

Documentation

Ipynb notebook environment

The application is built atop an Ipynb notebook environment, and can be launched in a browser using command prompt.

Dependencies

The web application is written completely in python, and its functioning is contingent on the following modules being installed on your system.

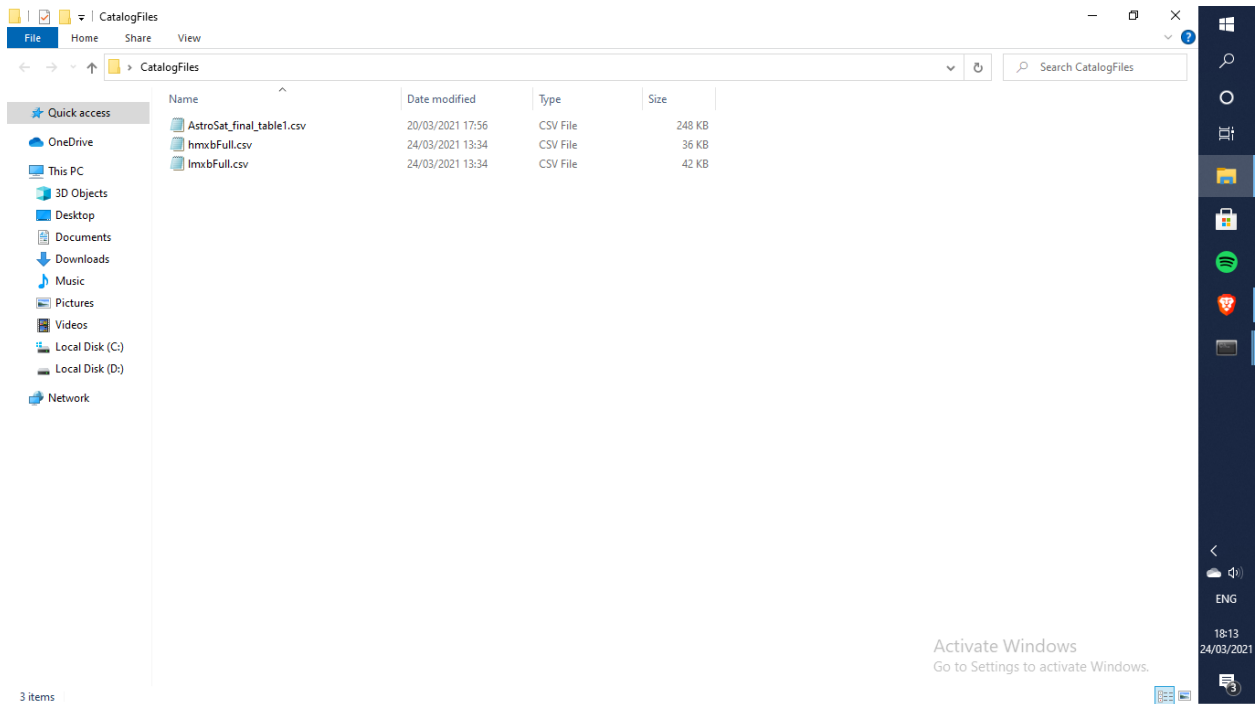
- a. Ipynb
- b. Ipynbwidgets
- c. Pandas
- d. Astropy
- e. Ipyaladin
- f. Fpdf

Tutorial:

We shall demonstrate how to use the application for loading the catalogs A and B, visualising the objects in catalog A over a skymap, searching for a particular object, and finding whether it exists in catalog B.

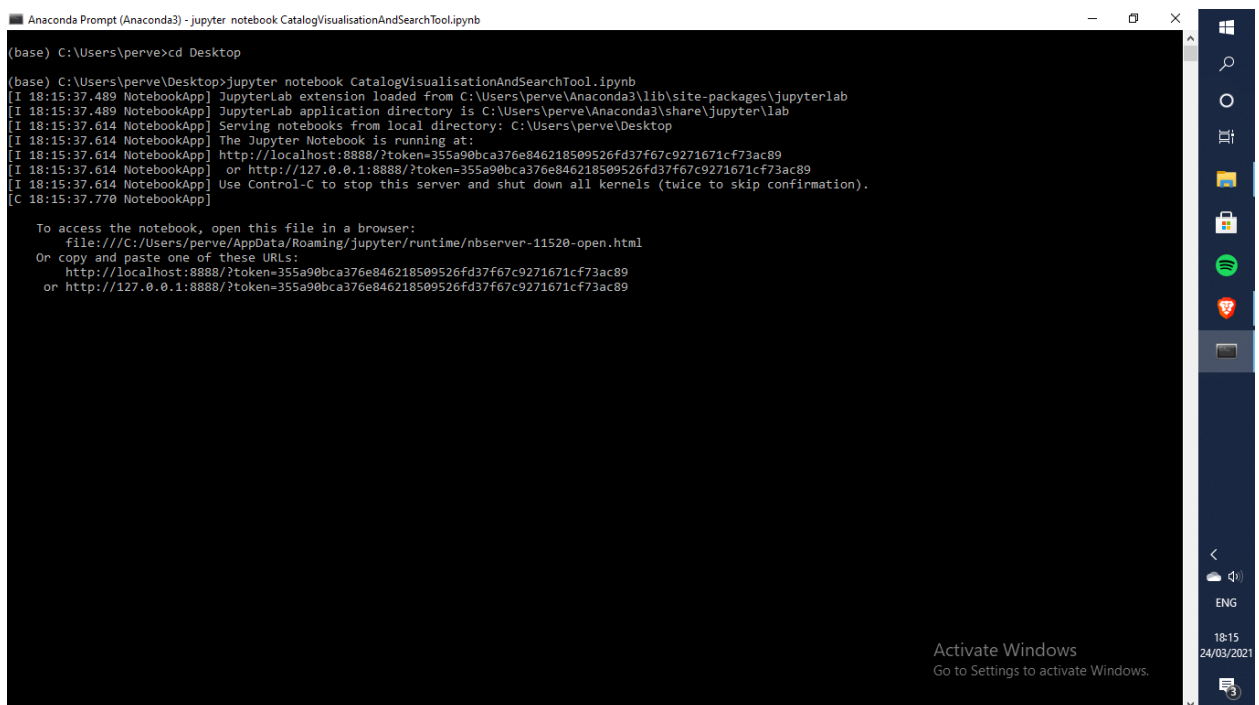
Note: The application requires some preprocessing to be performed on the files, before they are uploaded to the application. Also, simple changes in the code are required before we can add other catalogues than the one provided for the problem statement.

