Gaia
in the classroom

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Summary

- ★ Gaia astronomy in the classroom – why?
- ★ List of proposed activities
- ★ Two detailed examples: parallax and spectroscopy

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The Côte d'Azur Observatory

★450 people working in 4 different sites

★Astronomy, geosciences, physics

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Gaia in the classroom - motivation

- ★ Bring **science to society** through school students
- ★ Importance of sharing **real research** with school students
- ★ Use astronomy as an excuse to **learn physics** and **mathematics**

Pedagogical contents

★ Educational **activities** for **12-18 year-olds**

★ Deal with all **different scientific aspects** tackled by **Gaia**

★ Activities developed **initially** by the **European Space Agency** (ESA) and **adapted** and **completed** by the **Observatoire de la Côte d'Azur**

★ Conceived for an **international teacher training** in 2017, at Nice (France) with the occasion of the Gaia IAU conference.

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Subjects

- ★ **Parallax**:
  - ★ concept and application in real life
  - ★ heaven in the classroom

- ★ **Exoplanets**:
  - ★ computing distances to known exoplanets using Gaia archive
  - ★ understanding transit light curves

- ★ **Asteroids** – NEA (Near Earth Asteroids), risks, computing trajectories with Stellarium
- ★ Stellar **spectroscopy**
- ★ Gaia's **orbit** – Lagrange points

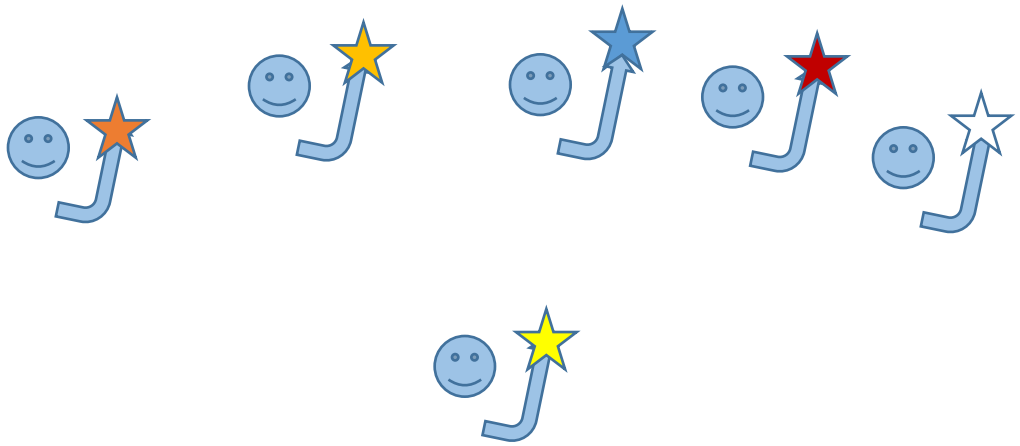
Pedagogical unit contents

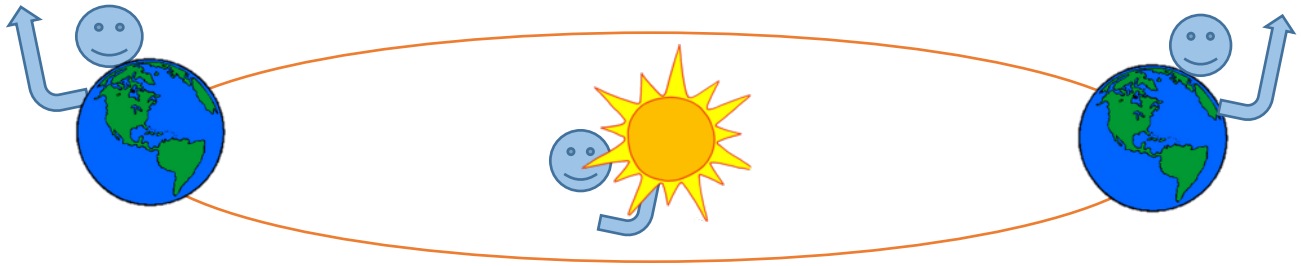
- ★ Teacher sheet
- ★ Power Point presentation
- ★ Student sheet
- ★ Answer sheet

