

Verification of Dark Matter
Mission Chief's Document
- PHYSICS -
NovaScience

Mission Chief's Document



Background

You are a group of scientists specialized in the detection of dark matter in space.

Your mission: **To send your pilot to the space station to get information about several stars.** In exchange, NASA will give you information on five stars from the galaxy UGC 11748, a galaxy we have strong reason to believe contains dark matter.

The team will have to first prove their competencies by carrying out several simulations **before blasting off to the space station.**

To accomplish the mission, the pilot, mission chief and engineer will have to work together and pool the complementary information available to them.

Good luck!

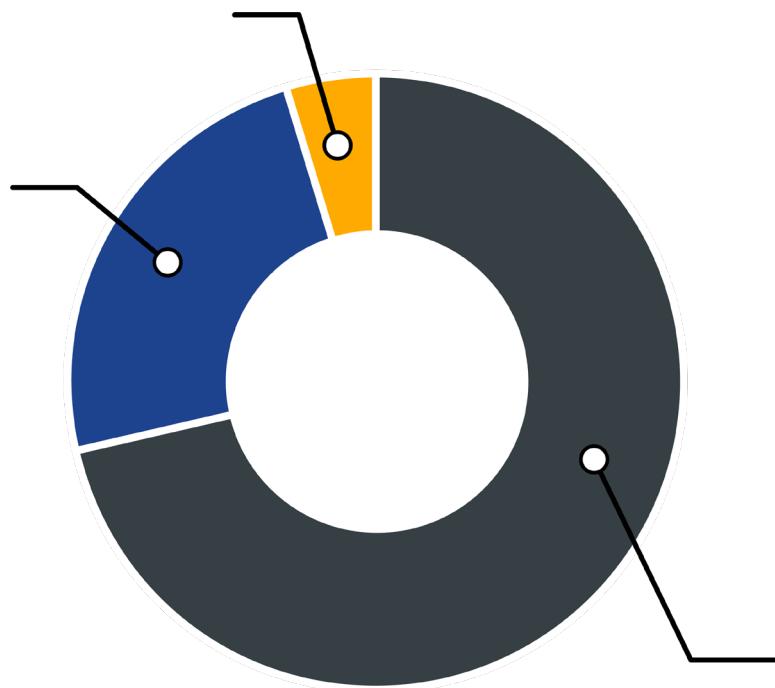


Composition of the Universe



Preliminary step

Help your pilot by searching for the missing information on the web in order to advance.



71.4 %

4.6 %

24 %

Atoms

Dark matter

Dark energy

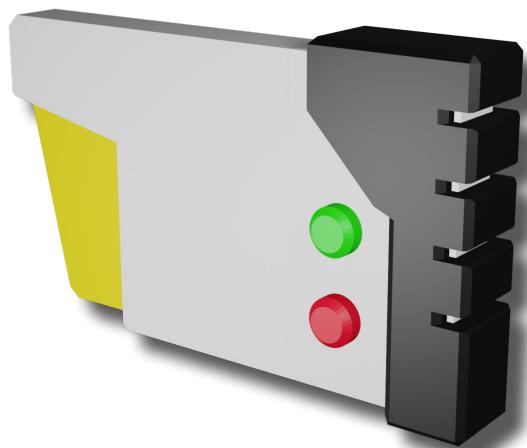


* Use your mobile device to find the answers faster.