1. Preprocessing the files is a prior step. It simply involved linking related files by means of related entries, the process of which has been uploaded in Data preprocessing files, namely :
 - Data Preprocessing.ipynb
 - Data Preprocessing of Astrosat Observations.ipynb
 - Data Preprocessing of Astrosat Publications.ipynb
2. As a result of the preprocessing, we end up with the final files, which simply have an added column indicating the references to the objects mentioned in an entry of the catalogues. We have two catalogues A (hmx and lmx respectively) and catalog B (astrosat catalogue).

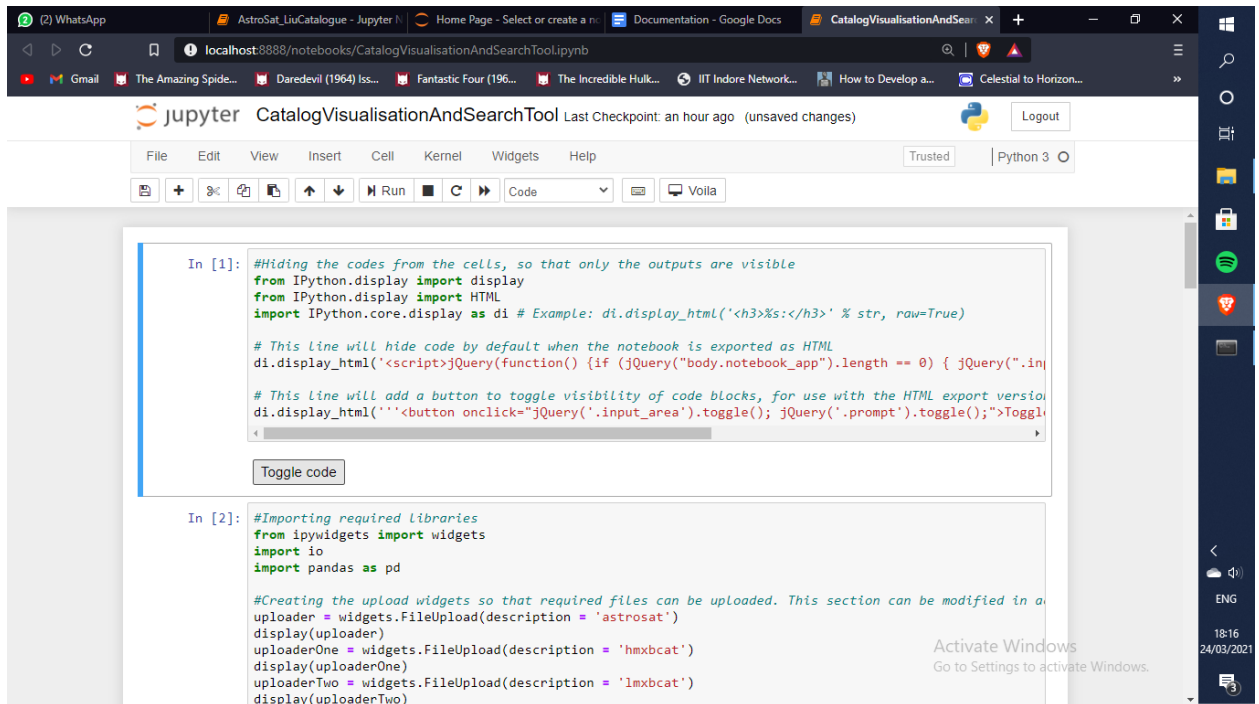


You need to have these files saved somewhere on your system so that you can upload them to the application.

