STARS SIZES

(Designed by: Circolo Astrofili Veronesi, Italy)

Description

This tool is composed of a set of polystyrene spheres representing stars of various sizes.
The unit of measurement chosen is the diameter of the Sun, which is represented by a sphere 1mm in diameter.
With this scale, the various types of stars, from dwarfs to supergiants, are simulated with manageable-sized spheres.
In the set described here the largest star considered is Y Canum Venaticorum, but even bigger stars (e.g., Betelgeuse or UY Scuti) can be simulated using inflatable balls.

Objectives

To allow the participants to contextualize the different dimensions and the respective proportions of some stars with respect to the Sun, and between the stars.

Material

10 Polystyrene spheres and other materials depicting ten stars

Sun: 1mm, yellow

Sirius: 2mm, white

Aldebaran: 4cm, orange

Polaris: 5cm, yellow

Mirfak: 6cm, yellow

Rigel. 7cm, light blue

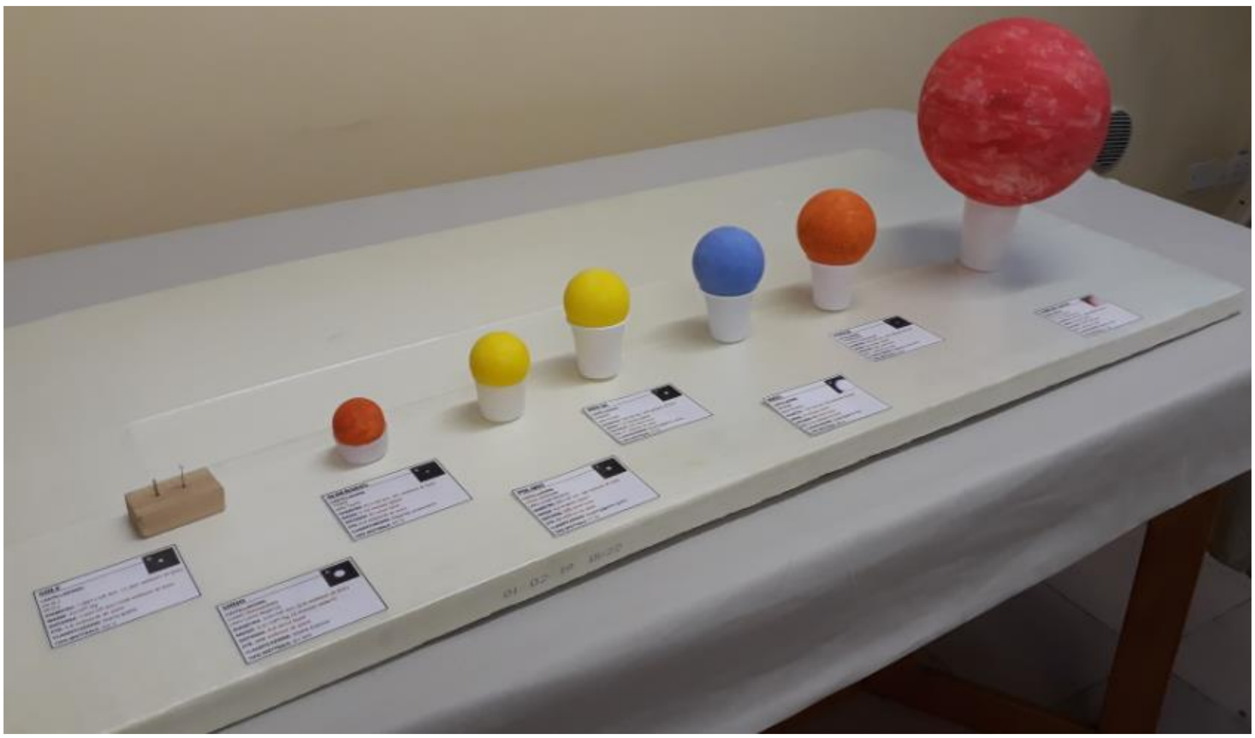
Almak: 8cm, orange

Y Canum Venaticorum: 20cm, red

Tempera colors

Preparation

The scale used for this tool is 1 mm : 1,391,000 km (average diameter of the Sun). This scale is needed to be able to include the sizes of all of the stars. The reference stars used are, in order by size: Sun (1mm ball, yellow), Sirius (2mm ball, white), Aldebaran (4cm ball, orange), Polaris (5cm ball, yellow), Mirfak (6cm ball, yellow), Rigel (7cm sphere, blue), Almak (8cm sphere, orange), Y Canum Venaticorum (20cm sphere, red). The stars are colored using tempera colors that represent color temperatures of the stars.



Procedure

Step 1: Explanation of the Sun, explanation of what a star is, and display 1 mm ball (the size of the Sun)

Step 2: Point out that the size of the Sun on this scale, the size of a planet, of the Earth, are imperceptible. Introduce the final step in the evolution of these types of stars (white dwarf)

Step 3: The participant holds the Sun in one hand and is then given the next sphere, representing the star Sirius. Compare the sizes of the two stars. Introduce the idea of stars having different sizes.

Step 4: The participant holds the Sun in one hand and is given the next sphere, representing the star Aldebaran. Compare the sizes of the two stars. Using Aldebaran, introduce the idea that stars have different colors.

Step 5: The participant holds the Sun in one hand and is given the next sphere, that of Polaris. Compare the sizes of the two stars. Using Polaris, introduce the concept of double stars.

Step 6: The participant holds the Sun in one hand and is given the next sphere, that of the star Mirfak. Compare the sizes of the two stars. Using Mirfak, introduce the final stage of evolution of these types of stars (supernova).

