DeepL

Subscribe to DeepL Pro to translate larger documents.
Visit www.DeepL.com/pro for more information.

EXPLOITER LA BASE DE DONNÉES

EXOplanet.eu

This database presents the latest detections and data announced by professional astronomers on exoplanetary systems.

It lists objects lighter than 60 times the mass of Jupiter, in orbit around stars, in binary systems or free-floating, as well as circumstellar disks.

InTRODUCTIOn

1. Go to the "plots" tab on the exoplanet.eu website and use the appropriate tool to produce a histogram of the number of exoplanet discoveries over time.

2. Explain the variations observed. If necessary, you can use the Internet to find the dates of certain missions or instruments.

USING HISTOGRAMS

3.

- Use the histogram tool to analyse the spatial distribution of stars hosting exoplanets. What do you conclude?

- Plot the number of stars as a function of the logarithm of the distance. What can you see? Is this an expected result?

4.

- Explore the mass histogram. Comment on the minimum and maximum bounds.

The mass distribution shows an increasing number of planets as the mass decreases. Is this true?

- Activate the log scale to "zoom in on small values", and change the mass unit to Earth masses. Comment on what happens around 30 Earth masses?

5.

- Explore the histogram of the semi-major axes. Where are the most distant exoplanets detected? Put it into perspective in relation to the distances in the Solar System. Where are most of the planets discovered? Justify this value with a quick calculation.