Composition of the Universe

Access card

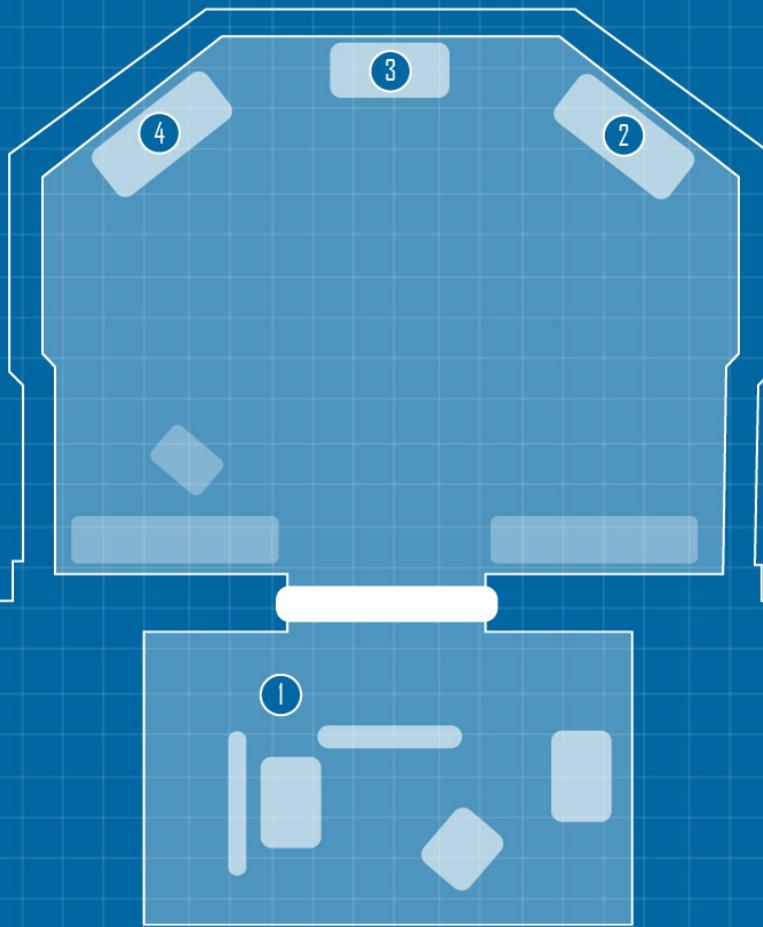
When your pilot provides the missing information, he or she will have to go pick up the access card in order to move to the next step.



Control base

Now you have access to the control base. The next pages will guide you through the tasks that will allow you to launch your rocket to the space station.

CONTROL BASE BLUEPRINT



LEGEND

- (1) STUDY ROOM
- (2) PILOTING SIMULATION STATION
- (3) VALIDATION STATION
- (4) CELESTIAL ANALYSIS STATION

Control base: Launch energy formula

Your pilot should have opened the door to the rocket launch control room.

The first step is to confirm the algebraic formula for the initial energy required, which you calculated **on page 7 of the preparatory document**.



Using this formula, you will be able to determine the initial energy required for the launch. First you will have to perform the tasks at each station to determine the values required to calculate the initial energy required to reach the space station.

Control base: Piloting simulation

Piloting simulation station (Station 2)

The purpose of this exercise is to test the piloting skills, using a simulation.

The goal is simple: using the joystick, turn the vessel toward the specific sector of space to see the following constellation:

Aries

At this station, the pilot has to use the joystick to turn toward the constellation mentioned.

You can assist the pilot using the maps provided at the end of this document.

Once your pilot has turned the vessel toward the sector, the piloting skills test is confirmed and the screen to the pilot's left will display some of the information required to calculate the energy. Namely:

- Speed of the space station
- Radius of the Earth
- Mass of the rocket

Write down these values on page 3 of the Engineer's Document so the engineer can calculate the required energy once you have all the information you need.



Control base – Celestial analysis

Station 4 - Celestial analysis station

Your pilot must identify the star Shadir from the Cassiopeia constellation.

To do this, the pilot can manually point at it.



Once your pilot has identified the star, the celestial analysis test is confirmed and the screen will display some of the information required to calculate the energy.

Namely:

- Mass of the Earth
- Orbital radius of the space station
- Earth's rotation speed

Write down these values on page 3 of the Engineer's Document so the engineer can calculate the required energy once you have all the information you need.

Verification station

By this step, you should have the information you need to calculate the energy required for the launch. Namely:

- Radius of the Earth
- Mass of the Earth
- Mass of the rocket
- Speed of the space station
- Rotational speed of the Earth
- Orbital radius of the space station

Now you can calculate the energy required for the launch (W_{nc}). Once you have this information, your pilot will be able to confirm the value using the verification console.



Docking sequence

To begin the launch sequence, your pilot will have to grasp the control arm.



