Practical round

Both age groups (A and B).

Text of these problems is available also in Bulgarian, Danish, Portuguese and Russian.

7. The masses of Capella's components.

The 6-meter telescope of SAO is one of a few to carry out speckle-interferometric observations of visual binary stars. The purpose is a direct measurement of stellar masses. You are proposed to estimate the masses of Capella's components, using our observational data.

Capella (Alpha Aur) is a very close visual pair. Fig.1 shows a relative orbit of the component **B** as observed over many years by observations by different observatories. The points obtained in SAO are marked in red. The position of the component **A** is marked by a cross and is connected to the periastron point with a straight line. The radial velocity curves of the both components are shown in Fig.2.

Capella's parallax is π **= 0".077**, the revolution period of its components is **P = 104^{d}**.

- Consider a three-dimensional model of the system allowing, in particular, for the orbital eccentricity and the inclination of the orbital plane towards the line of sight.
- Estimate the masses of the components, using the Kepler's Third Law.
- Consider the possible causes of the errors of your estimates.

8. A galaxy's mass.

Erge-on spiral galaxies are suitable for the determination of their masses. Prof. I.D.Karachentsev and his colleagues complied a cataloge of such galaxies and obtained their mass spectroscopically. The spectrum of one galaxy, FGC 1908 in Dragon, is given below. It was obtained on the 4-th of March 1997, with the help of a spectrograph installed at the primary focus of the 6-meter telescope. As the figure shows, the spectrograph slit was aligned with the major axis of the galaxy. Vertical lines crossing the spectrum are emission from the night sky. Other

emissions belong to the galaxy. Their laboratory wavelengths are indicated. When determining the galaxy's mass at the SAO the Hubble constant was taken to be H = 74 km/(s•Mpc).

You are required to repeat the estimate of the galaxy's mass. Recall that 1 pc = $3.09 \bullet 10^{18}$ cm, the mass of the Sun is $M_O = 2 \bullet 10^{33}$ g and the gravity constant is $G = 6.67 \bullet 10^{-8}$ dyn•cm^2/g^2.

- Explain why a two-dimensional spectrum of the galaxy looks exactly like that.
- Estimate the mass of FGC 1908 and compare it to the mass of our galaxy.
- Consider the possible causes of the errors of your estimates.