6. Explore the histogram of eccentricities. Any comments?

Astronomy Summer School, August 2025
A.Doressoundiram - S.Paupy

clea

EXPLOITER LA BASE DE DONNÉES

EXOplanet.eu

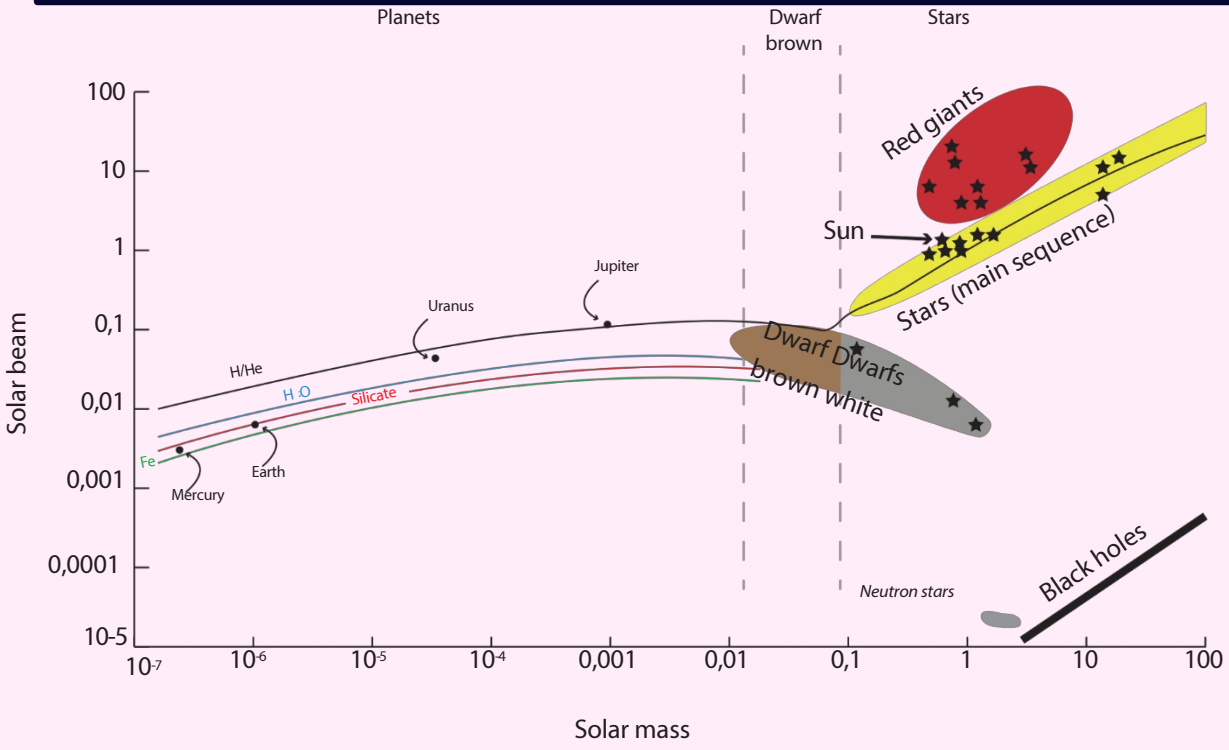
PROLOnGEMEnTS

7. Use another tool on the exoplanet.eu website to produce a figure showing all the exoplanets known to date, classified by distance from the star (x), mass (y) and eccentricity (variable size).
- Locate on this figure the coordinates of the positions of the planets in the Solar System, as well as 51 Peg b (a=0.05UA; m=0.47 MJ) and Kepler 10 b (a=0.017UA; m=4.6 MT).
- Find the different families of exoplanets.

8. Mass-Ray diagrams

Explore the Mass-Ray diagram, in log-log coordinates and in Earth units. How do planets of Earth radius disperse?

The following figure shows a diagram of all the celestial objects and compares them with material densities. We can see that the Earth and Mercury are compatible with rocky objects. Any comments?



9. Periods - Semi-major axes diagram

Display the Periods - Half-Major Axes diagram, in log-log coordinates. What does it show? Explain the dispersion of the points

10. Bonus - Check Kepler's third law

- In the filter bar, search for a specific system, for example: "trappist" in name Plot log a (Half
- major axis) as a function of log P (Period)
- Check Kepler's law
- Calculate the mass of the host star

Astronomy Summer School, August 2025 A.Doressoundiram - S.Paupy

clea

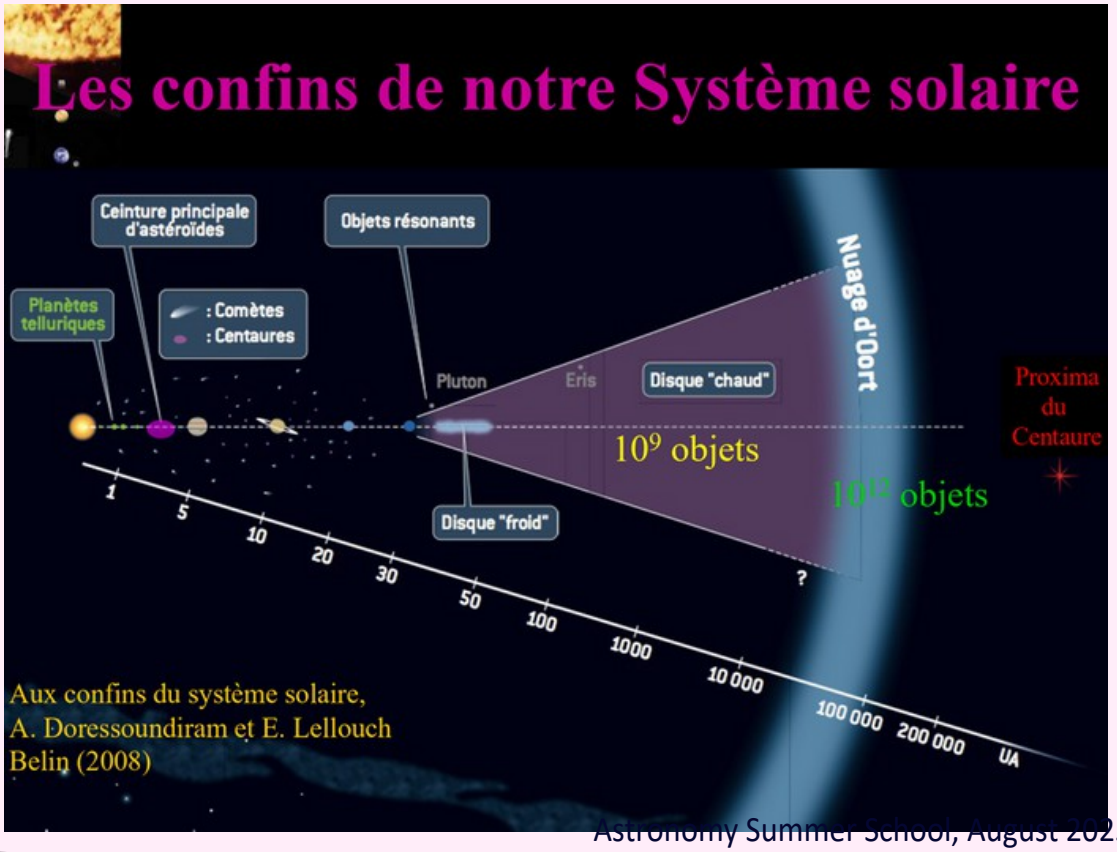
Elements of correction

The database lists objects lighter than 60 times the mass of Jupiter.