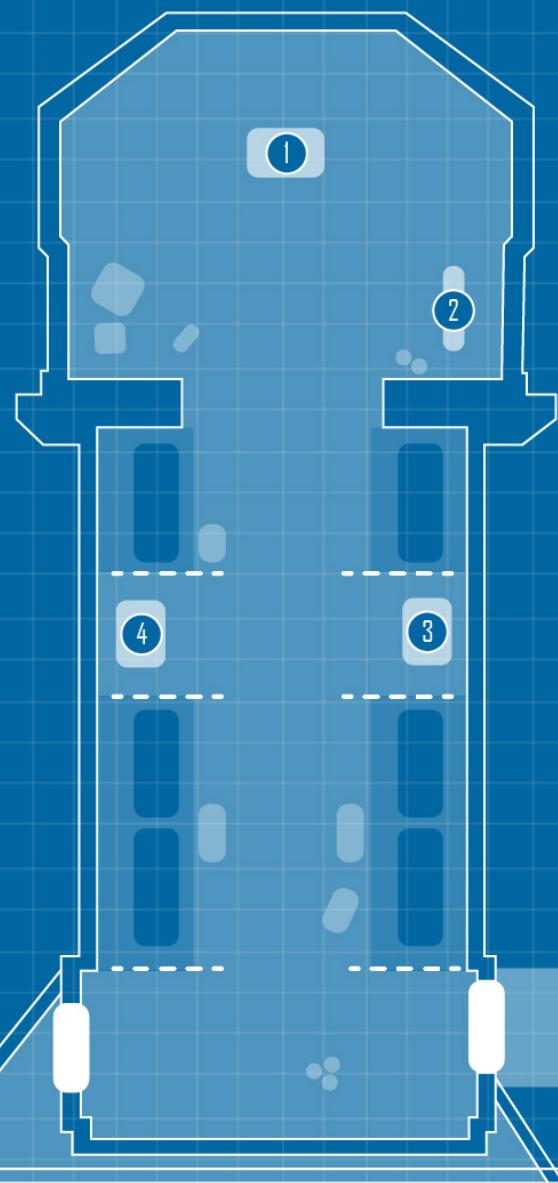
Once the rocket is close enough to the space station, carefully check the graphs showing the energy variations. Then you can begin the docking sequence by pressing on this button.



Space station

You are now aboard the space station. The next pages will guide you through the tasks you have to perform in order to complete your mission.

SPACE STATION BLUEPRINT



LEGEND

- (1) PILOTING STATION
- (2) ANALYSIS STATION
- (3) SECTORIZATION STATION
- (4) ARTIFICIAL GRAVITY
- (5) SHUTTLE AND PORT

Space station

The pilot's mission, after boarding the space station, is to collect information about the five stars and communicate it to NASA, which, in exchange, will give you information about galaxy UGC 11748, which you have good reason to believe contains dark matter.

NASA will communicate the orbital radius of these stars, which your pilot will pass along to you so you can calculate the stars' speed based on the known mass of that galaxy, using the formula determined on page 10 of the preparatory document.

Your pilot will enter these speeds into the onboard computer in order to compare them to the observed speeds. This operation will allow you to generate a 3D hologram of the distribution of dark matter in the galaxy, in order to complete your mission.

In brief, the tasks to be performed in the space station are:

1. The pilot finds each of the stars requested by NASA, shown on the next page, by pointing at each star.
2. The information about each star is transmitted automatically, and the information received from NASA appears on the analysis station's left screen.
3. The engineer takes note of this information in order to calculate the star's speed.
4. The pilot enters the calculated speed in the computer to the left of the analysis station.
5. When all the values have been sent to the computer, the results will be compiled in the form of a hologram.

Space station

Stars to find for NASA

Name of the star	Name of the star in Latin	Constellation the star is in
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Shedir	<i>Alpha Cassiopeiae</i>	<i>Cassiopeiae</i>
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Hamal	<i>Alpha Arietis</i>	<i>Aries</i>
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Spica	<i>Alpha Virginis</i>	<i>Virgo</i>
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Vega	<i>Alpha Lyrae</i>	<i>Lyra</i>
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Sirius	<i>Alpha Canis Majoris</i>	<i>Canis Majoris</i>
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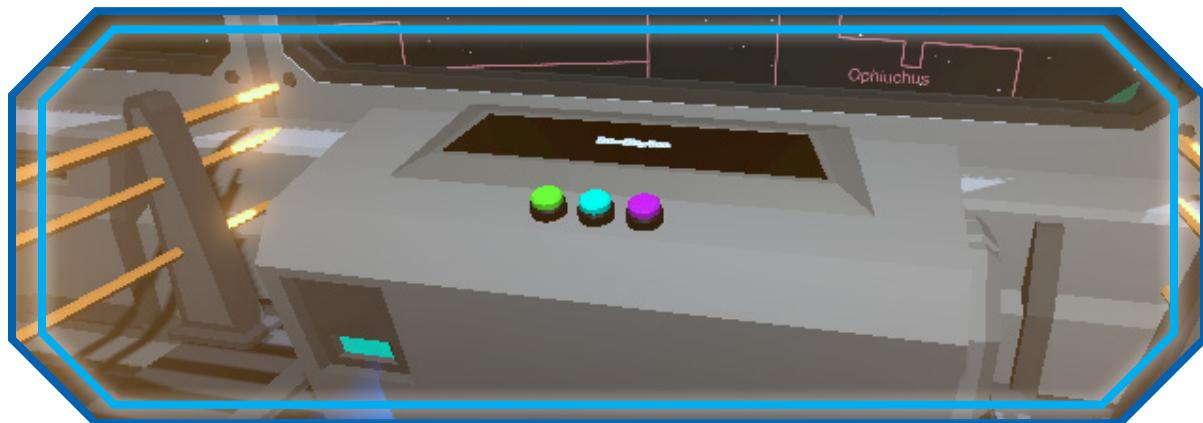
Space station

Before you can gather the information about these new stars for NASA, your pilot will have to find the star in the sky and analyze it using the equipment.



