

Problem 3

.During the Soviet-French experiment on the optical location of the Moon the light pulse of a ruby laser ($\lambda = 0,69 \mu\text{m}$) was directed to the Moon's surface by the telescope with a diameter of the mirror $D = 2,6 \text{ m}$. The reflector on the Moon's surface reflected the light backward as an ideal mirror with the diameter $d = 20 \text{ cm}$. The reflected light was then collected by the same telescope and focused at the photodetector.

- 1) What must the accuracy to direct the telescope optical axis be in this experiment?
- 2) What part of emitted laser energy can be detected after reflection on the Moon, if we neglect the light losses in the Earth's atmosphere?
- 3) Can we see a reflected light pulse with naked eye if the energy of single laser pulse $E = 1 \text{ J}$ and the threshold sensitivity of eye is equal $n = 100$ light quantum?
- 4) Suppose the Moon's surface reflects $\alpha = 10\%$ of the incident light in the spatial angle 2π steradian, estimate the advantage of a using reflector.

The distance from the Earth to the Moon is $L = 380000 \text{ km}$. The diameter of pupil of the eye is $d_p = 5 \text{ mm}$. Plank constant is $h = 6,6 \cdot 10^{-34} \text{ J}\cdot\text{s}$.