- ★ Available in : https://www.oca.eu/en/training/gaia-training

Parallax in the classroom

Use parallax in the classroom as if you were in the sky

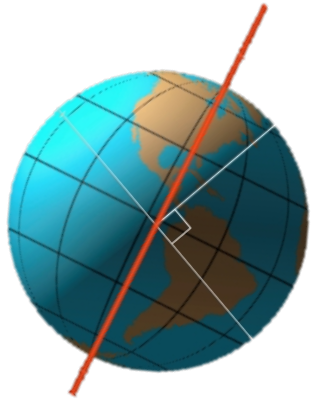


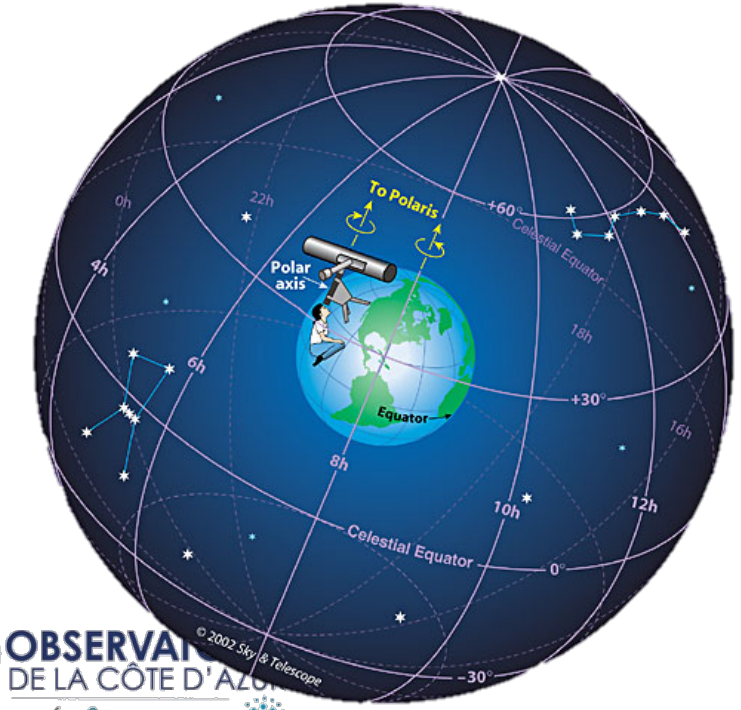


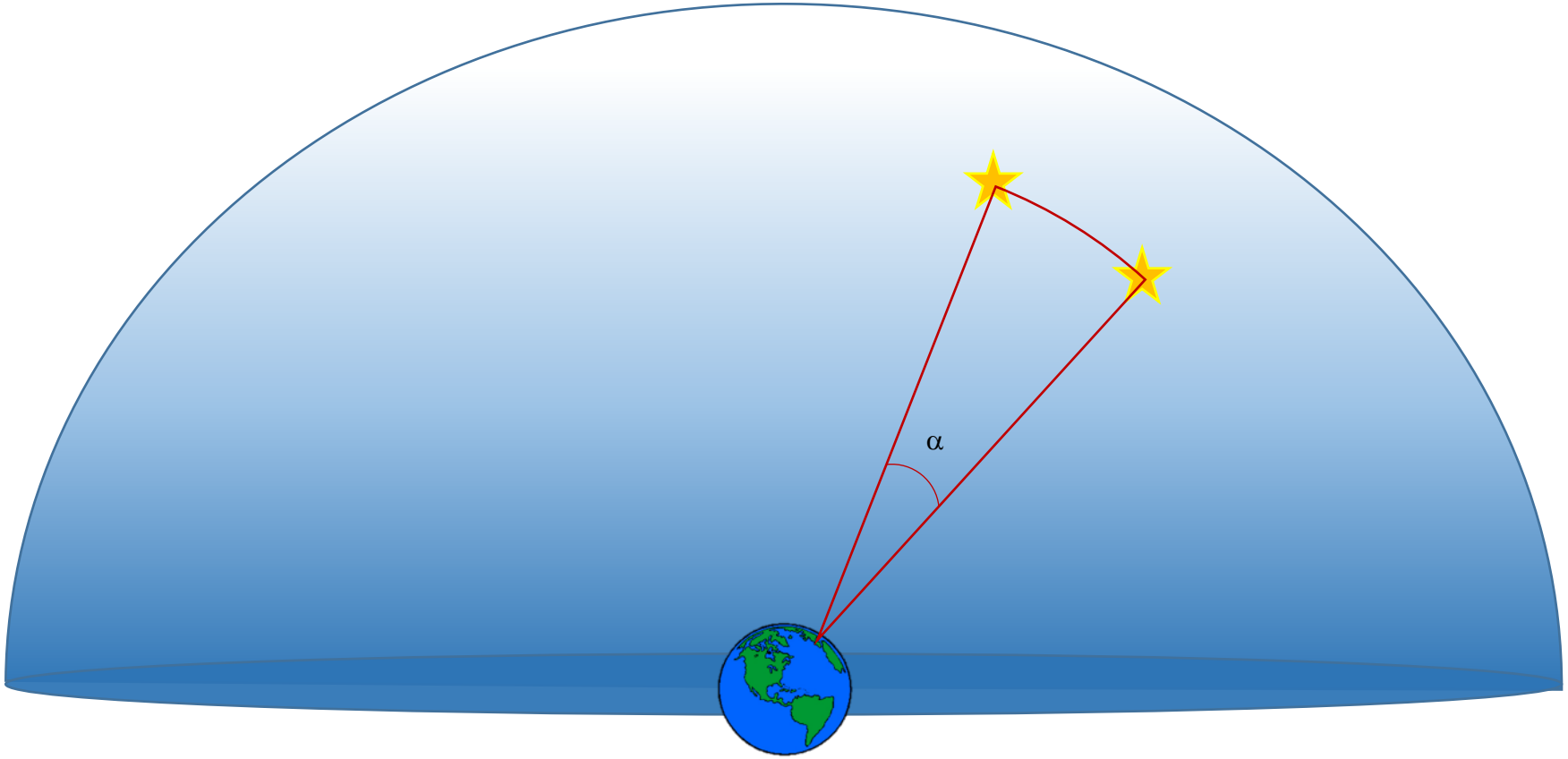
Measure the angular distance between the stars