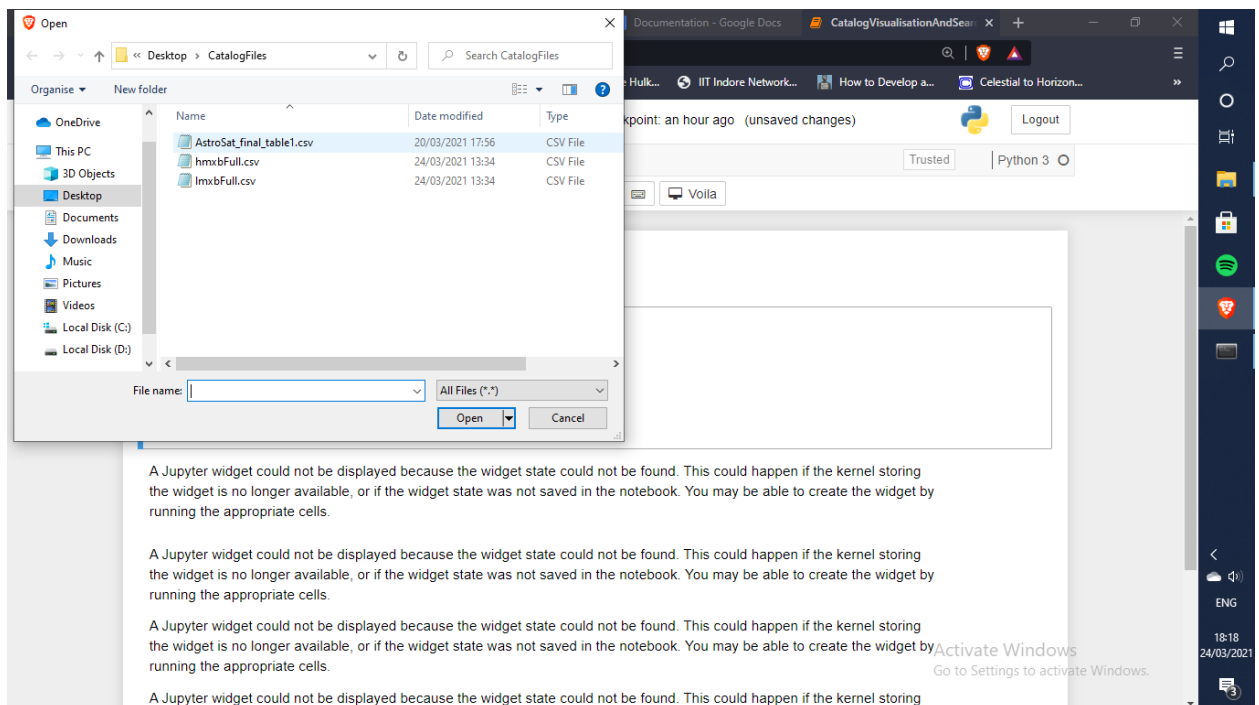
3. We now launch our application using the command prompt. Navigate to the directory where you have saved the .ipynb file and launch it.