Step 7: The participant holds the Sun in one hand and is given the next sphere, that of the star Rigel. Compare the sizes of the two stars. Using Rigel, explain blue supergiants.

Step 8: The participant holds the Sun in one hand and is given the next sphere, that of the star Almak. Compare the sizes of the two stars. Using the star Almak, explain multiple star systems.

Step 9: The participant holds the Sun in one hand and is given the next sphere, that of the star Y Canum Venaticorum. Compare the sizes of the two stars. Describe the star named by Angelo Secchi "La Superba."

Step 10: The participant holds the Sun in one hand. Explain to the participant that the largest known star is the UY star of the constellation Scud with a diameter of 1708 million km. With the scale we are using, it would be a 1.7-meter sphere. It is currently the largest star in the Milky Way. If placed at the center of our solar system, the surface of the star would swallow Jupiter and reach 1 AU beyond Saturn.

<u>Let's analyze</u>

Take the spheres of the various stars and place them on the table, and let the participant touch them:

What do you remember about their sizes?

Which star do you remember? Why?

What do you imagine these stars would look like in a telescope?

Explain why the stars are always seen as point-like. (ANSWER: the stars are so distant that they are only points of light that even the largest telescopes cannot magnify)

Our human body is carbon-based. Where do we find carbon in the Universe? Explain the nuclear reaction process of the various elements of the periodic table. (ANSWER: All elements are produced inside the stars, except for the hydrogen that present at the beginning of the Universe.
Stars are nuclear reactors that fuse elements, starting from hydrogen, to produce all the other elements, including the carbon we are made of.
Specifically, stars form all the elements from helium to iron during their lives, while all the elements heavier than iron are created during the explosion of a supernova)

TACTILE CONSTELLATIONS

(Designed by: Circolo Astrofili Veronesi, Italy)

<u>Description</u>

This tool is composed of star maps with the layout of the constellations in relief.
The stars are marked by pins and the constellation layout is traced by wool threads that connect the stars to form the design of the constellation.
The set described here was made following a star map that contains more constellations than were used, but by decreasing the image scale you can make panels with constellation of larger size.

<u>Objectives</u>

Understand the rotation of the Earth and the apparent movement of the celestial sphere by using the different positions of the constellations on the tables. Recognize by touch the different shapes of the constellations and the different brightness of the stars. Remember the main star of the unfolded constellation.