To help you find these stars, you can display the star chart containing the names of the stars and constellations, using the buttons on the sectorization station. Make sure you activate this tool before you start your search.

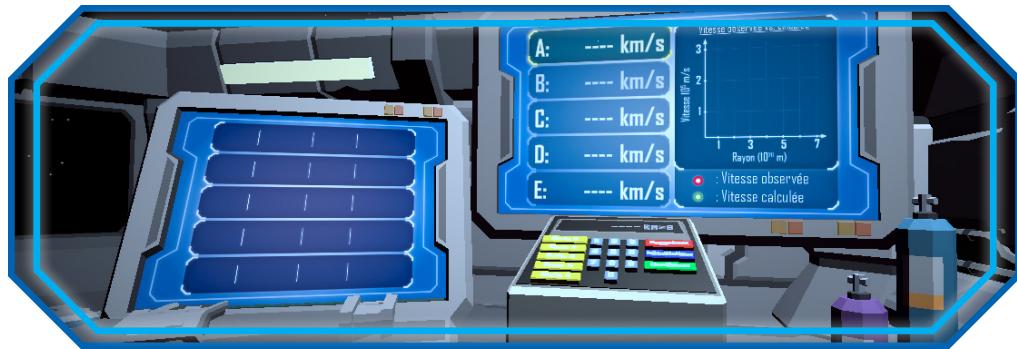
The stars to find may be anywhere around the space station, including in the regions of space you could not see when you boarded. Use the piloting station to reorient the space station, as you did in the piloting simulation.



Space station

When your pilot points to a star, the values are automatically transmitted to NASA, which, in return, will display the data you need on the analysis station's left screen. Your pilot will be able to communicate this information to you.

As you receive the information, you can start calculating the star speeds. Your pilot will be able to enter the star speeds you calculate into the onboard computer (seen below) to compare them with the observed speeds.



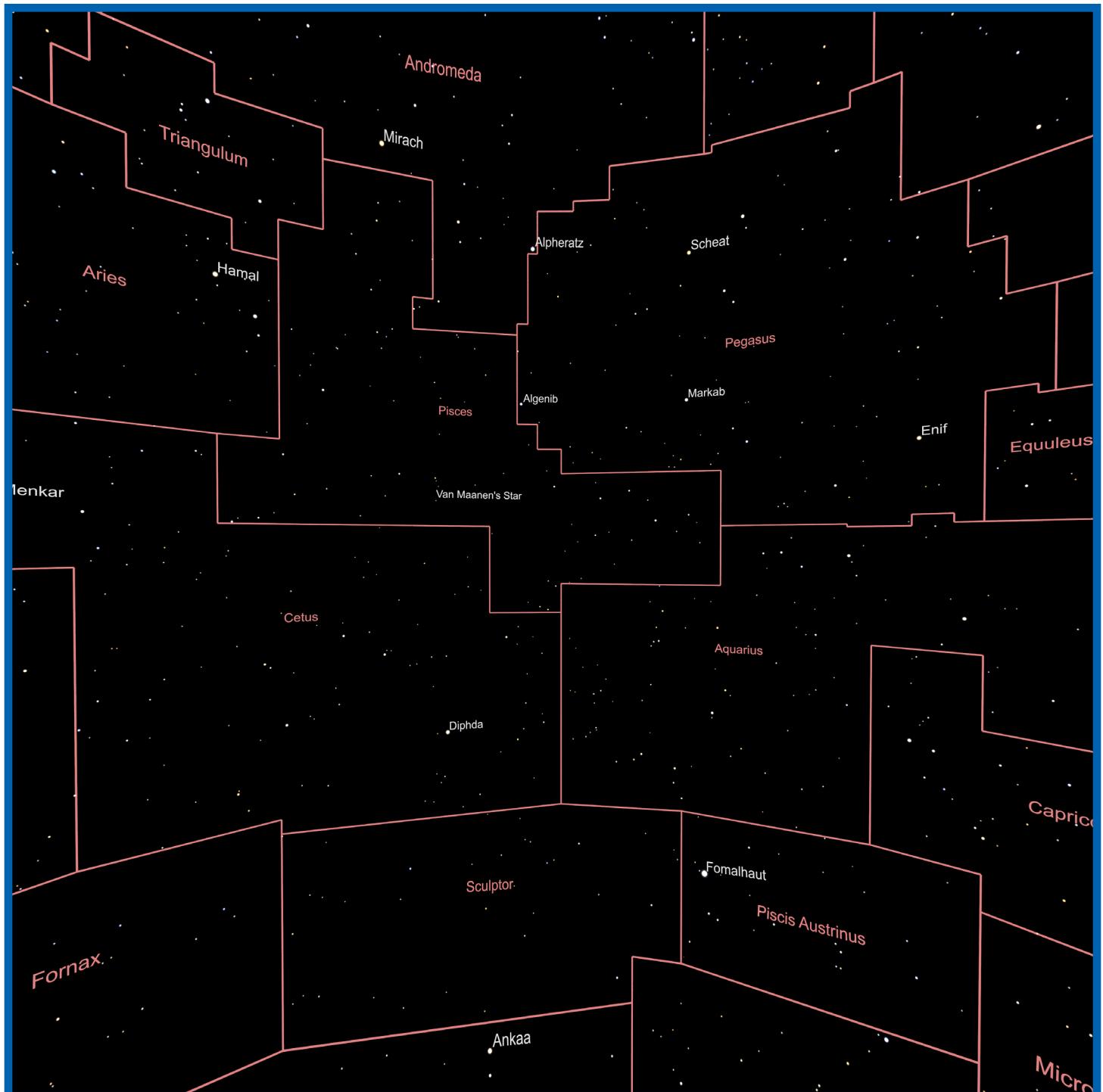
Reminder of the steps:

- 1- The pilot finds each of the stars requested by NASA by pointing at each star.
- 2- The information about each star is transmitted automatically, and the information received from NASA appears on the analysis station's left screen.
- 3- The engineer takes note of this information in order to calculate the star's speed.
- 4- The pilot enters the calculated speed in the computer to the left of the analysis station.
- 5- When all the values have been sent to the computer, the results will be compiled in the form of a hologram.

Space maps

Here are visible the constellations of :

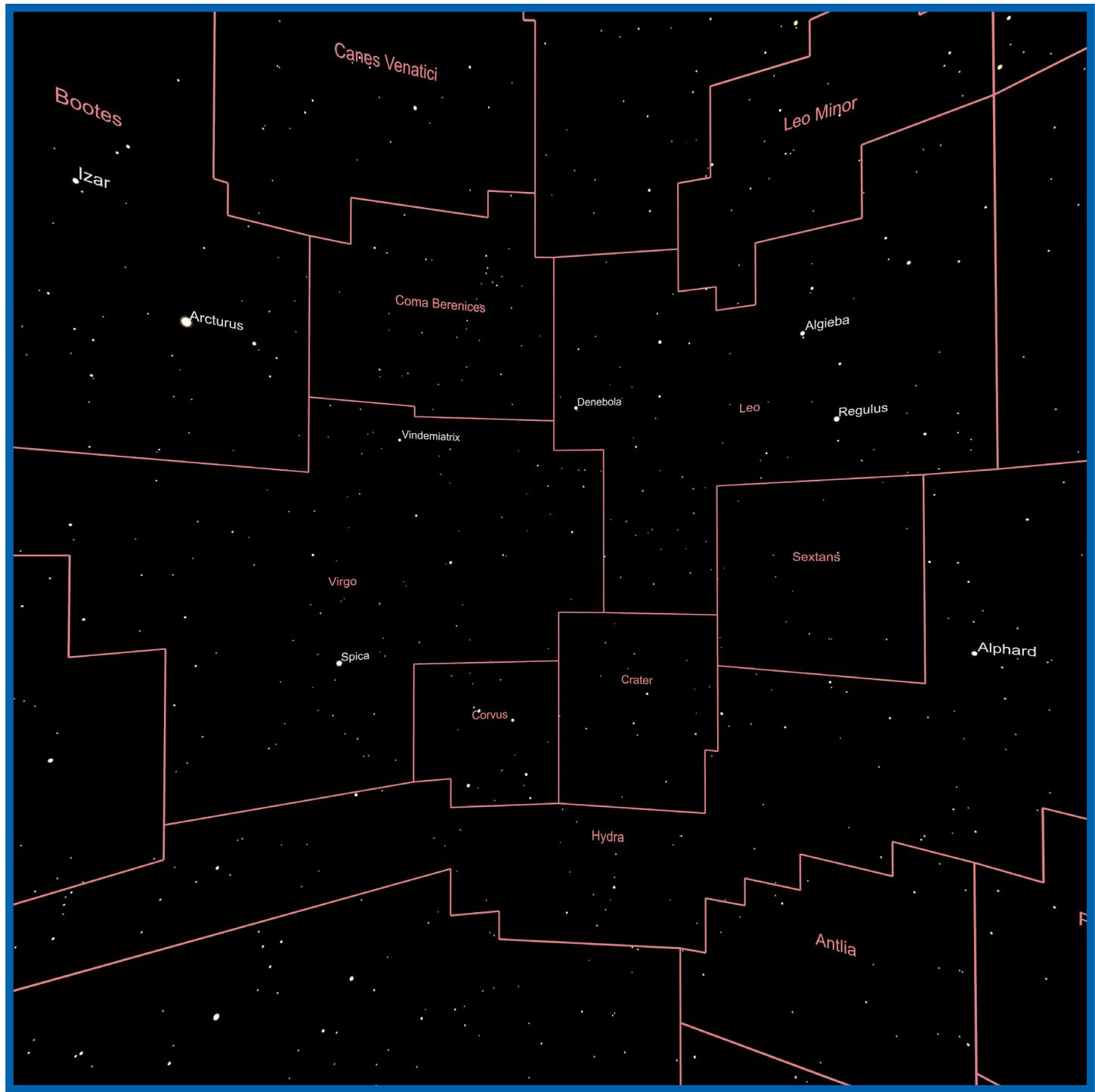
Andromedae and Aries



Space maps

Here is visible the constellation of :