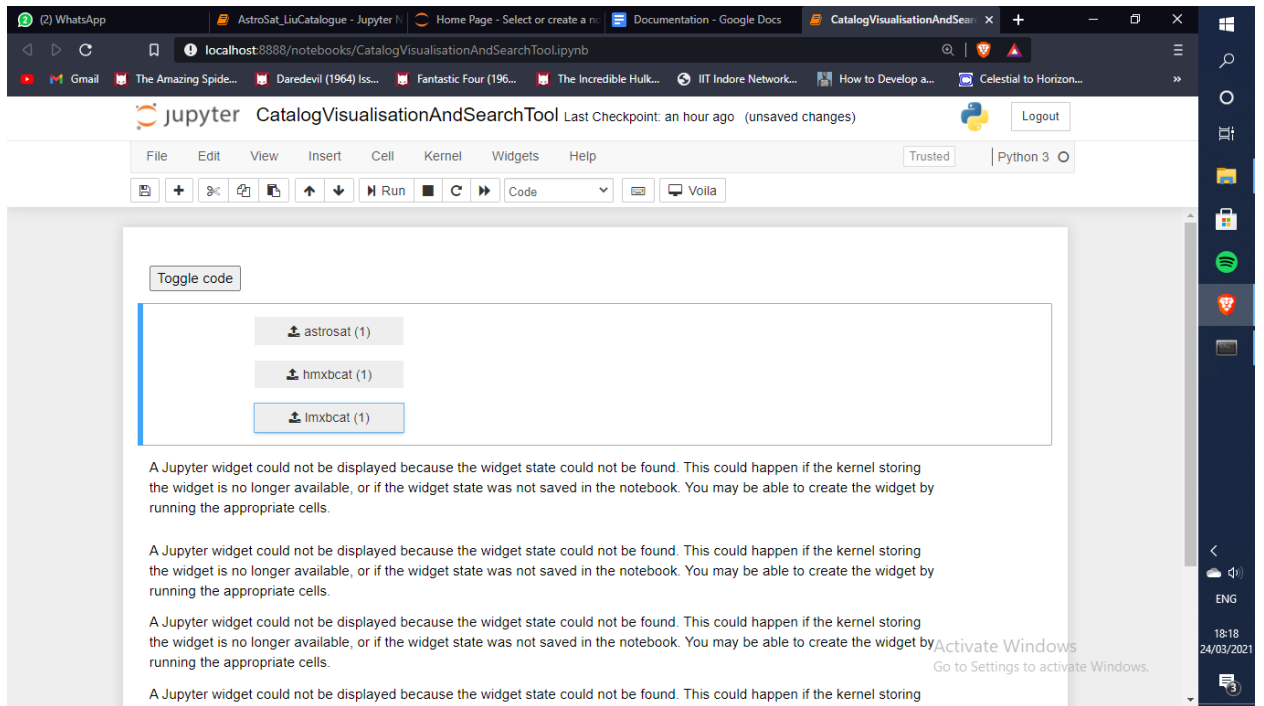


4. Hit 'Toggle code' to hide the code section.

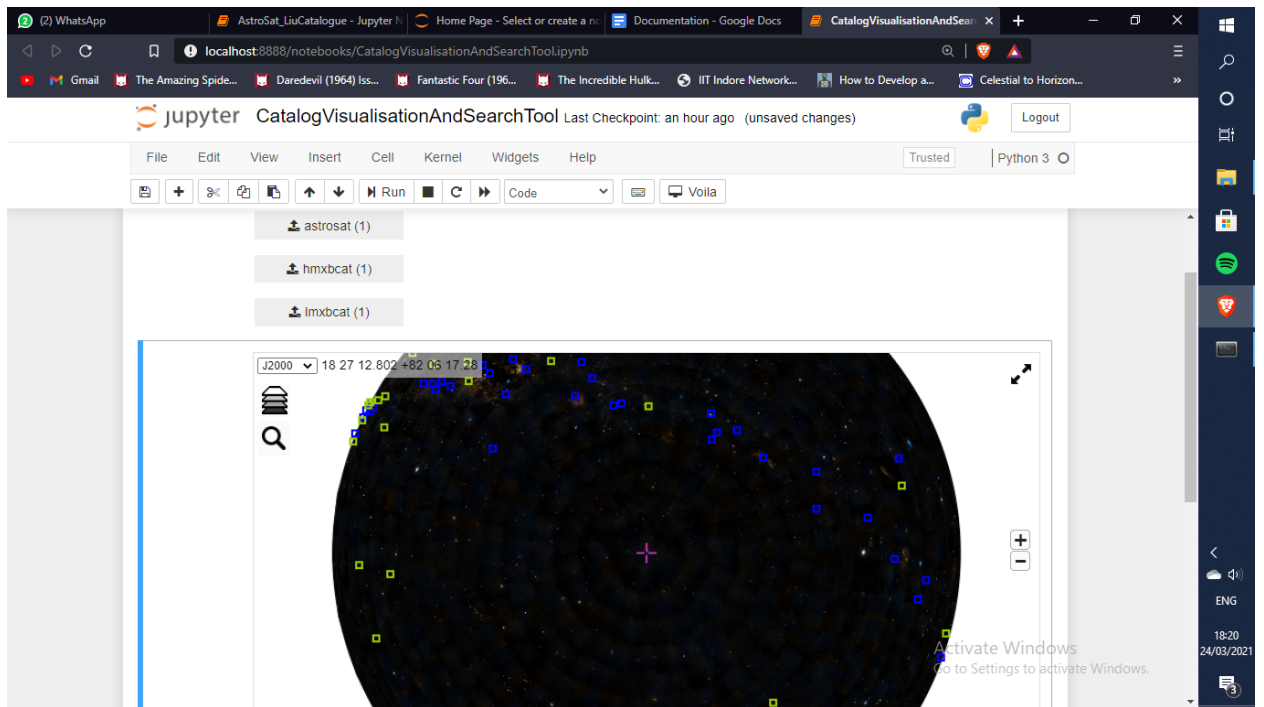


5. Press Ctrl+Enter to execute the first cell. It would ask you to upload the files under mentioned headings, add them there.

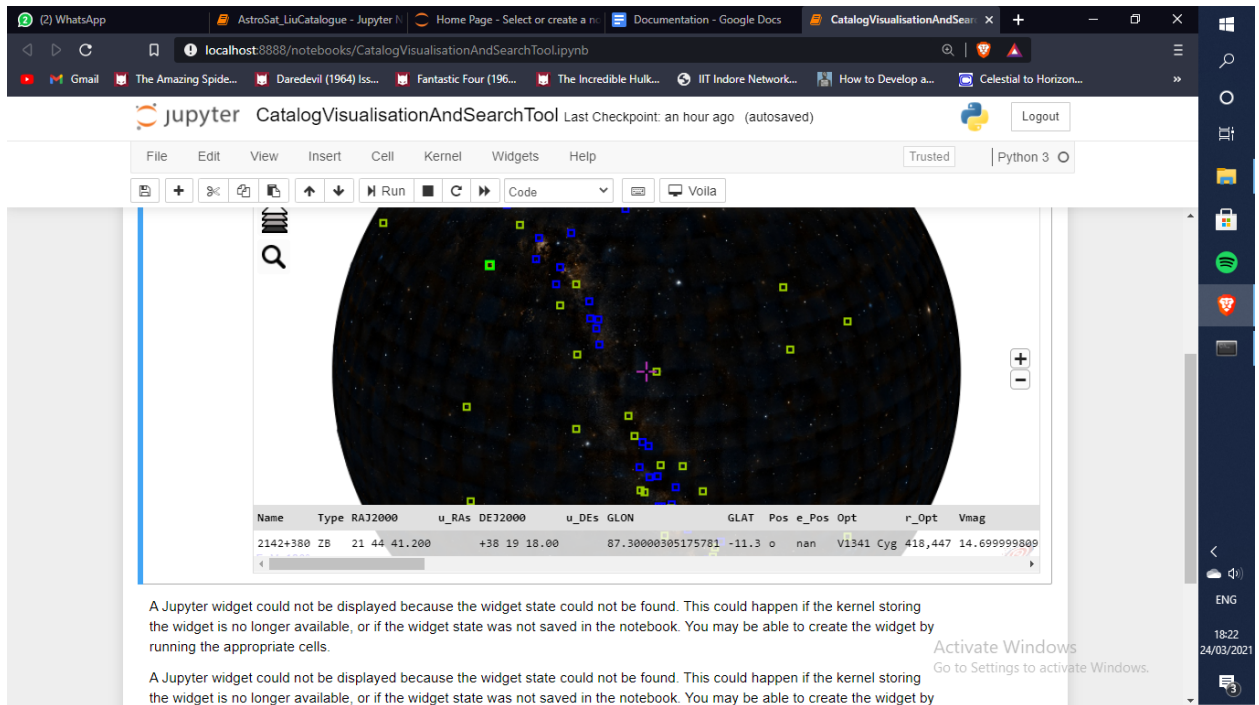




6. After adding all three files at proper places, run the next cell. This would take some time (~ 30 seconds) as the program calculates the correlations between added files and generates a list of objects to be displayed on aladin.



