АСТРОНОМИЧЕСКОЕ ОБЩЕСТВО

EURO–ASIAN ASTRONOMICAL SOCIETY

Round **Prac**

Group α β

XVII Международная астрономическая олимпиада
XVII International Astronomy Olympiad

Корея, Кванджу   16 – 24. X. 2012   Gwangju, Korea

язык language **_English_**

Practical round. Problem 7 to solve

Note. If you find somewhere in the problems an impossible situation, write in English «**impossible situation**».

7. **Fireball.** A fireball was observed from three different observing sites I, II, III. The position of the observing sites, the altitude and azimuth of start and end points of the fireball's trajectory are given in Table 1. Azimuth is measured eastward from the North direction, and altitude measured above the horizon, and both the angular measurements are in degrees. Following the steps below, find true trajectory and location on the surface of Earth of fallen debris of the fireball (meteorite).

Table 1. Observational Data for a Fireball

	observing position		starting point (**A**)		end point (**B**)	
	longitude	latitude	azimuth	altitude	azimuth	altitude
I	127.3°E	+35.7°	17°	35°	77°	10°
II	128.5°E	+37.0°	235°	-	139°	-
III	128.5°E	+35.4°	325°	-	48°	-

7.1. You are provided by a scaled marked graph paper. Mark the 3 observing positions (I, II, III) and draw a projected trajectory of the fireball as seen on the surface of Earth.

7.2. Calculate the longitude and latitude of start (λ_A, φ_A) and end (λ_B, φ_B) points of the fireball and total length **L** of the trajectory projected on the earth surface.

7.3. Find the heights of starting point h_A and end point h_B. of the fireball's trajectory above the surface of Earth.

7.4. Where can you find a meteorite, if it survives passage through the atmosphere and hits the ground? Calculate the longitude and latitude (λ_C, φ_C) of the location of the meteorite on the surface of Earth's.

Finally, redraw the table below to your answer-book and fill the empty cells with you results.

point	longitude λ	latitude φ	L (km)	h_A (km)	h_B (km)	You may find the meteorite at	
						longitude λ	latitude φ
A							
B							

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Practical round. Problem **8** to solve

Note. If you find somewhere in the problems an impossible situation, write in English «**impossible situation**».

8. **Clusters.** Using the moving cluster method, the Hyades cluster is known to be 45 pc away. This open cluster is important as a standard candle, because we can use it to determine the distances of other clusters. However, the interstellar medium absorbs light making a star appear fainter and redder, which is called the interstellar extinction A_V and reddening $E_{(B-V)}$, both measured in stellar magnitudes. The true distance modulus can be computed using the relation

$$m - M = 5 \log d - 5 + A_V.$$

The empirical relation between A_V and $E_{(B-V)}$ is

$$A_V = 3 \cdot E_{(B-V)}.$$

In Tables I and II, you are provided with photometric data of the stars of the two open clusters, Hyades and NGC 2682.

8.1. Make the colour-magnitude diagrams of the Hyades cluster and NGC 2682 using the provided scaled marked graph paper (A). In the diagrams, draw the main sequence line of each cluster.

8.2. Plot the colour-colour diagrams of the Hyades cluster and NGC 2682 using the provided scaled marked graph paper (B).
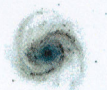
8.3. Assuming that the interstellar reddening of Hyades cluster is negligible, derive the interstellar reddening, $E_{(B-V)}$ of NGC 2682.

8.4. Determine the distance to NGC 2682.

8.5. Find the absolute magnitude and colour index (B-V) of the main sequence turn-off star in each cluster, approximately.

8.6. Which cluster is older? (Write in English «**Hyades**» or «**NGC 2682**».)

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Практический тур. Таблицы к задаче 8

Practical round. Tables for Problem 8

Таблица 1. Данные о Гиадах
Table 1. Hyades data

m_V	(B-V)	(U-B)
7.78	+0.62	+0.16
7.14	+0.51	+0.05
8.46	+0.72	+0.31
7.47	+0.57	+0.08
4.22	+0.14	+0.12
6.02	+0.34	+0.04
5.13	+0.21	+0.12
9.99	+1.06	+0.95

m_V	(B-V)	(U-B)
6.62	+0.42	-0.01
5.65	+0.28	+0.08
3.61	+0.99	+0.84
4.80	+0.16	+0.12
3.85	+0.96	+0.74
4.27	+0.12	+0.11
9.05	+0.84	+0.53
8.06	+0.64	+0.17

Таблица 2. Данные о NGC 2682
Table 2. NGC 2682 data

m_V	(B-V)	U-B
12.80	+0.79	+0.27
12.67	+0.68	+0.19
12.93	+0.93	+0.59
15.64	+0.89	+0.53
15.19	+0.80	+0.30
17.33	+1.19	+0.97
12.16	+1.02	+0.81
12.22	+0.42	+0.03

m_V	(B-V)	(U-B)
13.66	+0.55	+0.03
12.55	+0.41	+0.03
14.00	+0.61	+0.11
16.38	+1.00	+0.70
14.96	+0.76	+0.28
14.23	+0.64	+0.12
13.14	+0.45	+0.01
13.25	+0.52	+0.01