5. Explore the histogram of the semi-major axes. Where are the most distant exoplanets detected? Put it into perspective in relation to the distances in the Solar System. Where are most of the planets discovered? Justify this value with a quick calculation.

The histogram extends to more than 100,000 AU. By way of comparison, the furthest planet from the Sun is 30 AU and the most distant space probes have only recently exceeded 165 AU.
Exoplanets beyond 100 AU from their star have all been detected by direct imaging. It should be noted that it is then difficult to be sure that the planet detected is gravitationally linked to the star.

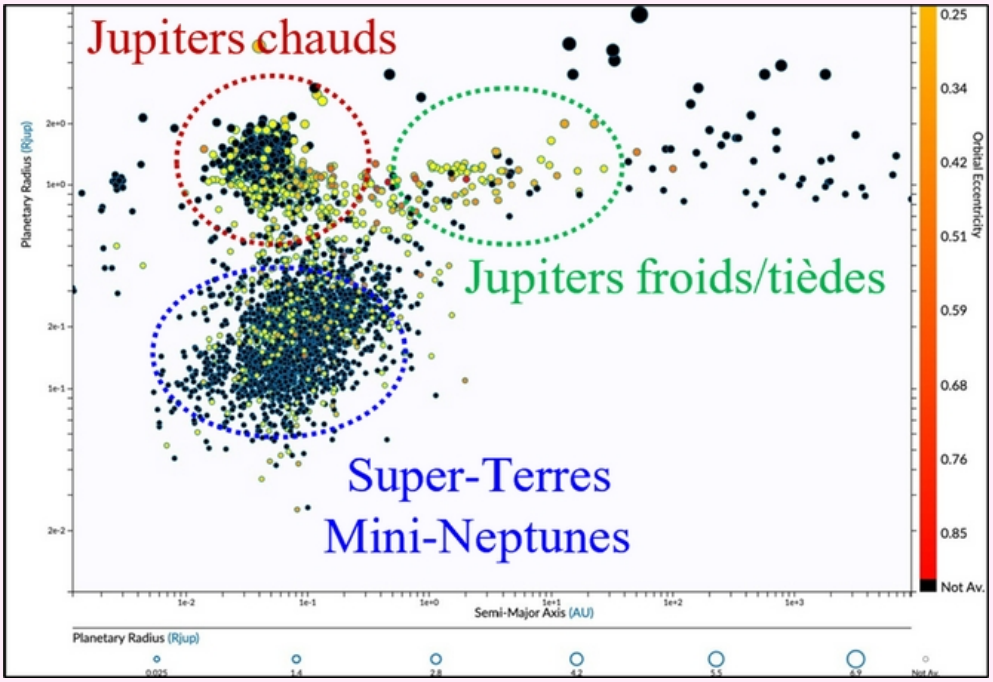
Most of the planets are less than 10ua from their star. If we play around with the detection methods, we can see that this bias only concerns planets detected by transits or radial velocities. These indirect methods require us to follow the movement of the star for at least one period of the planet. Since the search for exoplanets began 30 years ago, indirect methods have only been able to detect planets with periods of less than 30 years. Kepler's 3rd law can be used to calculate that this period corresponds to a semi-major axis of 302/3= 10 ua.



Elements of correction

The database lists objects lighter than 60 times the mass of Jupiter.

7. Use another tool on the exoplanet.eu website to produce a figure showing all the exoplanets known to date, classified by distance from the star (x), mass (y) and eccentricity (variable size). Locate the coordinates of the planets in the Solar System on this figure.

Zoom in to see the 2 planets more clearly and use the mouse to display the grid of coordinates to see the targets more clearly!
Find the coordinates of the positions of the planets in the Solar System. For example :
Earth (a=1UA; m=1 MT),
Mercury ((a=0.39UA; m=0.055 MT),
Jupiter ((a=5.2UA; m=318 MT), Neptune ((a=30UA; m=17 MT),

The different families :
Hot Jupiter;
super Earth;
warm Jupiter,
warm Neptune