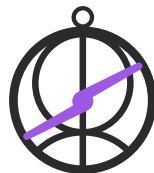




SPACE[☆] awareness

DISCOVER THE COLOURS OF THE STARS

Learn how the colors of the stars reveal their temperature
, Haus der Astronomie



Temat z programu nauczania
Stars

Ważna koncepcja nauki

Słowa kluczowe

Islamic Heritage, Stars

Wiek

8 - 14

Poziom kształcenia

Primary School, Middle School

Czas trwania

1h30

Rozmiar grupy

None

Nadzór ze względów bezpieczeństwa

None

Koszt

Low (< ~5 EUR)

Lokalizacja

Indoors (small, e.g. classroom)

Umiejętności kluczowe

Asking questions, Analysing and interpreting data, Communicating information

Rodzaj zajęć edukacyjnych

Partial enquiry

KRÓTKI OPIS

Al-Sufi was the first astronomer that recorded the colour of the stars in a catalog. Following the steps of this Persian astronomer, the children watch the constellations with a slide viewer and in the night sky. They discover that stars not only differ in brightness but also in colour. Linking this important property of the stars to modern astronomy, they also explore how the colours of the stars are related to their surface temperature.

CELE OGÓLNE

Students learn that stars have different properties that can be measured directly (brightness, colors) or inferred indirectly (temperature). They also learn by analogy to relate the colours of the stars with another important property: their temperature.

CELE OPERACYJNE

After this activity, the children will be able to:

- distinguish the different colours of the stars.
- explain why different stars have different colours.

EWALUACJA

- During the activity, the children identify different colours of stars. The teacher can check the results of the exercise. In addition, teacher can ask the children for the range of colours in stars.
- The teacher may show pictures or illustrations (artist impressions) of stars having a red, a yellow and a red colour. The children should indicate the main difference one can infer from those colours (namly: the temperature of the stars).
- Afterwards, the children may be asked to indicate, what a "cool" and what a "hot" colour of a star is.

MATERIAŁ

- Set of images for this activity
- Constellation viewer

PODSTAWOWE INFORMACJE

When Al-Sufi started to observe the stars in Isfahan, he noticed the colours of some stars differed from others. This difference in colour had never been noted or recorded by Greek, Babylonian or Egyptian astronomers! Al-Sufi thought that the colour is an important property of the stars and included it in his catalogue together with their brightnesses and positions on the night sky.

Now we know that stars are hot due to nuclear fusion in their central regions: due to the high pressure, cores of atoms (like hydrogen) collide and fuse into heavier elements (helium, carbon, oxygen, etc.) creating the elements that we know in chemistry, up to the element iron. The colour is indicative of the surface temperature of stars.

PEŁNY OPIS ZAJĘĆ

The names of the stars

(a) *(Optional for students who have done activity 5.1.1 "Help Al-Sufi match the Greek and Arabic constellations")* Look closely at the Orion constellation: Do you remember the name of the corresponding Arabic constellation?

(b) Do you remember the name of the brightest star in the Orion constellation and what it means?

(c) Do you notice any difference between the colours of the stars in this constellation? What star colours do you see?



Fig. 10 Orion constellation (Credits: Hubble/ESA)

(d) Al-Sufi kept and used the Arabic names of stars in the Orion constellation in his "Book of the Constellations". You can find the meaning in the table below:

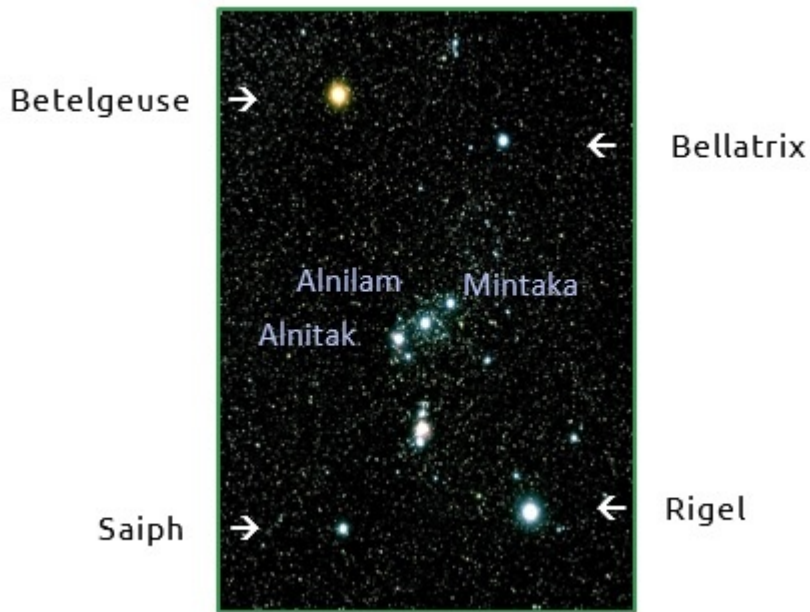


Fig. 11 Orion

constellation (Credits: Hubble/ESA)

