

Contents

- 1) **HOW TO plot more advanced graphs from the Exoplanet Catalogue using TOPCAT**
- 2) **How to plot the catalogue on the celestial sphere using Aladin**

1) HOW TO plot more advanced graphs from the Exoplanet Catalogue using TOPCAT

We are going to use TOPCAT (Tool for Operations on Catalogues And Tables) developed by Marc Taylor at Bristol University.

First click on “VO CONNECTION ON” (fig 1)

This will launch TOPCAT and send the full catalogue using a Virtual Observatory protocol called SAMP. For security reasons TOPCAT will require you to approve the connection, click on yes. You will then see in the web page the TOPCAT application icon (yellow cat) and in TOPCAT's table list window you will see the Exoplanet.eu catalogue data. If the connection is already opened, click on “send table” to send the data.

click on the grid icon “Display table cell data” to browse the catalogue, highlighted in red on fig 1. The result is shown on fig 2.

The screenshot shows the TOPCAT software interface. At the top, there is a 'Load New Table' dialog box with a menu bar (File, DataSources, Examples, Help) and a toolbar. Below the menu is a 'Format: (auto)' dropdown and a 'Location:' text field with an 'OK' button. There are also 'Filestore Browser' and 'System Browser' buttons. Below this is a 'Loading Tables' area.

In the center, there is a 'Catalog' window with a 'VO CONNECTION' section containing 'ON' and 'OFF' radio buttons, a 'topcat' logo, and a 'Send table' button. Below this is a 'Download VOTable | CSV | DAT' link.

At the bottom, there is a table of astronomical data with columns: e, i (deg), Ang. dist. (arcsec), Status, Discovery, and Upd. The table contains several rows of data, including '1RXS1609 b' and '24 Sex b'.

fig 1 : catalog with TOPCAT

The screenshot shows the 'TOPCAT(1): Table Browser' window. It displays a detailed grid view of astronomical data for the 'Exoplanet.eu catalog'. The table has columns for name, mass, mass error, radius, orbital period, semi major axis, and eccentricity. The data is organized into a grid with rows and columns.

name	mass	mass error	minmass	error max	radius	radius er...	radius er...	orbital period	orbital period...	orbital period...	semi major ...	semi major a...	semi major a...	eccentrici
1 11 Com b	19.4	1.5	1.5					326.03	0.32	0.32	1.29	0.05	0.05	0.231
2 11 Umi b	10.5	2.47	2.47					516.22	3.25	3.25	1.54	0.07	0.07	0.08
3 14 Ara d b	5.33	0.57	0.57					185.84	0.23	0.23	0.83			
4 14 Her b	4.64	0.19	0.19					1773.4	2.5	2.5	2.77	0.05	0.05	0.369
5 16 Cyg B b	1.68	0.07	0.07					799.5	0.6	0.6	1.68	0.03	0.03	0.689
6 18 Del b	10.3							993.3	3.2	3.2	2.6			0.08
7 1RXS1609 b	14.	3.	2.	1.7							330.			
8 24 Sex b	1.99	0.38	0.26					452.8	4.5	4.5	1.333	0.009	0.009	0.09
9 24 Sex c	0.86	0.22	0.35					883.	14.	14.	2.08	0.02	0.02	0.29
10 2M 0103(AB) b	13.	1.	1.								84.			
11 2M 0122-2439 b	13.	1.	1.								52.	6.	6.	
12 2M 044144 b	7.5	2.5	2.5								15.	0.6	0.6	
13 2M 0746+20 b	30.	25.	25.	0.97	0.06	0.06	4640.	25.	25.	2.897	0.005	0.005	0.487	
14 2M 2140+16 b	20.	20.	80.	0.92	0.39	0.39	7340.	584.	584.	3.53	0.15	0.15	0.26	
15 2M 2206-20 b	30.	20.	70.	1.3	0.18	0.18	8686.	69.4	69.4	4.48	0.4	0.4		
16 2M1207 b	4.	1.	6.								46.	5.	5.	
17 30 Ari B b	9.88	0.94	0.94					335.1	2.5	2.5	0.995	0.012	0.012	0.289
18 4 Uma b	7.1	1.6	1.6					269.3	1.96	1.96	0.87	0.04	0.04	0.432
19 42 Dra b	3.88	0.85	0.85					479.1	6.2	6.2	1.19	0.01	0.01	0.38
20 47 Uma b	2.53	0.06	0.07					1078.	2.	2.	2.1	0.02	0.02	0.032
21 47 Uma c	0.54	0.073	0.066					2391.	87.	87.	3.6	0.1	0.1	0.068
22 47 Uma d	1.64	0.48	0.29					14602.	5095.	5095.	11.6	2.9	2.9	0.16
23 51 Peg b	0.468	0.007	0.007					4.23077	5.000000E-5	5.000000E-5	0.052			
24 55 Cnc b	0.8	0.012	0.012					14.651	0.0001	0.0001	0.1134	0.0006	0.0006	0.0159
25 55 Cnc c	0.169	0.008	0.008					44.3446	0.007	0.007	0.2403	0.0017	0.0017	0.053

fig 2 : All the data have been transferred to TOPCAT you can visualize values using the grid view

a) Work on a subset of the catalog

We are going to select a subset to create a new sample and plot it.