7. Zoom out and pan through to see the objects added from catalog A. The ones in blue are the objects from the hmxh catalog, while the ones in green are the objects from the lmxh catalog.
8. Select one of the objects. The pertinent related information from catalog A is displayed in a table at the bottom of the skymap.



9. If you want to search for the details and obtain them in a printable format. Execute the next cell. You'll end up with a search bar.

jupyter CatalogVisualisationAndSearchTool Last Checkpoint: an hour ago (unsaved changes)

Name	Type	RAJ2000	u_RAs	DEJ2000	u_DEs	GLON	GLAT	Pos	e_Pos	Opt	r_Opt	Vmag
2142+380	ZB	21 44 41.200	+38 19 18.00	87.30000305175781	-11.3	o	nan	V1341	Cyg	418,447	14.6999999809	

Enter the name of the object
 search
 Download (PDF)

- Copy the name of the object. In this case, '2142+380' and paste it into the search bar. Press the 'search' button.

jupyter CatalogVisualisationAndSearchTool Last Checkpoint: an hour ago (unsaved changes)

Name	Type	RAJ2000	u_RAs	DEJ2000	u_DEs	GLON	GLAT	Pos	e_Pos	Opt	r_Opt	Vmag
2142+380	ZB	21 44 41.200	+38 19 18.00	87.30000305175781	-11.3	o	nan	V1341	Cyg	418,447	14.6999999809	

2142+380
 search
 Download (PDF)

search

Download (PDF)

From the low mass x ray binary catalogue

```
(148, Name
Type
RAJ2000
u_RAs
DEJ2000
u_DEs
GLON
GLAT
Pos
e_Pos
Opt
r_Opt
Vmag
Vmag1
u_Vmag
B-V
u_B-V
B-V1
U-B
l_E_B-V_
E_B-V_
2142+380
ZB
21 44 41.200
NaN
+38 19 18.00
NaN
87.3
-11.3
o
NaN
V1341 Cyg
418,447
14.7
NaN
NaN
0.5
NaN
NaN
NaN
-0.2
NaN
0.45
```

11. You'll end up with a list of the details of the object in question, such as its name, its coordinates in different systems, its photometric data, alternative names, and orbital and pulse periods. These informations are dependent on the catalog one uploads, and aren't calculated by the application.
12. In the event that the object was present in the Astrosat catalog (catalog B) as well, you'll see related details from the Astrosat catalog mentioned as well.

Ra 326.172
Dec 38.3217
Name: 148, dtype: object)

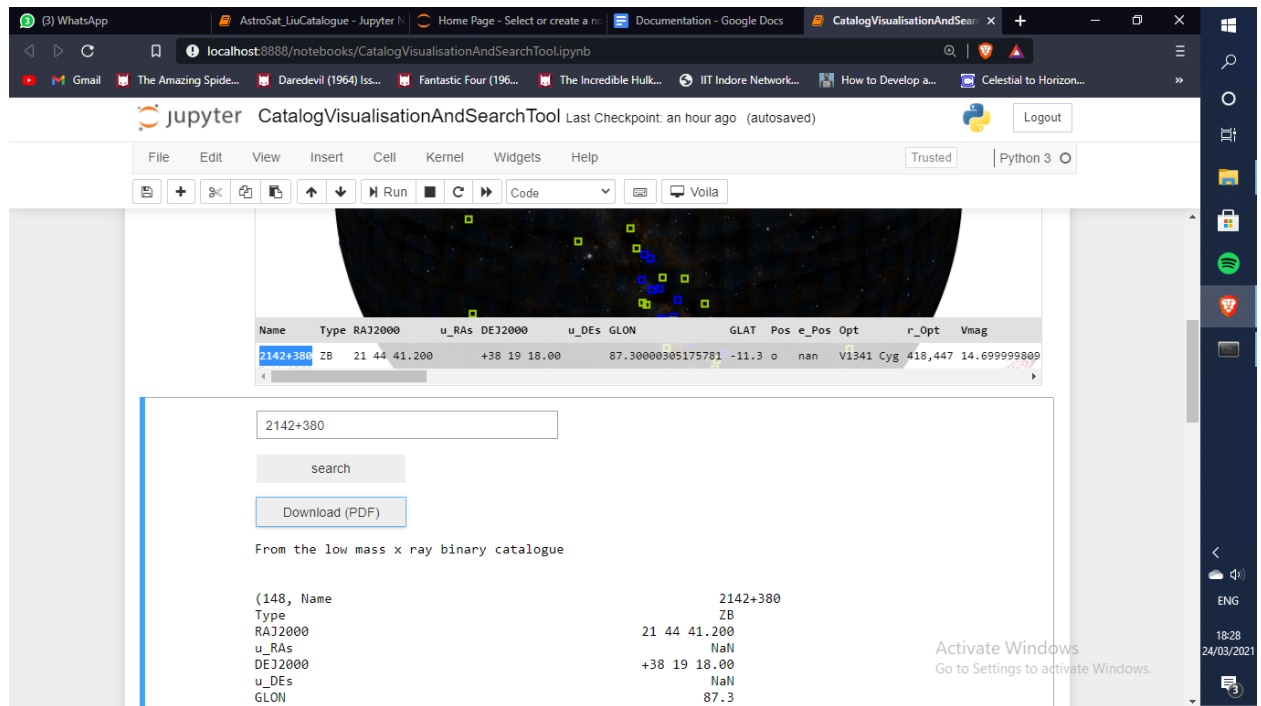
From the Astrosat catalogue

```
Unnamed: 0 347
Unnamed: 0.1 347
Sr.No 348
Date_Time 2019-07-29 16:08:02
U1 A06_002
U2 T02
CR1 326.171
CR2 38.3214
U3 A06_002T02_9000003064::Cyg X-2
I1 1axpc2
In A06_002T02_9000003064
Name Cyg X-2
Bibliographic_Codes 2021NewA...8301479D, 2020MNRAS....
Name: 347, dtype: object
```