To carry out this activity it is necessary to imagine that background stars are a part of the heavenly vault (curved!!)

In the same way the Earth is mapped with longitude and latitude, we must map the sky: we must measure the angle between every star.

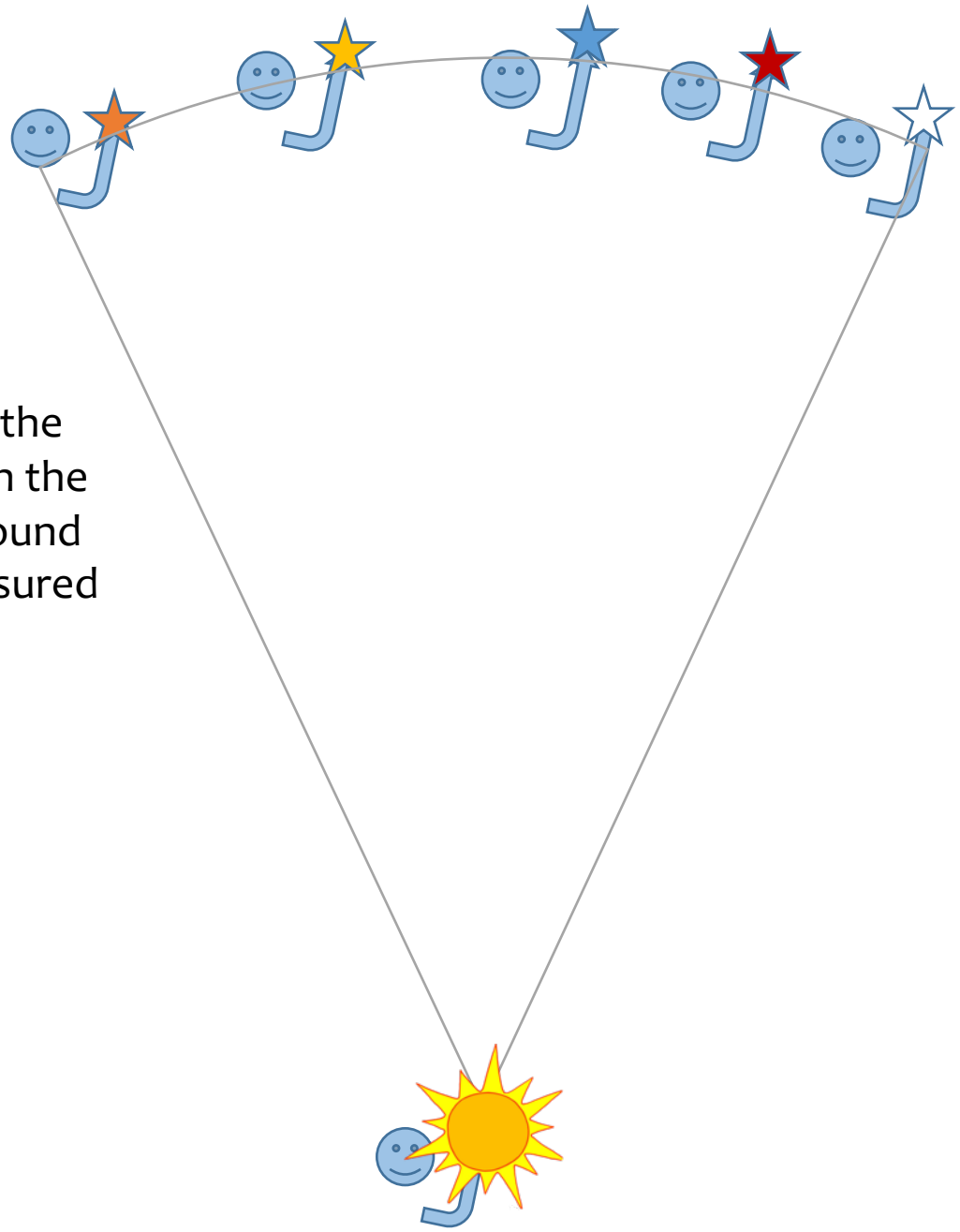






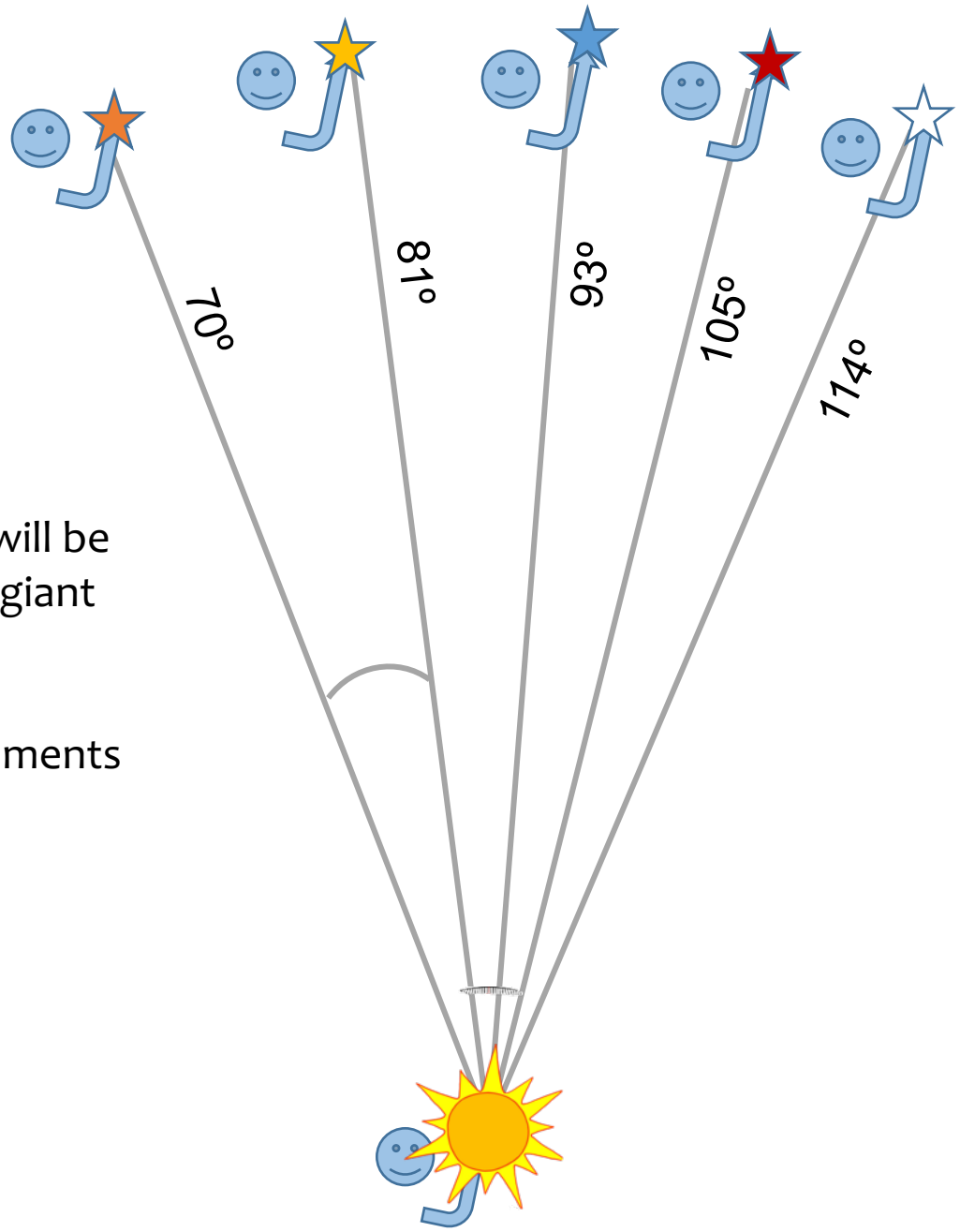
Example of angle (angular distance) between 2 stars

In the classroom the distance between the different background stars will be measured



The measurements will be carried out with the giant protractor.

