# STELLARIUM FOR BEGINNERS

G. Iafrate e M. Ramella
INAF - Osservatorio Astronomico di Trieste

Information and contacts:  **http://vo-for-education.oats.inaf.it**  -  **iafrate@oats.inaf.it**

*Within this use case you learn about Stellarium'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

Stellarium is a free software that transforms your home computer in a planetarium. It calculates the positions of the Sun and the Moon, of planets and stars, and draws the sky how it would appear to an observer anywhere on the Earth and at any epoch. Stellarium can also draw the constellations and simulate astronomical phenomena such as meteor showers and solar or lunar eclipses.

Stellarium may be used as an educational tool for kids of all ages, as an observational aid for amateur astronomers wishing to plan an observing night, or simply to explore the sky. Stellarium shows a realistic sky, very close to what you see with naked eye, binoculars or telescope. Stellarium gives astronomical data (coordinates, magnitude, distance, etc.) of most of the celestial objects visualized on the screen.
You can freely download Stellarium from our site http://vo-for-education.oats.inaf.it or from http://www.stellarium.org

This guide introduces you to the basic use of Stellarium. Once you will have learned the basic functions, you will be able to discover the more advanced use of Stellarium by experimenting on your own with options and tools or even better by referring to the user

guide and the other documentation available on the site .

Note that you can interact with Stellarium either with the mouse or with the keyboard. In what follows we illustrate the use of Stellarium assuming you will prefer the mouse, but we also give the corresponding keyboard commands within square brackets.

## 2. Vertical Menu on the bottom left: options and search

**Your observing location** [F6]. Write the name of the town in the bar with the magnifying glass, e.g. Trieste, and confirm it by clicking on the correct town among those found by Stellarium. You can make this town your default observing place by checking "use as default". If your location is not contained in the database, or it is not a town, you can insert directly its terrestrial longitude and latitude. It is also possible to select the location by dragging the red arrow on the world map. This possibility allows you to easily verify how the motion of the celestial sphere changes depending on the location of the observer. You can easily move to the Poles (anywhere at the bottom or top of the world map) or to the equator (anywhere in the middle of the world map) and verify what happens going from the northern to the southern hemisphere.

We also point out the possibility to set your observing location on another planet of the solar system, or on a selection of its minor bodies. These choices, besides being fun, will help you to understand how the motion of the celestial sphere is related to the rotation and orbit of the solar system bodies.

**Time and date** of the observation [F5]. This function is really easy and needs no explanation.

**Sky and viewing options** [F4]. (Note that most basic functions in this window have a dedicated button in the bottom menus described in sections 3 and 4).

*Sky*: The basic options of this menu allow you to display the names of the planets (recommended) and to locate them more easily by marking them with small red circles. It is also possible to trace the orbits of planets on the sky [O].

Thanks to sliders it is possible to select how bright stars, nebulae and solar system bodies have to be in order to have their position marked with a label. By moving toward the right the slider the number of labels increases. You should be careful not to exaggerate with labels because they soon overlap becoming unreadable and cover a good fraction of the sky. In general, we advise to keep the default setup. It is important to label fainter stars only if your field of view on the sky becomes too small (high zoom level). In this case there may be no bright stars with labels at all.
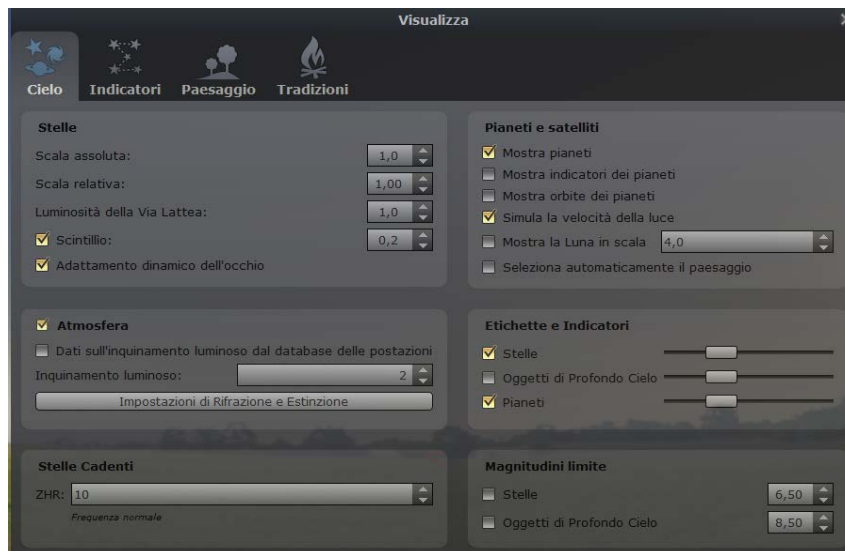
Fig. 1: finestra "visualizzazione e livello di dettaglio"

Finally, it is possible to simulate the effect of light pollution on the visibility of stars. You should check the atmosphere on, or [A]. Then, by selecting values between 1 and 9 on the scale in the light pollution section of the viewing option window, you will increase pollution from zero to maximum: the number of stars displayed on the sky will decrease accordingly. High light pollution levels are normal in towns or in any other illuminated place: the use of the correct light pollution level will help you to identify objects in the sky.



