object



|      | Nom             | Modifié le       | Type                | Taille |
|------|-----------------|------------------|---------------------|--------|
| e    | amalthea        | 04/07/2019 10:33 | Dossier de fichiers |        |
| aux_ | deimos          | 04/07/2019 10:33 | Dossier de fichiers |        |
| ool  | extra           | 04/07/2019 10:33 | Dossier de fichiers |        |
| oupo | gaia            | 04/07/2019 10:33 | Dossier de fichiers |        |
|      | geom            | 04/07/2019 10:33 | Dossier de fichiers |        |
|      | janus           | 04/07/2019 10:33 | Dossier de fichiers |        |
|      | milleniumFalcon | 11/07/2019 11:42 | Dossier de fichiers |        |
|      | phobos          | 04/07/2019 10:33 | Dossier de fichiers |        |
|      | prometheus      | 04/07/2019 10:33 | Dossier de fichiers |        |
|      | solarsail       | 04/07/2019 10:33 | Dossier de fichiers |        |
|      | spaceship       | 04/07/2019 10:33 | Dossier de fichiers |        |
|      | usse            | 04/07/2019 10:33 | Dossier de fichiers |        |

# 3D Object

| Ce PC > OS (C:) > Utilisateurs > Asus > .gaiasky > data > models > milleniumFalcon |                  |           |           |
|------------------------------------------------------------------------------------|------------------|-----------|-----------|
| Nom                                                                                | Modifié le       | Type      | Taille    |
| millenium-falcon.obj                                                               | 11/07/2019 11:42 | 3D Object | 13 072 Ko |

```
{ "model":{
 "args":[true],
 "model":"data/models/milleniumFalcon/millenium-falcon.obj"
}
```

# 3D Object

```
 "version" : 1,
 "data" : [
 {
 "loader": gaia.cu9.ari.gaiaorbit.data.JsonLoader,
 "files": ["data/meshes-dr2-dust.json",
 "data/meshes-dr2-hii.json",

 "data/planets.json",
 "data/moons.json",
 "data/satellites.json",

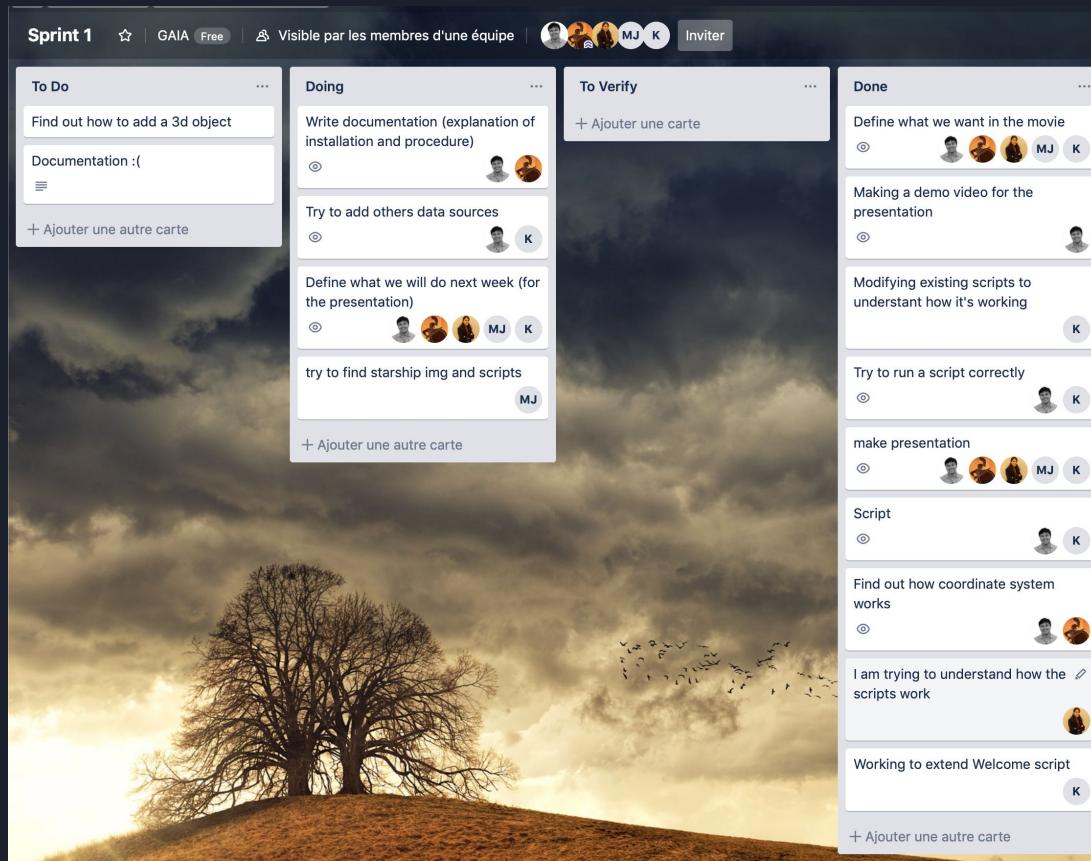
 "data/orbits-planet.json",
 "data/orbits-moon.json",
 "data/orbits-satellite.json",

 "data/extra.json",

 "data/locations.json",
 "data/locations-earth.json",
 "data/locations-moon.json",

 "data/asteroids.json",
 "data/orbits-asteroid.json",
 "data/asteroids-dr2.json",
 "data/orbits-asteroids-dr2.json"
 "data/milleniumFalcon.json"
]
]
```