select the lines you want to keep (using click, Shift click, ctrl click) then click on the button “Define a new row subset”

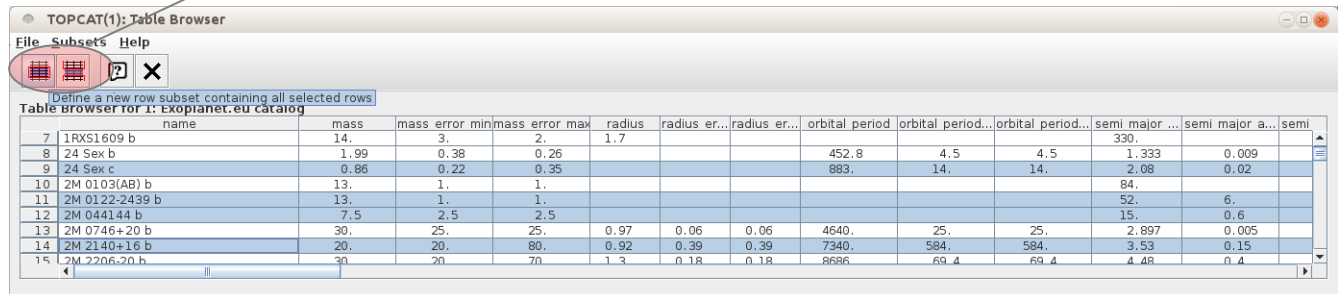


fig 3 : subset creation in TOPCAT

In the subset menu enter a name and click on “Add and Set Current Subset” to use that selection

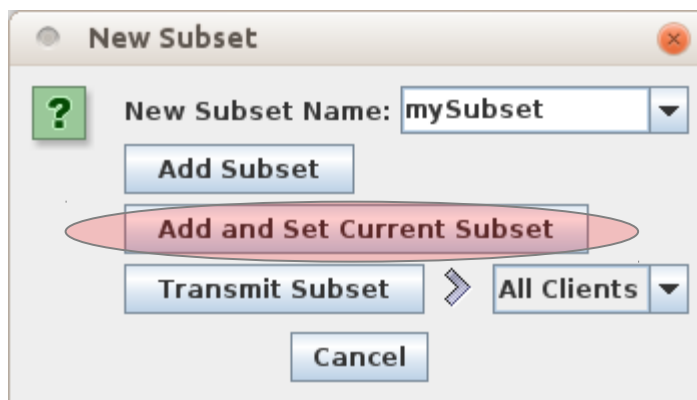


fig 4 : new subset window

From now, you will work on the selected subset to create all your plot or statistics

b) create a new column from the result of a mathematical operation and plot it

Click on the grid icon “Display table cell data” to browse the catalogue.

File Subsets Help

	name	mass	mass error min	mass error max	radius	radius er...	radius er...	orbital period	orbital period...	orbital period...	semi major ...
2	11 UMi b	10.5	2.47	2.47				516.22	3.25	3.25	1.54
3	14 And b	5.33	0.57	0.57				185.84	0.23	0.23	0.83
4	14 Her b	4.64	0.19	0.19				1773.4	2.5	2.5	2.77
5	16 Cyg B b	1.68						799.5	0.6	0.6	1.68
6	18 Del b	10.3						993.3	3.2	3.2	2.6
7	1RXS1609 b	14.			1.7						330.
8	24 Sex b	1.99						452.8	4.5	4.5	1.333
9	24 Sex c	0.86						883.	14.	14.	2.08
10	2M 0103(AB) b	13.									84.
11	2M 0122-2439 b	13.									52.
12	2M 044144 b	7.5									15.
13	2M 0746+20 b	30.			0.97	0.06	0.06	4640.	25.	25.	2.897
14	2M 2140+16 b	20.	20.	80.	0.92	0.39	0.39	7340.	584.	584.	3.53

fig 5 : action on table

Right click on the table and choose “new synthetic column”

You can define a mathematical expression using column name and predefine function from a large list