Fig .2: confronto tra due differnti livelli di inquinamento luminoso
(1 nell'immagine di sinistra e 9 in quello di destra)

To turn the effect of the atmosphere off is a very useful option, for example when you want to check in which constellation appears to be the Sun. In real life this is not possible because the atmosphere illuminated by the Sun is brighter than stars. To switch off the atmosphere is also necessary in order to follow orbital motions, e.g. those of Jupiter's moons. Usually in these cases you will also switch off the the ground [G] (see Landscape).

*Markings*: The menu you access by clicking this tab allows you to draw a number of lines and symbols that make it easier to use Stellarium and understand the sky. For example, if you are looking for planets it is convenient to draw the ecliptic, that is the apparent path of the Sun in the sky (also [ ,]). In fact all planets can be found close to this line since they all orbit around the Sun in the same plane. Other useful markings are those of the cardinal points (E)ast (S)outh (W)est (N)orth, (also [Q]) that are particularly helpful if you are trying to locate on the screen a small part of the sky that you are observing. Finally, by checking

"show art" (also [R]) you can draw the figures associated to the names of the constellations. Even if this option of Stellarium is fun to use and it may help to memorize the names of the constellations, it clutters the view of the sky for all other purposes.

*Landscape*: The main option in this menu is to display/hide the ground, i.e. the horizon [G], and the fog [F]. This option is often very useful in order to follow celestial bodies independently of their being above or below the horizon. It is commonly used with the option to simulate or hide the presence of the Earth's atnmosphere [A], see our description of the "Sky"menu.

*Starlore*: The options in this window allow you to compare the figures that cultures have seen in special configurations of stars that not always are the same of our Western constellations.

**Search window** [F3]. Write the name of the object to be displayed, e.g. Moon, Jupiter, M31, etc. Stellarium will find it and center it on the screen. If you want this object to remain in the center independently of Earth's movements you should block it with , or [blank] (see below).

**Configuration window** [F2]. The only elementary option available in this window is the choice of the language.

## 3. Horizontal Menu on the bottom left

The buttons of this menu are all on/off switches with the exception of "center selected object".

Draw constellation lines [C]

Write constellation names [V]

Draw the figures associated to constellation names [R]

Draw the grid of equatorial coordinates, those usually listed in catalogs [E]

Draw the grid of horizontal coordinates, needed in order to find, or catalog, objects in the sky [Z]

Display ground and horizon [G]

Display cardinal points (East South West North) [Q]

Simulate the effect of the terrestrial atmosphere [A]

Display the names of nebulae [N]

Display the names of planets [P]

Center the object you selected with the mouse and block it there [Spazio]

Set full-screen mode [F11]


## 4. Horizontal Menu on the bottom center

Slow down the time. Keep pushing the button in order to reverse time direction and to start accelerating toward the past  [J]

Stop/Start time at its normal rate [K]

Set the current date and time  [8]

Accelerate the passing of time. More clicks will accelerate further [L]

Exit Stellarium [Ctrl] Q

## 5. Move the sky

Use the arrows in order to view the sky in different directions.
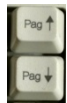
Use Pag ↑ e Pag ↓ in order to widen or narrow your field of view, i.e. zoom out and zoom in. By zooming out you can enjoy a panoramic view of the sky, up to the point where you will see the whole sky above your location. If you zoom out you magnify a region of the sky as you would do using a telescope or the tele-lens of a photographic camera.

You can move the sky also by clicking and dragging your mouse; you can also use the mouse wheel in order to zoom.

## 6. More options

S creates a file with the image of the window of Stellarium (screenshot). The names of the files will be stellarium-000.png, stellarium-001.png, etc. By default, these files are saved on the Desktop. If you want to make printed copies of the screenshot, it is convenient to go open the configuration window, select the Tool tab and check "invert colors". The screenshot file will have a white sky with dark celestial bodies with a significant saving of printer's ink and with a better readability of the hardcopy.

You can select an object by clicking on it with the left button of the mouse. The selected object will be marked with a small circle with four ticks. When you select an object, its basic data will appear in the upper left corner of the window. Yu can unselect the object by clicking on an empty part of the sky with the right button of the mouse.