<u>Material</u>

- Tables of the Toshimi Taki constellations; see http://takitoshimi.starfree.jp/atlas/atlas.htm (the star maps with constellation lines are identified by filename starting with "cr"; i.e. cr_1n_050115)
- Laminated cardboards (A3 size)
- Woolen threads of various colours
- Beads of various size

Preparation

Print the star maps with the chosen constellations on laminated cardboard (A3 size).

Glue the cardboard to a polystyrene board.

Choose the constellations to highlight and mark the stars that outline the layout of the constellation with different size beads according to their brightness.

Connect the beads with woolen thread to draw the constellation layout.


1


2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8


9


10


11


12

Procedure

Step 1: Present the boards to the participants and let them touch them

Step 2: Show how to locate the North Star through its position on the boards

Step 3: Start with the table depicting the evening sky of the month

Step 4: Help locate the constellations of the month starting from the North Star

Step 5: Explain the constellations: main stars, mythology, etc.

Step 6: Explain, using the globe, the earth's rotation and the apparent movement of the sky

Step 7: Show the next table with the constellations shifted by 4 hours

Step 8: Help locate the constellations starting from the North Star

Step 9: Explore the table and recognize the previous constellations and their displacement

Let's analyze

Take the different boards and arrange them on the table:

Which constellation did you like the most?

Which constellation can you recognize?

What does the design of the constellation make you remember or imagine?

The figures represented in the constellations recall stories of the myths of various cultures. Do you have any stories to tell?

PLANETS DISTANCES IN SCALE

(Designed by: Andrea Miccoli, Associazione Pontina Astronomia, Italy)

Description

This tool is composed of a rope where wooden items (balls or blocks) representing the planets of the solar system are positioned at appropriate distances.
The unit of measurement chosen is 1 cm = 10 million km, which allows simulation of the Sun-Neptune distance with a 5-meter rope.
With this scale, the tool is easily manageable inside a classroom but for outdoor use it can be made with a longer rope by decreasing the scale.

Material

- A rope about 5 meters long and 6-8 mm thick.
- Nine wooden balls about 2.5 cm in diameter (like the scented ones made to put in cupboards).

Preparation (wooden balls)

Pierce the balls in the center using a drill with a tip having a diameter equal to the thickness of the rope.

Each cm of the rope corresponds to 10 million km in reality. Thus, the whole rope will have to represent the existing distance between the Sun and Neptune; about 4.5 billion km represented by 4.5 meters of rope. Since the rope is 5 meters long (or more), there will be margins of free rope as desired, at the beginning and at the end, for handling.

These are the distances between the balls (rounded):

- First the Sun and then 5 cm from the Sun: Mercury.

5 cm from Mercury: Venus.

5 cm from Venus: the Earth.

5 cm from the Earth; Mars.

50 cm from Mars: Jupiter.

75 cm from Jupiter: Saturn.

150 cm from Saturn: Uranus.

150 cm from Uranus: Neptune.

Thread the balls onto the rope and place them at the distances indicated. The balls must be fixed to the rope using glue. Allow the glue to dry for a few hours.

Prepare 9 hard cards that each have, on both sides, the glued image of each planet with the name and the writing in clear and Braille. Equip each tag with tweezers and hang it near the appropriate ball.

Preparation (wooden parallelepipeds)

Instead of balls and tags (which can be cumbersome) you can use pieces of wood with 4 rectangular faces, about 6-7 cm long and with holes lengthwise to pass the rope through (see photo at the beginning of the article). These are easily obtained by cutting a stick 1 meter in height and with a square base with sides of about 2-3 cm. This should be easy to find at DIY stores.

The planets names are written on the pieces of wood in Braille (2 opposite sides) and in plain text (the other 2 opposite sides).

These too, as with the balls, will be fixed to the rope using glue.

The distances between the various pieces of wood are the same as those used between the balls.