INTRODUCTION TO ALADIN

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Within this use case you learn about Aladin's main features, each presented with examples taken from its most common use.

If used in the classroom this is a very simple exploration of the software tool that can be left to pupils provided with printed copies of the use case.

1. Introduction

This tutorial introduces in the basic use of Aladin. After having known the basilar functions, you can discover the more advanced ones trying using Aladin by yourself or, better, referring to the user guide or to the material available on the web site http://aladin.u-strasbg.fr.

2. Aladin

Aladin is an interactive sky atlas, developed and maintained by the Centre de Donnèes astronomiques di Strasbourg (CDS), allowing the user to visualize digitized astronomical images or full surveys, superimpose entries from astronomical catalogues or databases, and interactively access related data and information from the *Simbad database*,

the *VizieR service* and other archives for all known astronomical objects in the field.

Aladin has been designed in order to be used by professional astronomers as well as by amateur astronomers, students and the general public.

The user can locate data of interest, access and explore distributed datasets, visualize multi-wavelength data. The compliance with existing or emerging VO standard, interconnection with other visualization or analysis tools, ability to easily compare data are key topics allowing Aladin to be a powerful data exploration tool.

Aladin is available for free download from: https://aladin.u-strasbg.fr/java/Aladin9.0.jar.

In this use case we use Aladin in the *undergraduate* configuration that has been developed in the framework of the European project EuroVO-AIDA.

Start Aladin and select the option "undergraduate" from the menu

Modify -> user preferences -> profile -> undergraduate.

Restart Aladin in order to activate the option undergraduate.

3. Load data in Aladin

As soon as you open Aladin, the simplest way to load an image of the astronomical object of your interest is to write its name in the "location field" and press enter.
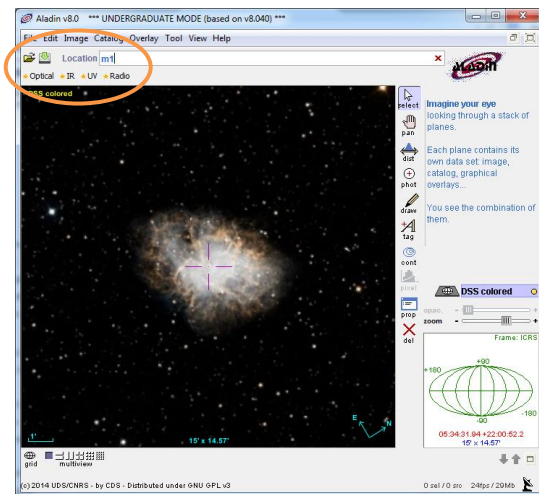

Fig. 1: main window of Aladin with highlighted the "location" field and the tabs "Optical", "IR", "UV" or "Radio".

You can write the name of the object or its coordinates.
A second way to load data in Aladin is to select one of the tabs "Optical", "IR", "UV" or "Radio" (fig. 1). In such a way you load the entire celestial sphere imaged in the selected wavelength, that means respectively visible light (optical), infrared, ultraviolet and radio (fig. 2)
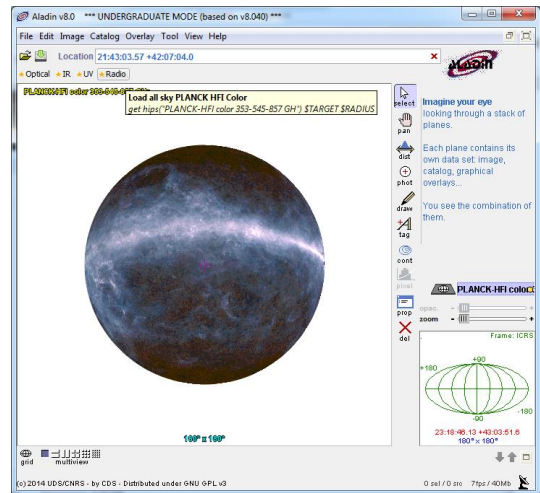

Fig .2: the radio sky loaded in Aladin.
If you need more options in order to load your desired astronomical image, or if you want to load a catalog, the solution is the server selector (fig. 3): click on the "folder" icon left of the location field.
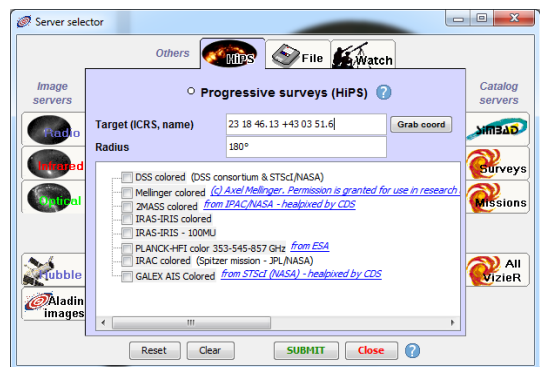

Fig. 3: server selector window.