Example of measurements



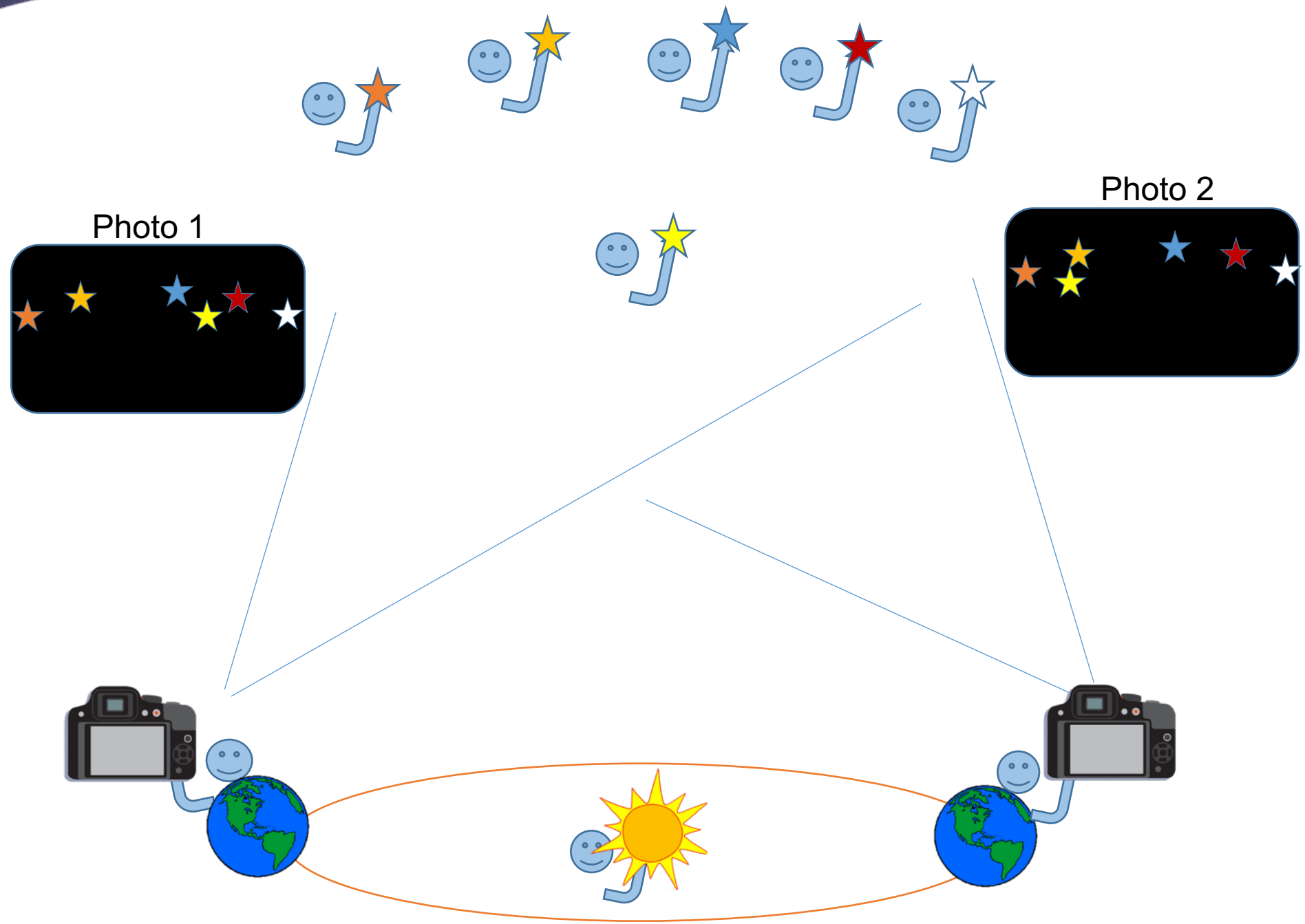


Photo 1
Photo 2

The yellow star has moved with respect to the background stars.

Comparing the 2 photos and using the angular position of each star we obtain this:

Photo 1

Estimation of the angular position of the yellow star in photo 1: ~99°

Photo 2

Estimation of the angular position of the yellow star in photo 2 : ~78°

Variation of the angular position of the yellow star = 21°

From the parallax definition

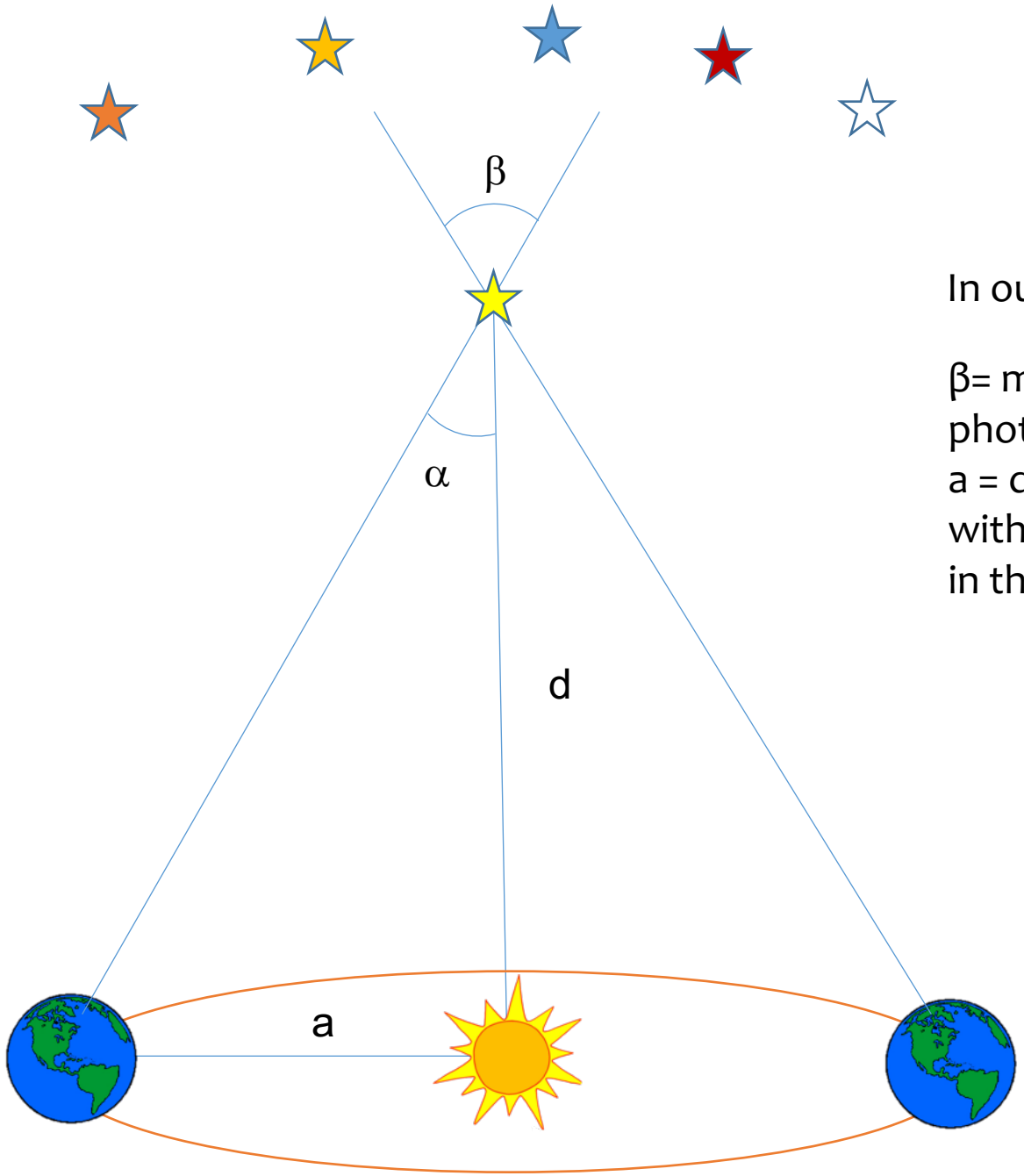
$$\alpha = \frac{\beta}{2}$$

$$\tan\alpha = \frac{a}{d}$$

$$d = \frac{a}{\tan\alpha}$$

If α is very small,

$$d = \frac{a}{\alpha}$$



In our case:

β= measured angle from the photos [21° in the example]
a = distance between the student with the camera and the student in the place of the Sun

Activity 6 : Spectrum of light, from bulbs to stars
Student sheet

What do you observe?

Do you see a continuous rainbow?

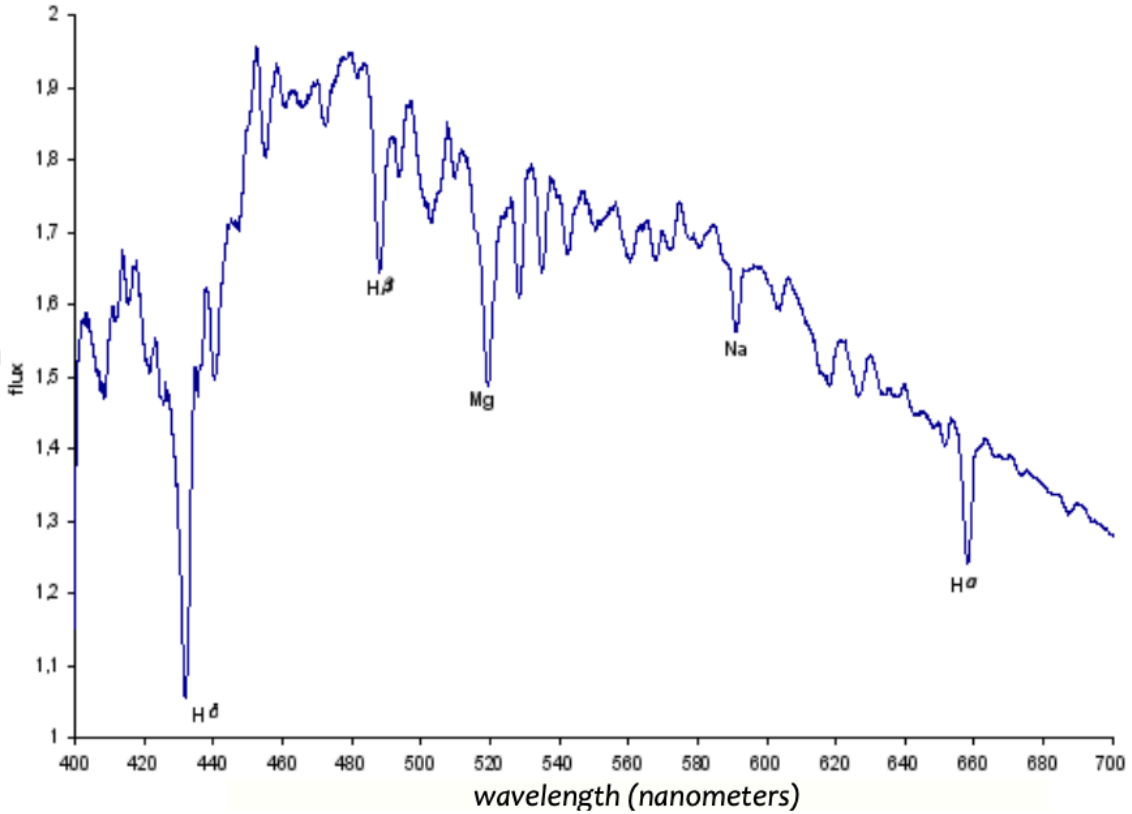
Or lines in different colours?