Define Synthetic Column

File Help

$f(x)$? X

Name: MyNewColumn

Expression: $(\text{semi_major_axis} * \text{semi_major_axis} * \text{semi_major_axis}) / (\text{orbital_period} * \text{orbital_period})$

Units:

Description: Kepler constant a^3 / T^2

UCD: no UCD

Index: 4

OK Cancel

fig 6 : define new synthetic column

You can now create a plot using this new column see fig 7

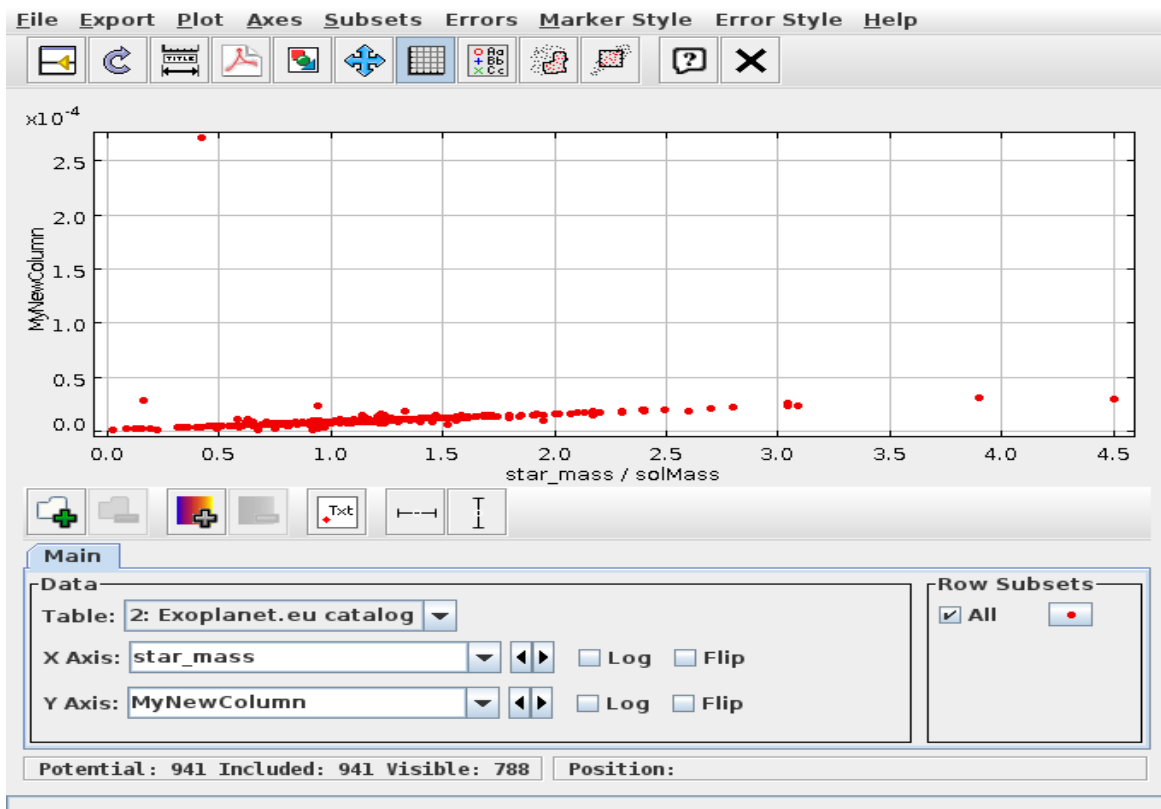


fig 7 : plot of synthetic column

c) How to plot catalogue in the sky using Aladin

As previously you will use VO Connection.

First start Aladin, go to <http://aladin.u-strasbg.fr/>, then start launch Aladin applet.

Click on “VO CONNECTION” in the Exoplanet Catalogue, if it's already connected click on “Send table”, then the catalogue will be sent to Aladin.

Then in Aladin choose menu File → all sky → image → optical → DSS → DSS colored as shown in fig 8