Name	Origin	Meaning
Betelgeuse	Arabic ءازوجل ا طبإ	Hand of Al-Jawza
Bellatrix	Latin	Female Worrier
Saiph	Arabic فيس	Sword
Rigel	Arabic لجول	Foot
Alnitak	Arabic قطنل	Belt
Alnilam	Arabic مظنل	Belt of pearls
Mintaka	Arabic قطنم	Girdle

(Credits: Scorza)

Cover the above picture of Orion with a piece of paper. Try to fill in the names of the four stars from the table in the picture below and their meanings:

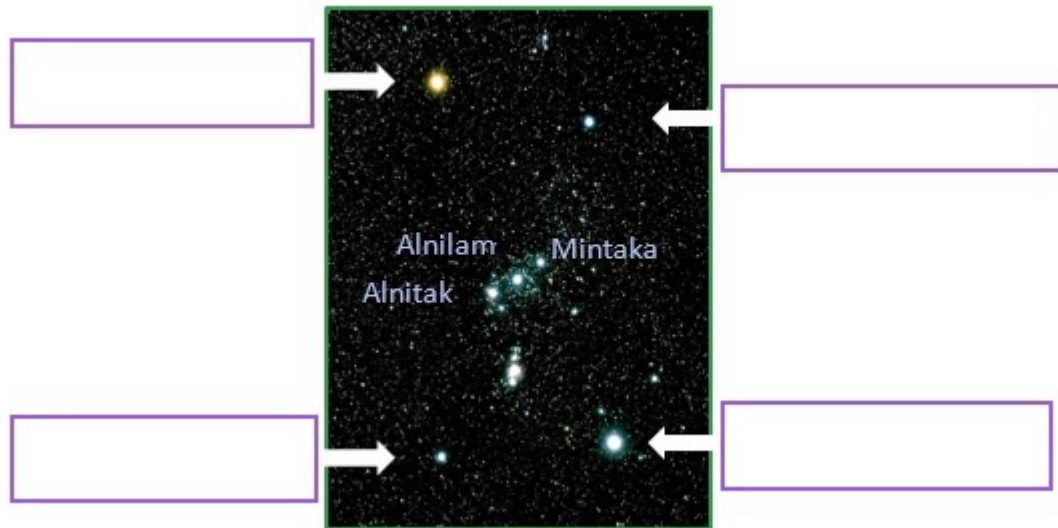


Fig. 12 Orion constellation (credits: Hubble/ESA)

The colours and temperature of the stars Have you ever seen an iron bar heated on the stove? In case you haven't, just take a look at the picture below. When the iron bar is heated and becomes hotter and hotter, it turns red, then yellow, then white and finally (before it melts) blue!

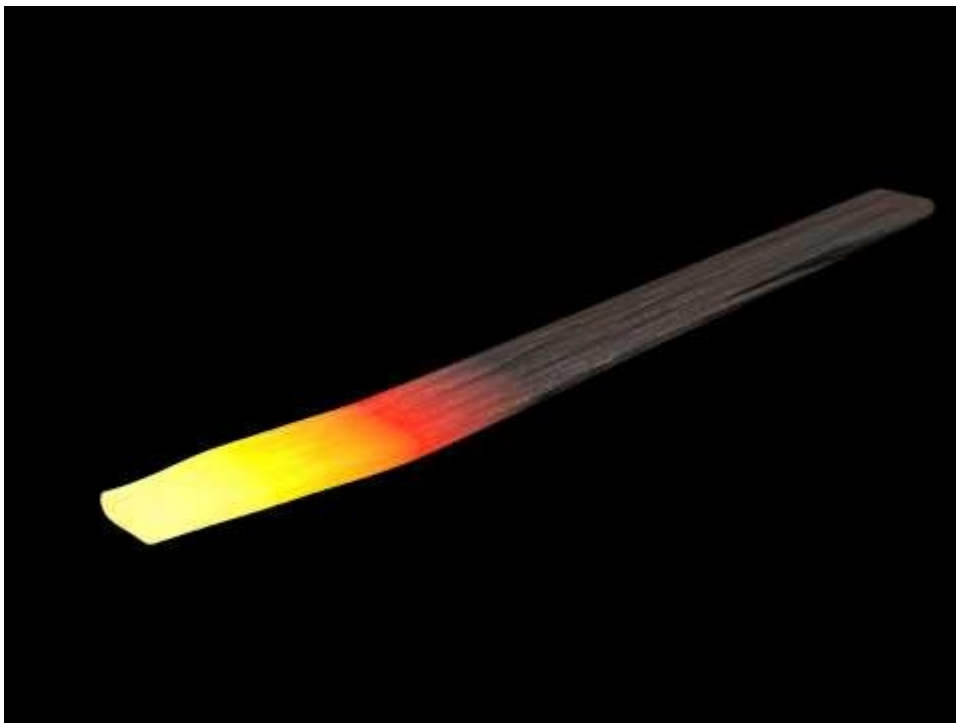


Fig. 13 Iron

bar (Credits: Blender3D)