At the top of the server selector window there are three tabs:
- **HiPS** – the "progressive" sky mode allows you to visualize a survey at any scales (from the whole sky to the resolution limit). It can be images, catalogs or density maps. Check the survey you want to visualize and click the submit button;
- **File** – allows you to load in Aladin your files or files on the web by inserting their link (e.g. http://apod.nasa.gov/apod/image/1412/M77-4_10m-RGB_final.jpeg);
- **Watch** – the watch option allows you to discover a specific class of

astronomical objects. The objects you select are superposed on a allsky map, so the suggestion is, first of all, to load a HiPS survey. Then you can select one or more classes of objects and press the submit button. For example, you can study the distribution of elliptical galaxies in the sky (fig. 4).

Near the name of each class of objects there are the *more info* and *example* link. *More info* opens in your browser the wikipedia page about that class of objects. *Example* loads in Aladin a demo image of one object belonging to that class.
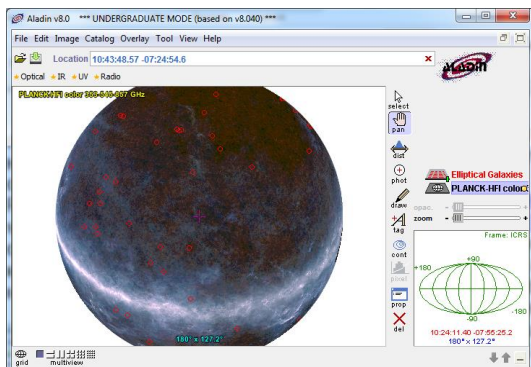

Fig. 4: distribution of elliptical galaxies in the sky (galaxy positions loaded in watch mode).

On the left side of the server seletor window there are the image servers:

- **Radio** – allows you to load an image in the radio wavelenghts;
- **Infrared** - allows you to load an image in the infrared wavelenghts;
- **Optical** - allows you to load an image in the visible wavelenghts;
- **Hubble** – allows you to search and load a press release image of the Hubble Space Telescope;
- **Aladin** – this is the most complete option, used often by professional astronomers, since it allows you to browse all the images on the Aladin server. Use it only if you need to load a very specific image of which you know details as field, survey, wavelenght, etc.

After having chosen the image server, you have to insert the target name (or its coordinates) and sometime some additional information as the search radius, image and pixel size, the survey, and then press the submit button.

Example: load an Hubble press release image of the Crab nebula (M1).

Open the server selector window -> select the Hubble tab

Enter "M1" in the target field and 14' as search radius -> pres submit

Select one entry, e.g. the Giant Hubble Mosaic of the Crab Nebula -> press submit

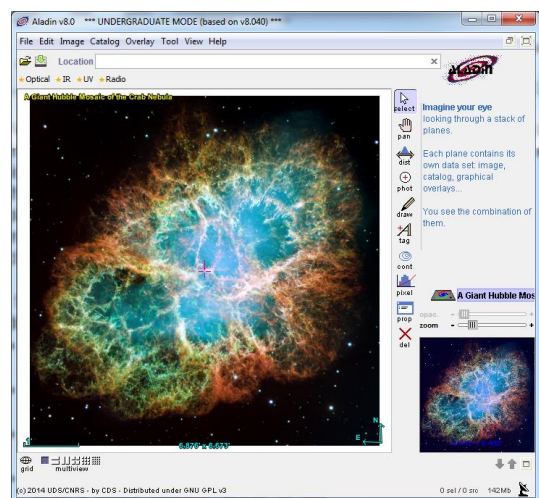*Wait few seconds and look at the image in the main Aladin window (fig. 5).*

Fig. 5: Hubble Space Telescope press release image of the Crab Nebula.

Aladin allows you to superpose a catalog on the loaded images. This option is very useful in order to find which celestial objects are in the field of view of an image and know some data about them. The catalog servers are on the right side of the server selector window:

- **Simbad** – allows you to load objects from the SIMBAD astronomical database, that contains information on more than 3000000 objects. Enter the target name and the search radius, select the filter you want to apply on the objects that will be visualized and press submit. The Simbad database is the option you will probably use more times to superimpose catalog data on your images;
- **Surveys** – allows you to load objects from some specific and well known surveys;
- **Missions** – allows you to see if there are observations taken by a specific instrument or telescope and load their footprints;
- **All VizieR** – allows you to load data from the whole VizieR archive of astronomical catalogs. This is the most complete option, used often by professional astronomers, since it allows you to browse more than 5000 catalogs. Use it only if you need to search and load a very specific set of data of which you know details as survey, wavelenght, etc.