From the Astrosat catalogue

```
Unnamed: 0 414
Unnamed: 0.1 414
Sr.No 415
Date_Time 2019-09-28 10:43:36
U1 A06_002
U2 T02
CR1 326.171
CR2 38.3214
```


13. Click on 'Download(PDF)' and you end up with a file on your desktop, thus saving the above details for future reference.

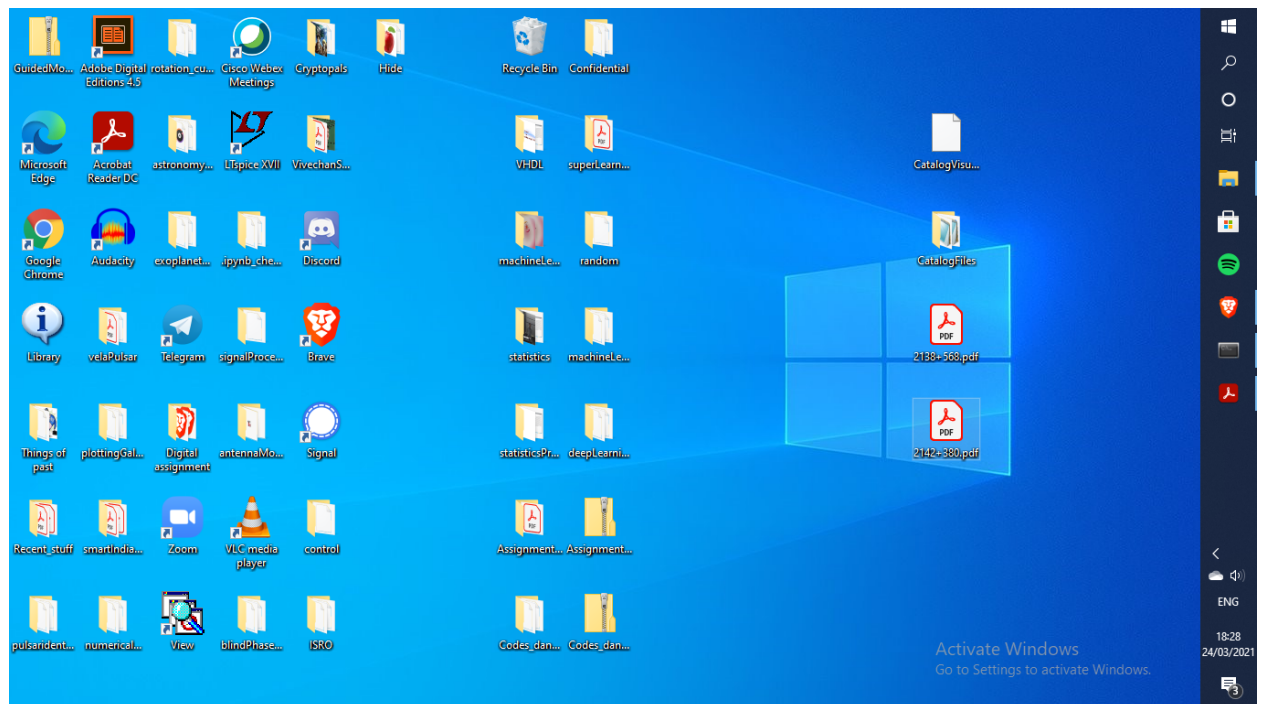


The screenshot shows a Jupyter Notebook interface with a search bar containing '2142+380'. Below the search bar is a 'search' button and a 'Download (PDF)' button. The text 'From the low mass x-ray binary catalogue' is displayed. Below this, a table of results is shown:

Name	Type	RAJ2000	u_RAS	DEJ2000	u_DES	GLON	GLAT	Pos	e_Pos	Opt	r_Opt	Vmag
2142+380	ZB	21 44 41.200	+38 19 18.00	87.30000305175781	-11.3	o	nan	V1341 Cyg	418,447	14.6999999809		

Below the table, the text '(148, Name)' is displayed, followed by a list of details for the selected object:

```
(148, Name
Type
RAJ2000
u_RAS
DEJ2000
u_DES
GLON
...
2142+380
ZB
21 44 41.200
NaN
+38 19 18.00
NaN
87.3
...)
```



The screenshot shows a Windows desktop with various application icons. A folder named 'CatalogFiles' is visible on the right side of the desktop, containing two PDF files: '2142+380.pdf' and '2142+380.pdf'.