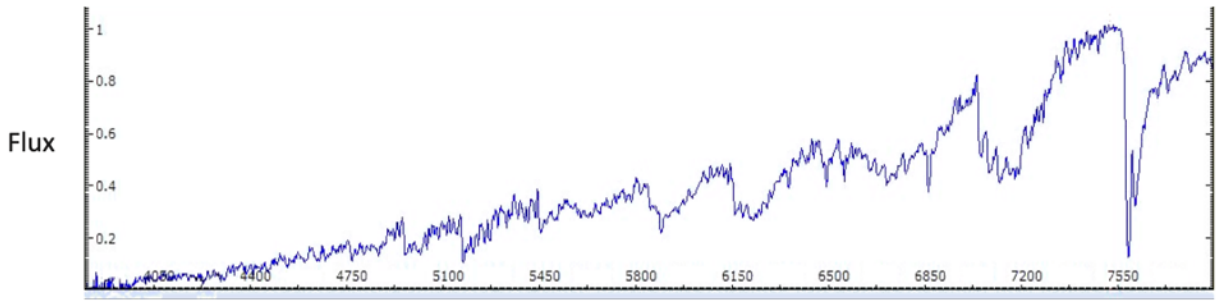
Activity 2. Characterization of stars: the color of stars

The spectra, as those that you have just observed, can be represented in a plot tracing, for each colour (wavelength) the quantity of light that we receive from this colour (flux).

Spectrum

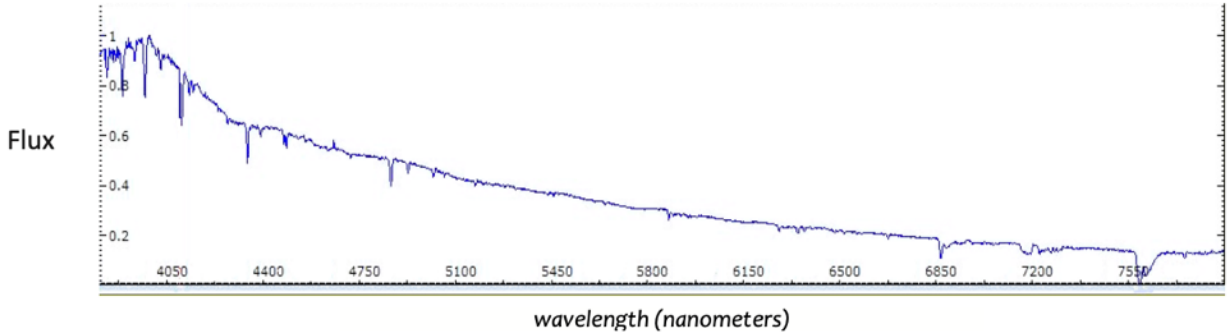
Plot associated with the spectrum





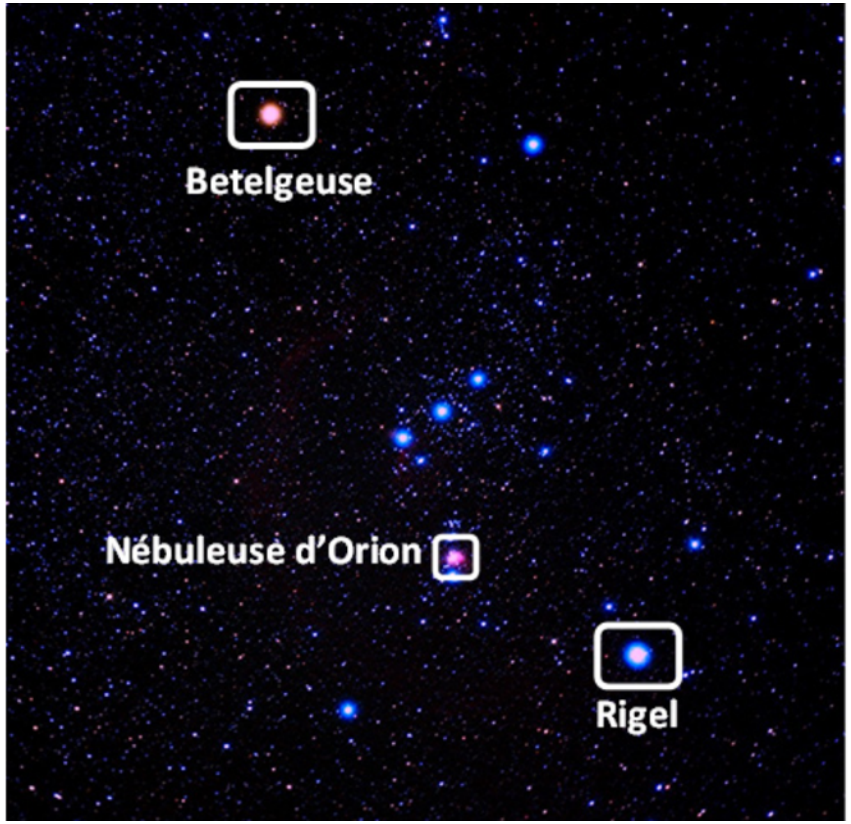
For which wavelengths do we get the maximum flux? _____
Does it correspond to red or blue colors? _____