Example: load data about x-ray sources in one degree around the the Crab Nebula.

Select the AllVizieR tab -> enter "M1" in the target field and "1 deg" in the radius field

Insert "x-ray" in the "Author, free text" field or select "x-ray" in the column "wavelenght" -> press submit

The list of all available catalogs whit data about x-ray sources around the Crab Nebula appears (fig. 6). Select one or more catalogs and press submit. Close the catalog list.

Fig. 6: list of available catalogs obtained in the VizieR service.

Look at the image of the Crab Nebula in the main Aladin window: catalog data are superposed as red and blue squares. If you select one or more of them, detailed informations are visualized below the image in table format (fig. 7).

Fig. 7: catalog data superimposed to the image and information on the selected ones visualized below the image in table format.

4. The stack

The stack, in the right part of the main Aladin window, shows all the downloaded data as a stack of "planes". Each image or catalog loaded in Aladin is a single plane in the stack. You can enable or disable a plane by clicking the plane logo in the stack.

You can move images and catalogs between planes by drag and drop them.

The user eye is on the top of this stack and sees all activated planes by transparency. Certain plane may be made semi-transparent so that planes below it in the stack may be seen. This is useful when comparing images.

The transparency level of an image can be changed by moving left and right the small slider on the plane logo. Moving to the left the transparency increases, moving to the right the transparency decreases. The transparency level can also be controlled by a larger slide bar in the image properties window (*right click on the image plane -> properties*).

If you want to see a catalog superposed on an image, the catalog has to be put in a plane above the image. Note that an image on top of the stack hides catalogues below it.

Example: load the x-ray image of the Crab nebula from the Hubble press release images and visualize it over the Giant Mosaic of the Crab Nebula loaded before.

Open the server selector window -> select the Hubble tab -> select Combined x-ray and optical images of the Crab Nebula -> press submit

Look at the stack: the new image has been loaded as a new plane on the top of the existing ones.

We want to set the Giant Mosaic as background image, so activate the corresponding plane by clicking on the small checkbox near the plane logo.

Now modify the transaprency level of the x-ray image by moving right its small slider: in such a way you see the Pulsar of the Crab nebula (a particular tipe of star visible in x-rays) superposed on the image of the whole nebula (fig. 8).
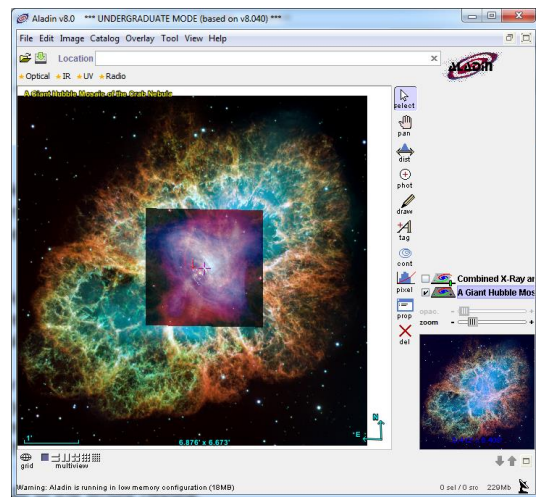

Fig. 8: Crab Pulsar superimposed on the image of the Crab Nebula.

For a more detailed description of the Crab Nebula see use case n. 8 here: http://vo-for-education.oats.inaf.it/eng_download.html.

5. Zoom

The zoom window, in the bottom right corner of the main Aladin window, shows the image area currently visible (blue rectangle) according to the factor of zoom and the center of the field of view.

You can modify the factor of zoom by moving left and right the zoom slid just above the zoom window.

6. Aladin tools

The main Aladin tools are located in the vertical tool bar on the right side of the main Aladin window. They are:

select - for selecting graphical additions: when Aladin displays graphical objects (e.g. sources from catalogs), it is possible to select some of these objects once the "*Select*" mode is activated. If this is not the case, click on the "*select*" button on top of the toolbar. Object

selection is done by clicking on it or by creating a selection rectangle that will encompass the targeted object(s) (click outside an object, drag and drop). Selected objects are highlighted with a small green square. If the selected objects are astronomical sources, then the associated measures will appear in the measure panel below the view.

pan - it is possible to move an image by using the *"pan"* button and then click and drag the image in the desired direction.

dist - allows you to draw a distance vector that measures the angular distance between two points on the image.

phot - over plots photometry measurements: click on a source to have its measurements, or drag and drop to have photometry of a circular region of your interest.

draw – allows you to draw on the image: drag and drop for hand drawings or click to append lines.

tag – over plots tag with/without labels.