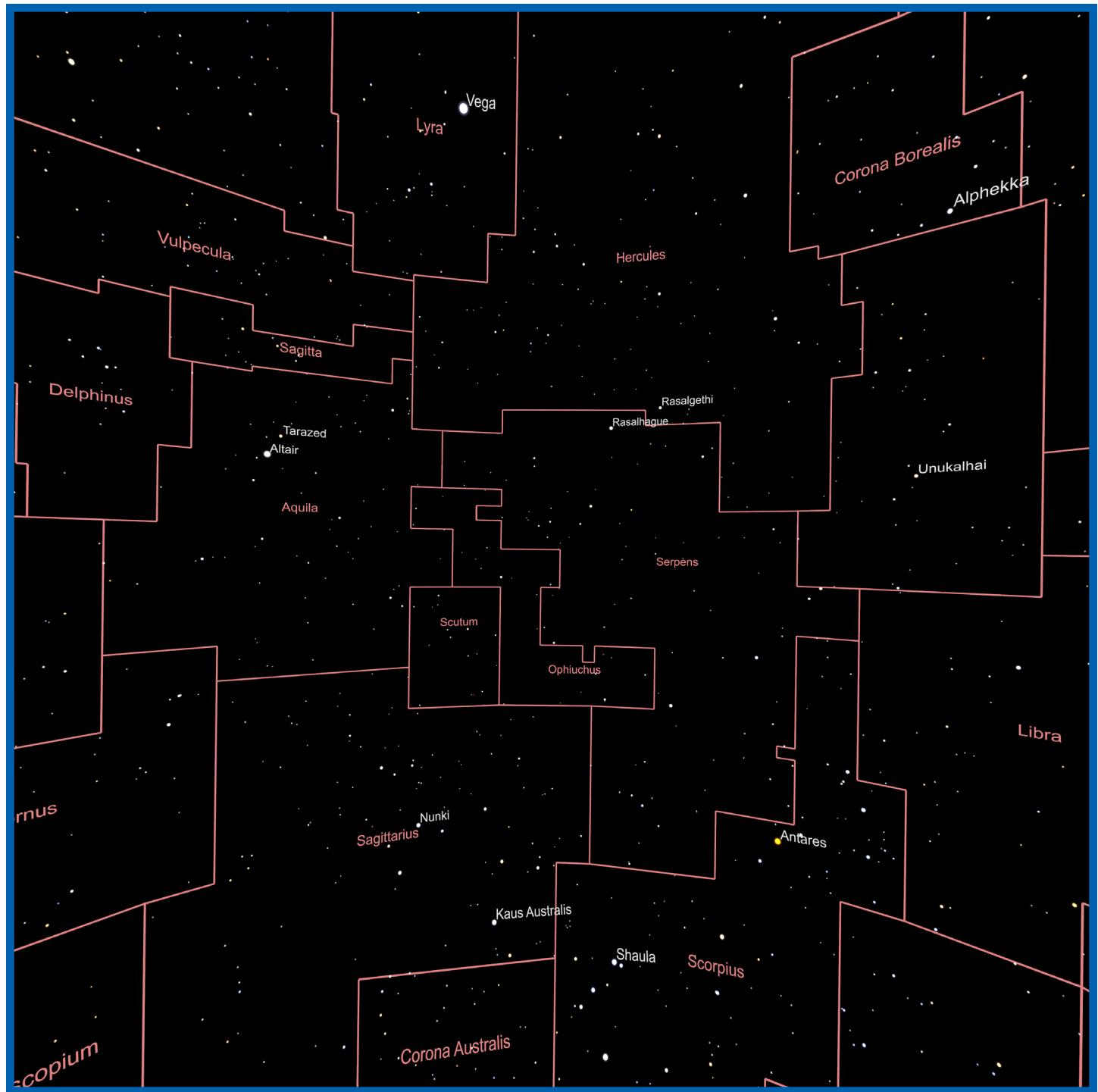
Virgo



Space maps

Here is visible the constellation of :