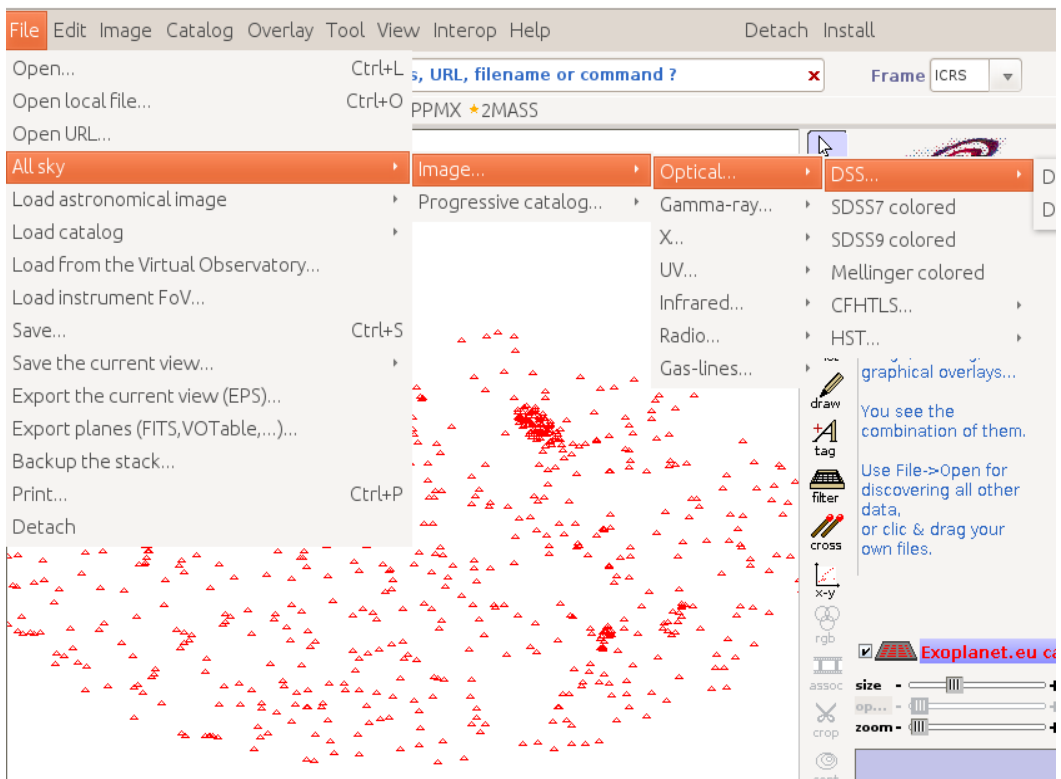


fig 8 : catalogue in Aladin

Then you can plot the catalogue on the sky, this plot is interactive and connected with the Exoplanet Catalogue webpage : if you select a planet in Aladin, it will highlighted in catalogue and vice versa. You can pan and zoom to change the region of the sky displayed.

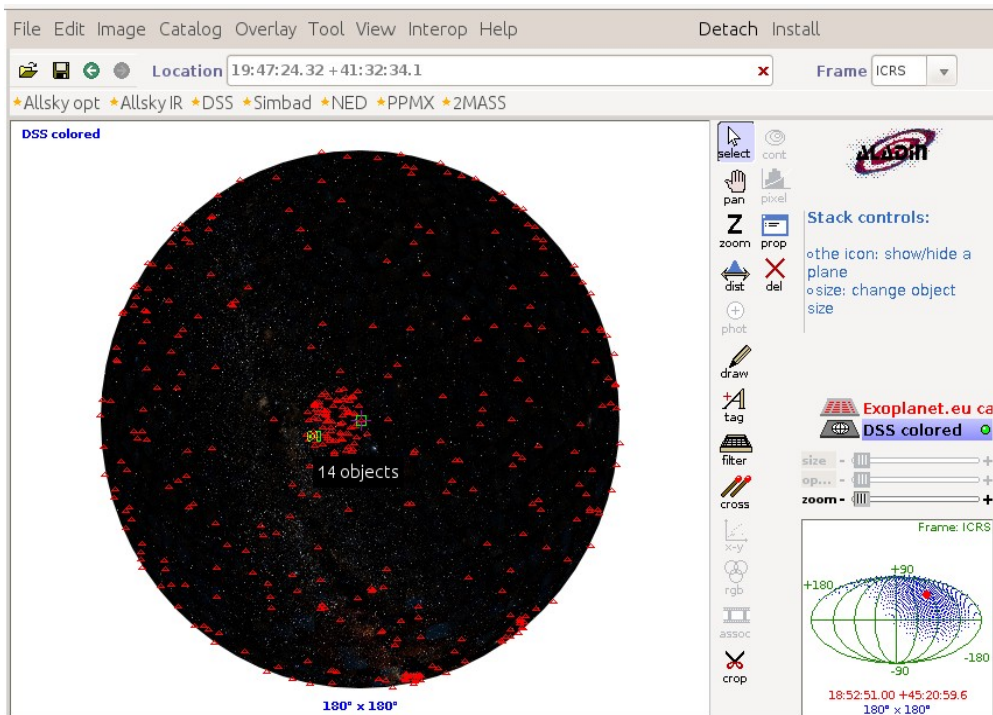


fig 9 : all sky mode in Aladin