2142+380.pdf - Adobe Acrobat Reader DC (32-bit)

File Edit View Sign Window Help

Home Tools 2142+380.pdf x

1 / 2 109%

From the low mass x ray binary catalogue

(148, Name	2142+380
Type	ZB
RAJ2000	21 44 41.200
u_RAs	NaN
DEJ2000	+38 19 18.00
u_Des	NaN
GLON	87.3
GLAT	-11.3
Pos	o
e_Pos	NaN
Opt	V1341 Cyg
r_Opt	418,447
Vmag	14.7
Vmagl	NaN
u_Vmag	NaN
B-V	0.5
u_B-V	NaN
B-VI	NaN
U-B	-0.2
I_E_B-V_	NaN
E_B-V_	0.45
I_E_B-V_2	NaN
E_B-V_2	NaN

Search 'Sign'

Export PDF

Adobe Export PDF

Convert PDF Files to Word or Excel Online

Select PDF File

2142+380.pdf

Convert to

Microsoft Word (*.docx)

Document Language: English (U.S.) [Change](#)

Convert

Convert, edit and e-sign PDF forms & agreements

Activate Windows

Go to Settings to activate Windows. Free 7-Day Trial

ENG

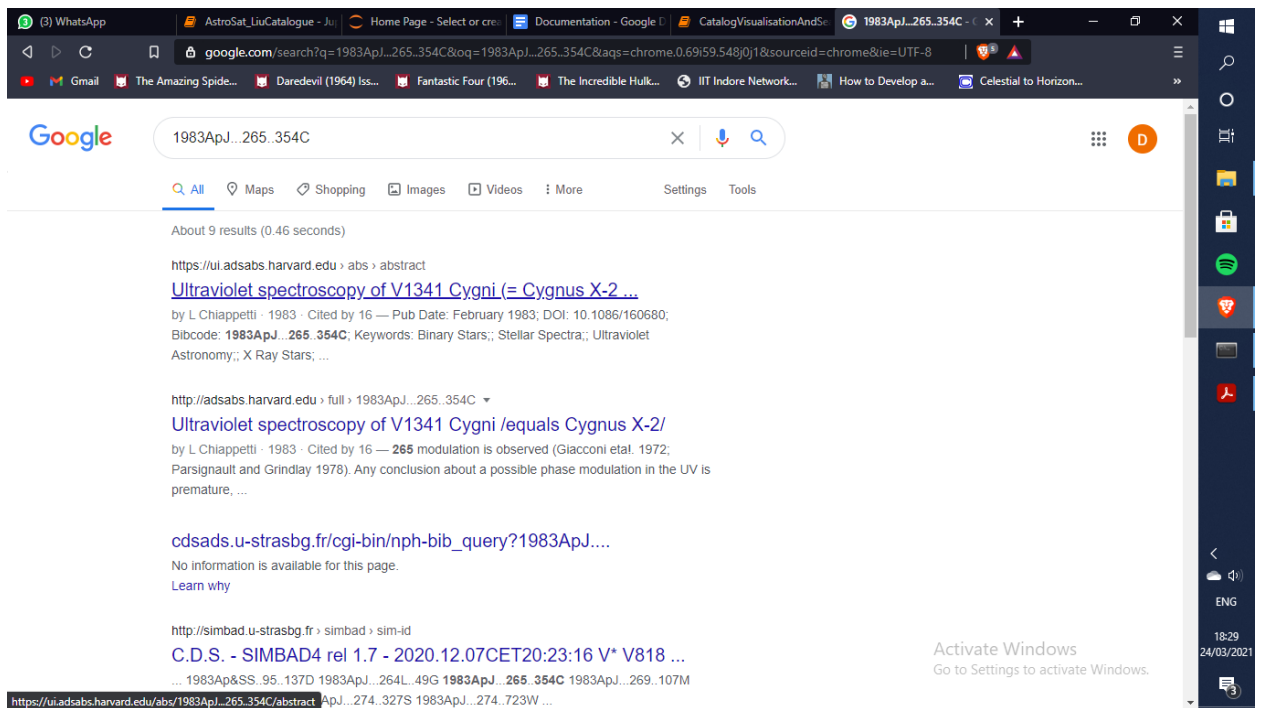
18:28

24/03/2021

14. Let's see how this data could be used. We can search for the relevant papers using the bib-codes.

The Jupyter Notebook displays a table of data for the object 1983ApJ...265..354C. The table includes various parameters such as r_Vmag, l_Fx, Fx, Fxu, Range, r_Fx, Porb, Porb2, u_Porb, Ppulse, u_Ppulse, r_Ppulse, Cat, SpType, Name2, u_Name2, Name3, BibCodes, Ra, Dec, and Name. The data is as follows:

r_Vmag	199,783,866
l_Fx	NaN
Fx	450
Fxu	NaN
Range	NaN
r_Fx	1399
Porb	236.2
Porb2	NaN
u_Porb	NaN
Ppulse	NaN
u_Ppulse	NaN
r_Ppulse	249
Cat	U,M,A,H,X,B,G
SpType	NaN
Name2	Cyg X-2
u_Name2	NaN
Name3	NaN
BibCodes	1983ApJ...265..354C-Chiappetti, L. et al.,1981...
Ra	326.172
Dec	38.3217
Name	148, dtype: object)
From the Astrosat catalogue	
Unnamed: 0	347
Unnamed: 0.1	347
Sr.No	348
Date_Time	2019-07-29 16:08:02
U1	A06_002
U2	T02



15. Now, if you want to search for the details of another object. You must rerun the last cell (which is a caveat and mentioned appropriately under it). Simply copying and pasting the names of the object, won't suffice.

