



**XX Международная астрономическая олимпиада**  
**XX International Astronomy Olympiad**

Россия, Татарстан, Казань

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ЯЗЫК	<b><u>English</u></b>
language	

**Practical round. Problems to solve**

**6. The extinction in terrestrial atmosphere.**

Extinction is a term used in astronomy to describe light attenuation due to its absorption and scattering.

A star was observed at different zenith distances during one night at the Engelgardt's Astronomical Observatory in the program of atmospheric extinction study at blue. Astronomers use parameter  $X$ , air mass, as an extinction characteristic. This parameter corresponds to relative length of the ray's way in the atmosphere. That means  $X = 1$  for zenith,  $X = 2/3^{1/2}$  for  $z = 30^\circ$ ;  $X = 2$  for  $z = 60^\circ$  and so on.

The determination of the star's brightness was performed with the method of photon counting. The 3<sup>rd</sup> column includes number  $n$  – the quantity of photons which were detected during one second. A luminescent source was used for calibration the data of observations. It produces a stable flow of photons  $N = 9900 \pm 100$  per second, which is equal to magnitude  $m_b = 9.64^m$  beyond the terrestrial atmosphere.

$z$	$X$	$n$	$\Delta m_b$
39.7		15135	
45.6		13816	
49.5		13180	
53.0		12246	
54.9		11800	
58.2		10089	

**6.1.** Draw the table (similar to that you see right) in your answer book. Calculate the air mass for given zenith distances in 1<sup>st</sup> column, and write the result into the 2<sup>nd</sup> column.

**6.2.** Calculate relative magnitude of the star  $\Delta m_b$  (blue), and write the result into the 4<sup>th</sup> column. Use the luminescent source as standard for the relative magnitudes.

**6.3.** Find functional relation between  $\Delta m_b$  and  $X$  with a help of graphical method.

**6.4.** Determine the magnitude of this star as it was observed in zenith.

**7. Variable star.**

A variable star was explored at the RTT-150 Russian-Turkish telescope in 2003. The observations were performed during whole night at the first time, the 1<sup>st</sup> table. The brightness of the variable star was measured occasionally during the other nights, and moments of maximal values of brightness ( $15.59^m$ ) were received on nights 2–5, the 2<sup>nd</sup> table. The time is in Julian days, and  $m_V$  is the yellow spectral colour magnitude.

**7.1.** Plot the light curve (magnitude vs time function), determine the moment of maximum in the first night and write result (in Julian days) in form of « $T_0 = \dots$ ».

**7.2.** Calculate the period of the variable star using the data of all 5 nights. Here period means the time between two closest maximums of the brightness. But actually astronomers usually do not know how many periods were passed between two observed maximums, because appropriate weather can not be same every day and a few periods can pass between two observed maximums.

**7.3.** What type of variable star is this – eclipsing binary or pulsating variable star. (Write in English: **Eclipsing** or **Pulsating** respectively.)

JD	$m_V$
2452805.3543	16.67
2452805.3712	16.57
2452805.3869	16.03
2452805.4026	15.69
2452805.4161	15.59
2452805.4512	15.80
2452805.5152	16.14
2452805.5848	16.32
2452805.6676	16.58
2452805.7734	16.68
2452805.8421	16.63
2452805.8643	16.62
2452805.9068	16.73

N	JDmax	$m_V$
1		15.59
2	2452830.5089	15.59
3	2452831.5772	15.59
4	2452839.5858	15.59
5	2452854.5340	15.59