GRAPHIQUE DU SPECTRE N°2



For this spectrum, in which wavelength is the maximum emission and what color does it correspond to?

_____



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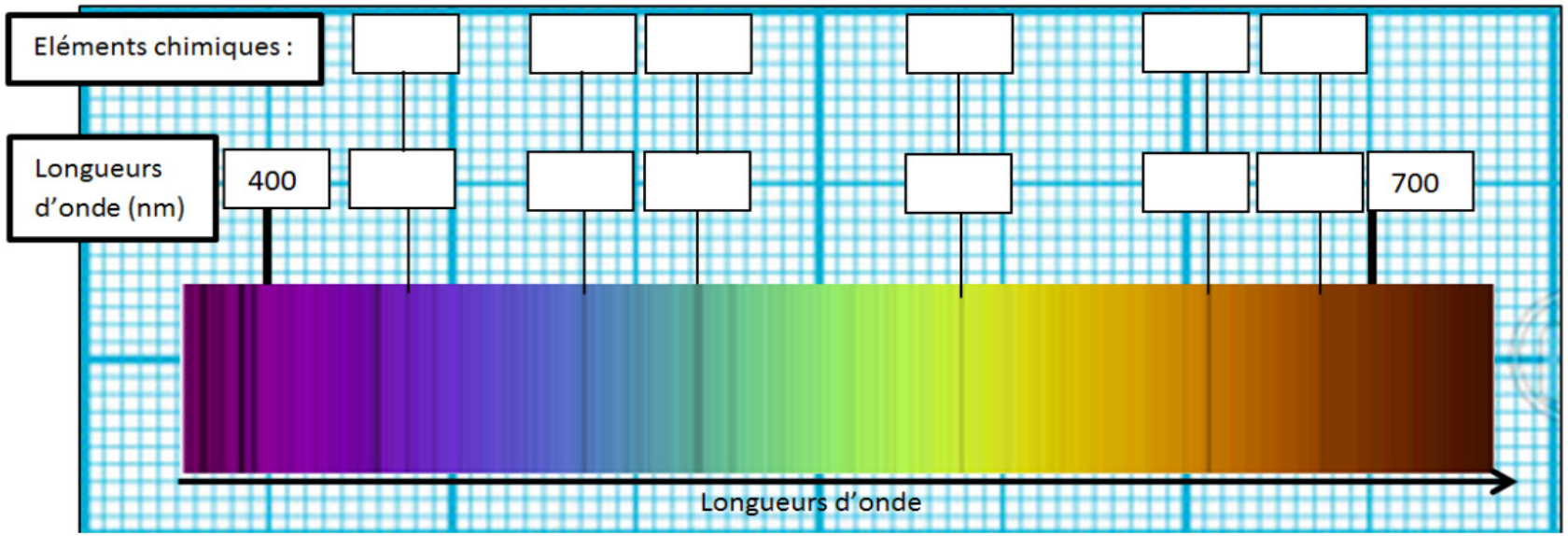

CHEMICAL ELEMENTS	*Wavelenghts in nm*
H (Hydrogen)	388, 397, 410, 486, 656
Na (Sodium)	589
Mg (Magnesium)	309, 470, 517
Ca (Calcium)	422, 458, 526, 616
Cr (Chronium)	464
Ti (Titane)	466, 498
Fe (Fer)	389, 404, 426, 438, 452, 459,536
Mn (Manganese)	402, 403
Ni (Nickel)	508, 509
O2 (Oxygen in that atmosphere)	686

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Conclusion

★ Set of educational activities that can be found here:

https://www.oca.eu/en - **Training – Gaia**

https://www.oca.eu/fr - **Formation – Formation enseignants – Gaia for teachers**

Thanks for your attention!