PRACTICAL EXERCISES FOR PUPILS

Name of the activity	Supposed time demandingness	Difficulty of the activity	Suitability for the age group	Tools and necessary materials	Objective of the activity
Distances and sizes in the Universe	20 – 30 minutes	Simple to medium difficult	13 – 15	encyclopaedia, star charts or internet/computer software such as Stellarium/Star chart, calculator	Reminding of typical distances and sizes of spatial objects, simple calculation of various distances
Balloon model of expansion of Universe	20 – 30 minutes	Medium difficult	14 – 15	Rubber balloon, felt-pen (or self-adhesive decoration stars), paper/tape measure, calculator	Modelling of expansion of Universe and determination of the distances within
Model of Orion constellation	1 – 2 hours	More time demanding, depending on the precision of the realisation	13 – 15	Bamboo stick, paper, glue or adhesive tape, tape measure, coloured paper or crayons/felt-pens, glue, polystyrene board, internet or computer software such as	Creation of three-dimensional constellation model, stars within ate not in the same distance from us

				Stellarium/Star chart	

Practical Exercise 1: DISTANCES AND SIZES IN THE UNIVERSE

1. Arrange to following spatial objects according to their distance from the Earth starting from the smallest to the biggest. If you have an Internet connection, try to determine the distances.[1]

ISS _____

Polaris _____

Jupiter _____

M31 Galaxy in Andromeda _____

Centre of our Galaxy _____

NGC 4414 Galaxy in Coma Berenices constellation _____

Moon _____

2. Arrange the following objects according to their size (typical dimension) starting from the smallest to the biggest. If you have an internet connection, try to determine the dimensions.

Planet of Saturn _____ Jupiter satellite Io _____

Sun _____ Galaxy _____

Nucleus of the Halley comet _____ meteorite _____

[1] Source of the images: Wikipedia

Local Group of Galaxies _____ Vesta asteroid _____

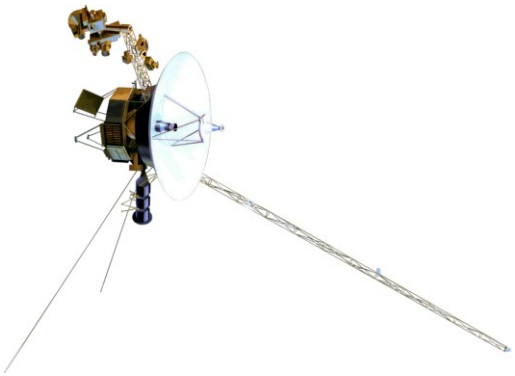
In the following activities, use the following approximate values of units and constants:

- *Speed of light c ≈ 300 000 km/s, 1 year ≈ 8760 h,*
- *1 ly ≈ 63 000 au ≈ 9 500 000 000 000 km, 1 au ≈ 150 000 000 km*
- *1 pc ≈ 3.26 ly ≈ 206 000 au*

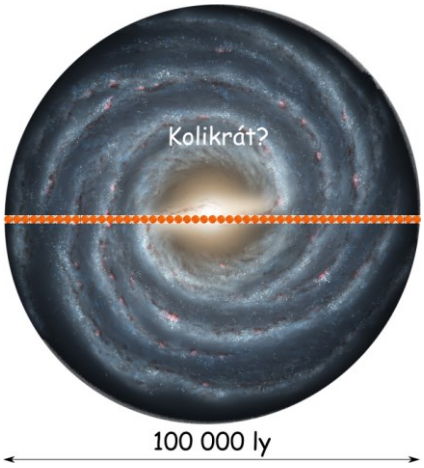
3. How long does it take to the light beam to travel from the east of the Slovak Republic to the west?

4. The closest star, situated outside our Solar System, is Proxima Centauri and its distance is approx. 4.2 ly. How long would take the journey there:

a) *By a train set Pendolino at a speed of 250 km/h;*
b) *By an aeroplane Airbus at a travelling speed of 800 km/h;*
c) *By a Voyager spacecraft at a speed of 17 km/s?*



5. A thin, spherical envelope named Oort cloud with approx. 200 000 au in diameter is sometimes considered as a boundary of our Solar System. How many times would the Solar System „fit“into the diameter of our Galaxy?



Kolikrát? – How many times?

6. Galaxy GN-z11 in the constellation of Ursa Major, discovered in 2016 by Hubble Space Telescope, is one of the remotest observed objects in the Universe. Its actual distance is estimated to 9 800 Mpc. How many light years is that? How many times is this distance larger that the Galaxy diameter?