cont – creates a contour map for your image (draws lines that encircle regions with the same luminosity). You can manually change levels in the contours plotting window that opens by clicking on the contour button (fig. 9).
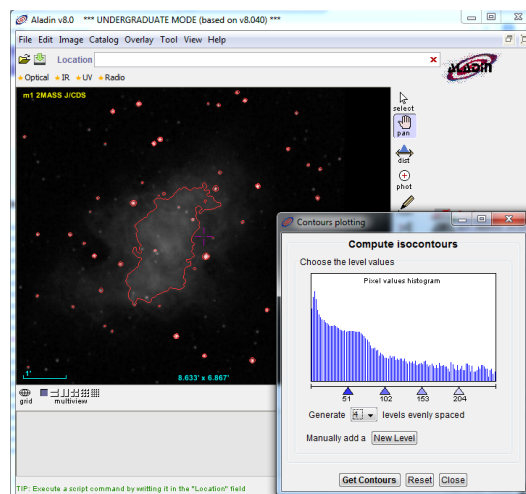

Fig. 9: contour map of the Crab Nebula and the contours plotting window.

pixel – allows you to adjust the pixel intensity visualization. You can increase and decrease the image contrast in order to have the best visualization: move the three triangles, or select a different function, on the pixel mapping window (fig. 10). By pressing the "reverse" button you obtain the image with reversed black and white colors. This last option is useful if you want to print the image with a white background color.
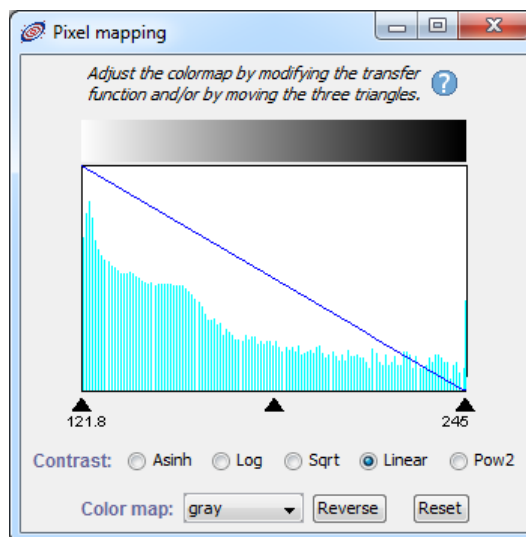

Fig. 10: the pixel mapping window.

prop - open the properties window for the selected plane.

 del – delete the selected plane.

7. Multiview

multiview

The multiview is a tool of Aladin very useful when you have to compare several images. The main panel can be divided in 2, 4, 9 or 16 sub-panels by clicking the multiview icons below the image in the main Aladin window. Each of these panels can display a different image and superposed graphical additions. These images can sample different regions of the sky or the same one. It is also possible to use different panels for a single image, for example in order to visualize different details of the image (fig. 11).
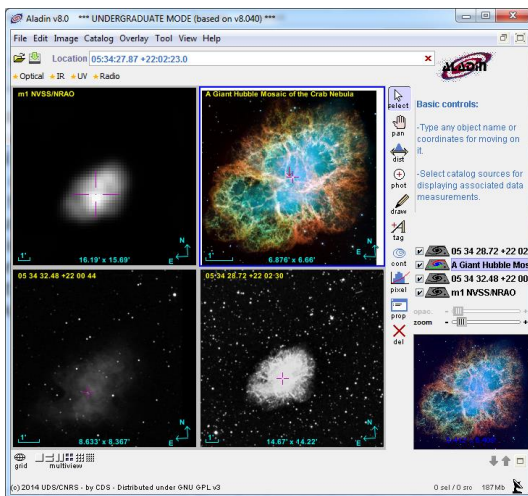

Fig. 11: four different images of the Crab Nebula visualized together in multiview mode..

8. Interaction with VO tools

Aladin connects to other applications, for example to tools that provide plotting capabilities or the display of spectra. You can open a tool from the *tool -> VOtool* menu and then send data to it without the need to save the data and open them in the new tool.

Example: send the data of x-ray sources around the Crab Nebuola to VOPlot (a plotting tool).

Open VOPlot from
Tool -> VO tools -> VOPlot

Right click on the x-ray catalog loaded before and send it to VOPlot by

Broadcast selected tables to -> VOPlot.

Now you can see the catalog data in the VOPlot window and work with them.

A more detailed example on the VOPlot usage is available in the usecase n. 5 at http://vo-for-education.oats.inaf.it/eng_download.html.

9. Print and export your work

In the *file* menu you have the two following possibilities to save your work:

- **Backup the stack** – create an Aladin file (.aj) with the whole stack of planes. The .aj file with your exported work can be opened in a new Aladin session from *File –> load local file.*
- **Print** – prnt the main window of Aladin as it appears on your screen.