# Proces : Teamwork



Sprint 1 ★ GAIA Free | Visible par les membres d'une équipe | Inviter

**To Do**

- Find out how to add a 3d object
- Documentation :(
- + Ajouter une autre carte

**Doing**

- Write documentation (explanation of installation and procedure)
- + Ajouter une autre carte

**To Verify**

- + Ajouter une carte

**Done**

- Define what we want in the movie
- Making a demo video for the presentation
- Modifying existing scripts to understand how it's working
- Try to run a script correctly
- make presentation
- Script
- Find out how coordinate system works
- I am trying to understand how the scripts work
- Working to extend Welcome script

+ Ajouter une autre carte

SoftwareForScience / summerschool2019-gaia

Code Issues Pull requests Projects Wiki Security Insights

No description, website, or topics provided.

66 commits 1 branch 0 releases 5 contributors

Branch: master | New pull request | Create new file | Upload files | Clone or download | Find File

KevinOGIER Update README.md | Latest commit d036af5 4 hours ago

Scripts Rename solarSystemRotation.py to solar\_system\_rotation.py | 4 hours ago

Gaia Sky 1st Presentati... Add files via upload | 5 hours ago

Gaia\_visualization\_v3.pdf Add files via upload | 5 hours ago

README.md Update README.md | 4 hours ago

README.md

**AUAS Summer School**

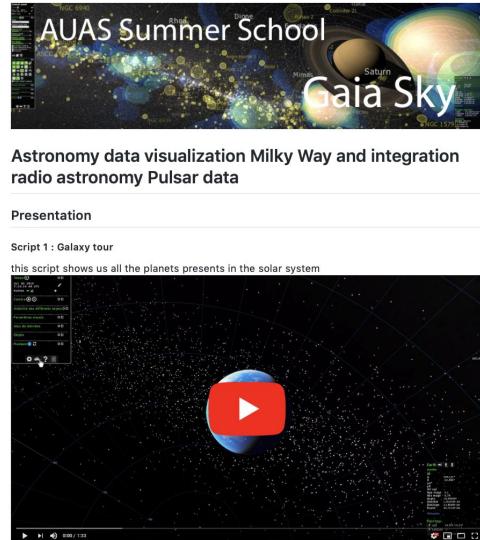
**Gaia Sky**

Astronomy data visualization Milky Way and integration radio astronomy Pulsar data

**Presentation**

Script 1 : Galaxy tour

this script shows us all the planets presents in the solar system



# Recommendations for future teams

- Ask for feedback continuously
- Don't download too much data for Gaia Sky, focus on the functional part.
- Do some awesome scripting!
- Try to add a 3d object
- Try quick workarounds for bugs





# Conclusion

- Learning how to understand and install scientific software;
- Learn about the importance of coordinate systems;
- Gain experience in the astronomy application;
- Improve understanding of software support for research.
- Dutch culture



Toedeledokie