WhatsApp AstroSat_LiuCatalogue - Jupyter Home Page - Select or create a n... Documentation - Google Docs CatalogVisualisationAndSea... x + -

localhost:8888/notebooks/CatalogVisualisationAndSearchTool.ipynb

Gmail The Amazing Spide... Daredevil (1964) Iss... Fantastic Four (196... The Incredible Hulk... IIT Indore Network... How to Develop a... Celestial to Horizon...

jupyter CatalogVisualisationAndSearchTool Last Checkpoint: an hour ago (autosaved) Logout

File Edit View Insert Cell Kernel Widgets Help Trusted Python 3

Run Code Voila

WhatsApp AstroSat_LiuCatalogue - Jupyter Home Page - Select or create a n... Documentation - Google Docs CatalogVisualisationAndSea... x + -

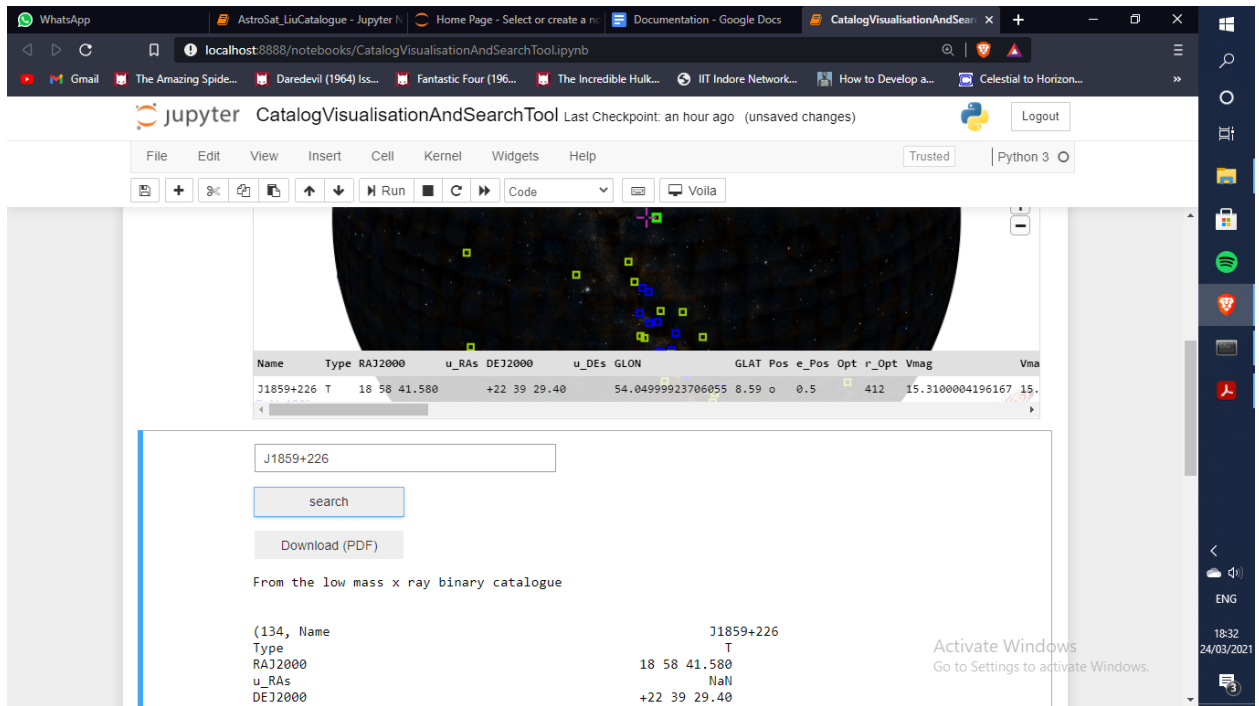
localhost:8888/notebooks/CatalogVisualisationAndSearchTool.ipynb

Gmail The Amazing Spide... Daredevil (1964) Iss... Fantastic Four (196... The Incredible Hulk... IIT Indore Network... How to Develop a... Celestial to Horizon...

jupyter CatalogVisualisationAndSearchTool Last Checkpoint: an hour ago (unsaved changes) Logout

File Edit View Insert Cell Kernel Widgets Help Trusted Python 3

Run Code Voila



Caveats

1. The code needs to have some minor adaptations before another catalogue could be added and visualised. This includes changing the number of upload buttons and the code for comparing the data between different catalogues (which requires you to have done some preprocessing if required as well). The changes are minor though, and different kinds of catalogues can be incorporated, compared and visualised.
2. The search bar needs to be run every time you want to search for the details of a new object from the catalog. Otherwise, the details of the old object shall remain unchanged, even when a new object name is added and the search button is pressed.

Future improvements

1. Higher flexibility as far as the addition of catalogues is concerned.
2. Eliminating the need to rerun the 'search cell' each time one requires to search for a new object from the same catalog.