(e) Look at the picture of stars taken with the NASA/ESA Hubble Space Telescope and try to answer the following questions:



Fig. 14

Credits: HST image

Which are the hottest stars? Which are the coldest ones? Which stars have a medium temperature?

Do you think that our Sun has a high, low or medium temperature?

We now know that stars have different colours because they are made up of hot glowing gas of different temperatures. Just as in the case of the iron bar, the star colours depend on how hot they are. The temperature of stars can sometimes reach 40 Million degrees in their inner cores! However the surface temperatures of stars range between approximately 3,000 to 40,000°C. **Al-Sufi didn't know that the colours of stars are related to their temperatures, but he would certainly have loved to discover it!**

(f) Take the constellation viewer and insert one after the other the cards with the following constellations:

Orion Great Bear Lyon Lyra Taurus Scorpio



Fig. 15 The constellation viewer (Credits: Scorza)

For each constellation and with the help of the Card-set 2, complete the table of Fig. 16 by filling in the names of the brightest stars of these constellations and their colours (according their temperature and the table 17a):

Constellation name	Name of the brightest star	Colour	Temperature

Fig. 16 Constellation table (Credits: Scorza)

Surface temperatures in °C	Colour of the star	
30000 – 60000	Blue	
10000 – 30000	Blue white	
7500 – 10000	White	
6000 – 7500	Yellow white	
5000 – 6000	Yellow	
3500 – 5000	Orange	
< 3500	Red	

Fig. 17a Table of temperature of the stars (Credits: Scorza)

Modification of the constellation viewer to watch the colours of the stars You can modify the cards of the constellation viewer such that the brightest stars shine in the viewer in their corresponding colours. You can do this by colouring small pieces of a transparent sheet with permanent markers. Glue these small pieces at the back side of the corresponding stars of the constellation figures before gluing the figures on the blue cards). When you insert these modified cards, you will be able to see not only the constellation, but now also the colours of the brightest stars!

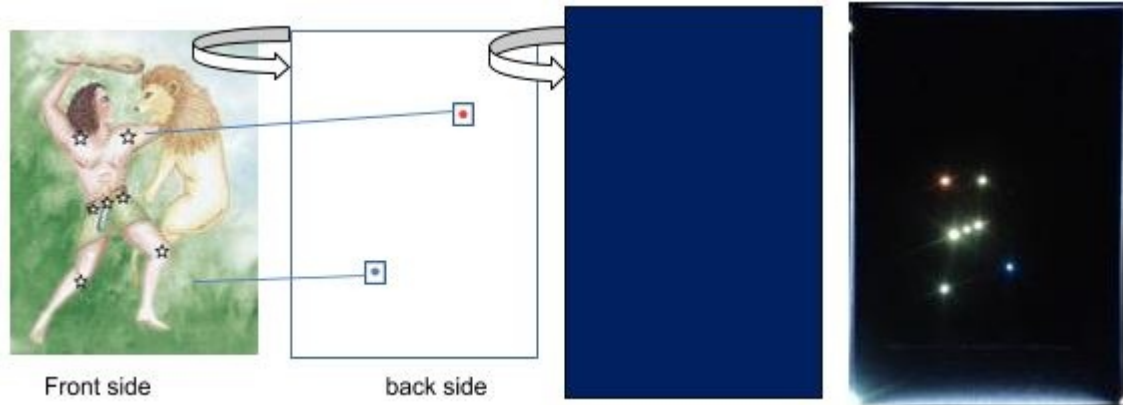


Fig. 17.b By inserting small pieces of coloured transparent sheets, you can reproduce in the constellation viewer the colours of Betelgeuse and Rigel (Credits: Scorza)

PROGRAM NAUCZANIA

Space Awareness curricula topics (EU and South Africa)

The journey of ideas, Stars

ZAKOŃCZENIE

This activity deals with the discovery of stars having colours, first documented by the Persian astronomer Al-Sufi. Without knowing, he set the stage for the physics of stars, since their colours are connected to their surface temperatures, a property that cannot be measured directly. The children that go through this activity discover the colours by themselves and learn how to interpret them. In this way, they combine the achievements of ancient and modern astrophysics.



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