## 7. Examples (Questions and Answers)

Q:      I am in Turin, Italy, on April 26, 2015. Will the Moon shine tonight at 9pm? If so, what will be its phase?

A:      Open the window ⬚ or [F6] and search for Turin in the database of Stellarium. Check with a click the found town of Turin and close the location window. Open the window ⬚ or [F5] and set the date and time: 2015/4/26 and 21:00:00. Close also this window. The default field of view (if you just started Stellarium) is in the South direction and the Moon is not visible. Open the window ⬚ or [F3] and type "Moon". Stellarium will move the viewing window toward the vertical point (zenith) and select the Moon, well visible high on the horizon. The altitude of the Moon on the horizon is 55° as it can be read in the top left corner of the display where both azimuth and altitude above the horizon (horizontal coordinates) are reported together with more information. In order to find out the phase of the Moon, block it at the center of the screen with ⬚ or [blank] and magnify it with the mouse wheel or with [PageUp] until you can see it well. The Moon is in the first quarter. This is the phase preceding full Moon. In order to verify it, keep the Moon blocked

and accelerate the passing of time with ⏩ or [l]. To increase the speed of time click several times on ⏩. Days will pass extremely fast and the Moon will very quickly rise above and set below the horizon. In order to follow the phase of the Moon it is convenient to switch off atmosphere and ground with ☁ and 👥 or [a] and [g]. Finally, note that the Moon oscillates rapidly because we observe it standing vertically in our position in Turin (horizontal coordinate system). If we imagine to be able to follow the Moon as a telescope does on its equatorial mount, i.e. to stand parallel parallel to the rotation axis of the Earth, then it will be the ground, that we do not see, to oscillate while the Moon will stand still at the center of the screen. In order to switch to an equatorial mount it is enough to click on 🌀 or [Ctrl] M.


Fig. 3: The sky seen from Turin on April 26 at 9 pm

Q:     I am in Trieste on January 15, 2015. What is the very bright celestial body I see at sunset, low on the horizon in direction West?

A:     Open the window ✳ or [F6] and search for Triest in the Stellarium database. Select Triest with a click and close the window. Open the window 🕐 or [F5] and set the date: 2015/1/15 and time: 17:00. Close this window too and click and drag the sky toward W, or find the direction of sunset searching for the Sun. The brightest celestial body in that region of the sky is the planet Venus.

Q:     In which direction should I to point my binocular in order to observe M31, the Andromeda galaxy?

A:     Open the window 🔍 or [F3] and type M31. Turn the wheel of the mouse until the image of the Andromeda galaxy is large enough to be certain that we have selected the correct object. In order to find M31 with the binocular use altitude and azimuth as given in the information list on M31 (top left corner of the screen). These coordinates are angles measured along the horizon starting from N in direction E (azimuth) and from the horizon toward the zenith along the meridian passing through M31 (altitude). Alternatively, use the mouse wheel to zoom out M31 until a few constellations appear in the field of view. Identify constellations with their lines, 🟦 or [C], and possibly with their names, 🟦 or [V]. Note that M31 lies between two constellations that are easy to recognize in the sky, Cassiopea and Andromeda. In particular M31 is found near an imaginary line linking the two stars α Cas

and δ And, slightly closer to this last star. With this information and with the large field of view of binoculars it should be easy to find M31 on the celestial sphere (in a dark night!).

Q:      I am in Ferrara and I wish to photograph the Sun as it rises on October 19, 2015. In which direction should I point my camera?

A:      Open the window  or [F6] and search for Ferrara in the list of locations of the Stellarium database. Select Ferrara with a click and close the window. Open the window  or [F5] and set the date:  2015/10/19. Move the field of view toward E with the arrows or by clicking and dragging the mouse. You will easily spot the Sun (in case it is not yet above the horizon, set a proper time in the time and date setting window). Select the Sun and use repeatedly the button  or [J] and invert the direction of time. Stop the apparent motion of the Sun with  or [K] as it gets close to the horizon and read the time from the horizontal window at the bottom of the screen and the azimuth from the information on the Sun. For a more precise determination of the time of sunrise, eliminate the atmosphere with  or [A] and change time using the time setting window. The Sun begins to be visible above the trees around 7:55 am – 8:00 am with an azimut 107° (corresponding to 17° from East to South). The official time of sunrise in Ferrara on the destre date is 7:34 am with azimut = 103°. For an even better determination of sunrise with Stellarium, you can use directly the horizontal coordinates of the Sun that are listed once you select it with the mouse.

Note: Other use cases that may  help you to familiarize with more advanced options of Stellarium can be freely downloaded from http://vo-for-education.oats.inaf.it.