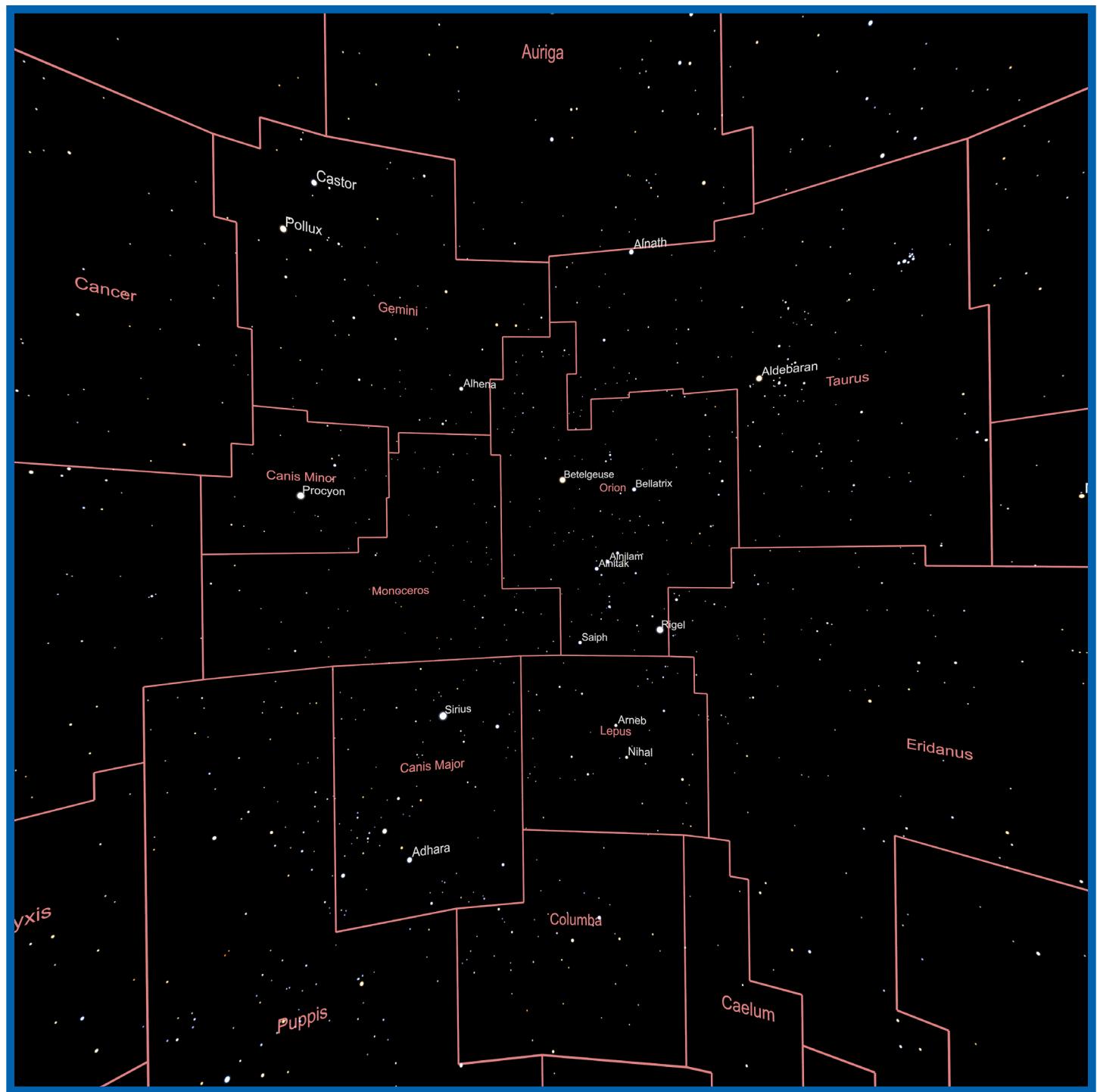
Lyra



Space maps

Here is visible the constellation of :

