EURO–ASIAN ASTRONOMICAL SOCIETY

XXIX IAO

IV International Remote Astronomy Olympiad

Dhaka, Bangladesh, 6-15. XI. 2025.

Round **Theo**

Group | | **β** | **γ**

language **English**

Theoretical round. Problems to solve

Reminding. Most of the problems are compiled in such a way that when writing solutions, minimal use of any language is required from the participant. So minimum texts are allowed in solutions of the problems (neither in the native language, nor in one of the official languages of the IAO). Pay more attention to formulas, drawings and graphs. It is permitted to write a few keywords in English (for example, "Yes", "No", "Assume", "Answer", "Average", "Minimum", "Maximum", "Impossible situation", etc.), as well as terms contained in the accompanying tables and names of objects.

6(βγ). Model of the Universe. In one of the medieval models of our Universe, the Earth is located in the center of the Universe and rotates around its own axis relative to the sphere of fixed stars. The Moon and the Sun orbit the Earth, Mercury and Venus orbit the Sun. Mars, Jupiter, and Saturn move in epicycles around invisible objects, which in turn orbit the Earth along deferents.

6.1. Let us assume that the Earth–Moon system is correctly described in this model, and the mass of the Sun is negligible compared to the mass of the Earth–Moon system. Find the distance between the Earth and the Sun and the diameter of the Sun in this model.

6.2. What could be the radius of the sphere of fixed stars in this model, if the accuracy of measuring angles in the sky at that time was about δ = 10″? With the distance to which celestial objects in our real world can this radius be compared?

7(βγ). Distant galaxy. The wavelengths λ of the spectral lines of hydrogen obey the formula:

$$\frac{1}{\lambda} = R\left(\frac{1}{m^2} - \frac{1}{n^2}\right),$$

where $R = const$, m and n are natural numbers, and $n > m$. Lines with the same m are combined in series. The most famous line is H**α**, the first line (i.e., the line with the longest wavelength) in the Balmer series ($m = 2$).

Research of a distant galaxy showed us that the H**α** line in its spectrum is observed at a wavelength of about the first line of the Brackett series ($m = 4$). Roughly (with an accuracy of 10%) estimate:

7.1. The receding velocity of the galaxy.

7.2. The distance to the galaxy.