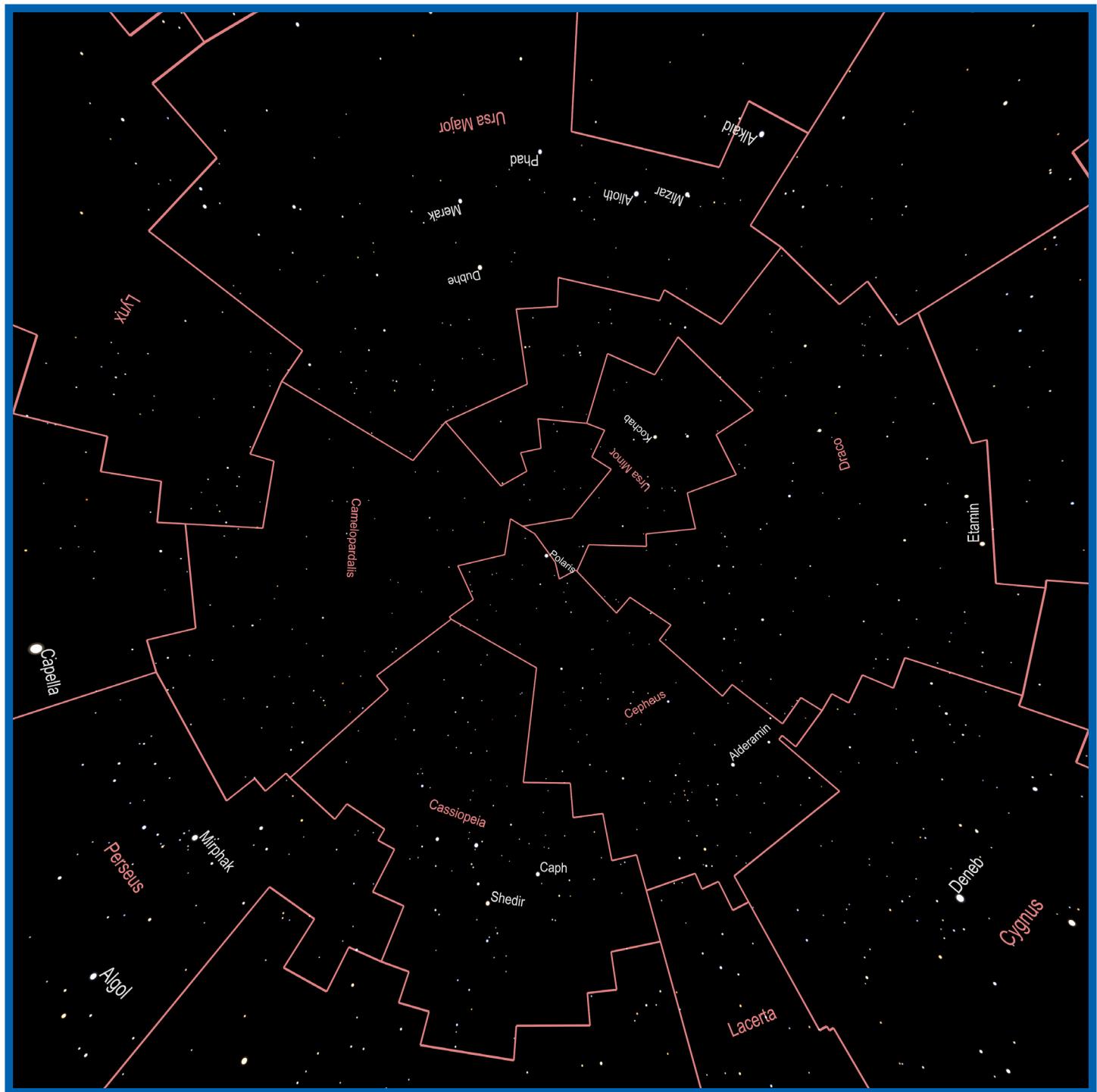
Canis Majoris



Space maps

Here is visible the constellation of :

Cassiopeiae



Space maps

