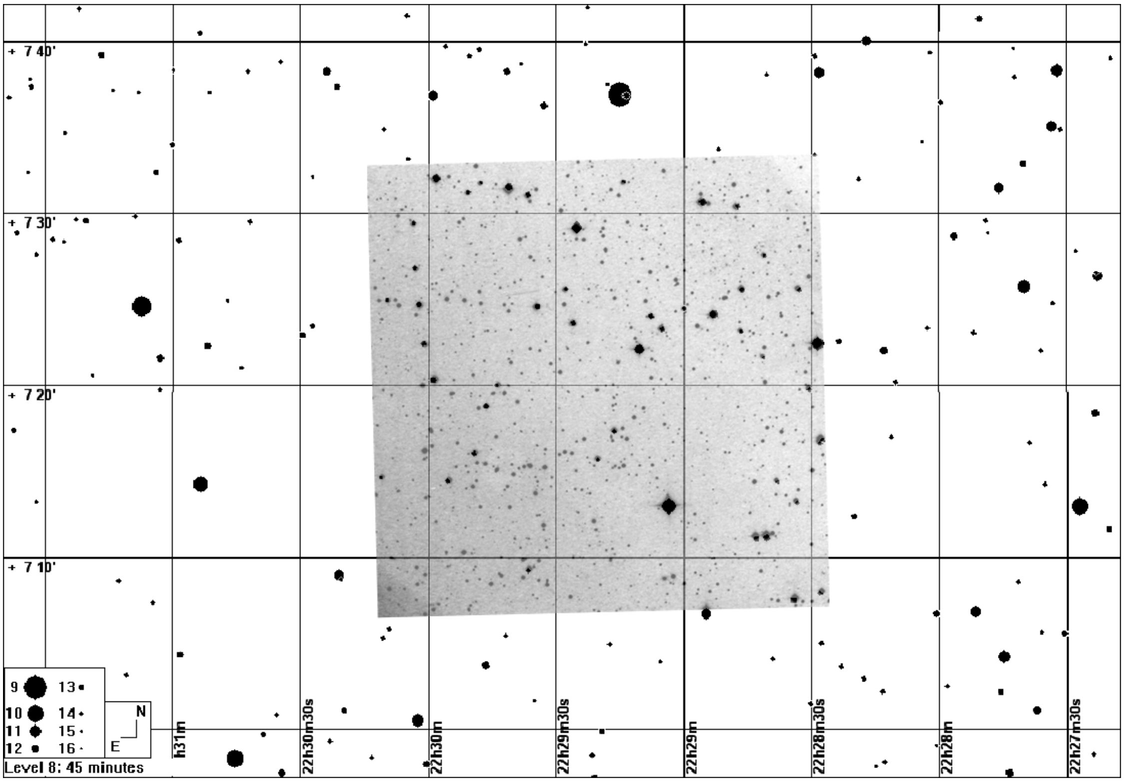
1) 0.5 point for one star, totally 2 points

2)



(2 p)

3) According to the pic of A2, it's easy to find the field of view of the telescope. It's about 26', and the

declination of the center of the CCD image is 7.3°. Thus the side length of the field of view is :

$$26' \times \cos 7.3° = 1550''$$

Image scale is $d = f\theta$, so, $s = f/206.265$ mm/arcsec = 0.0154 mm/arcsec.

The chip size is 1550 × 0.0154 = 24mm. (4p)

4) The star is 10 pixels across, so the FWHM is 10/3.5 = 2.9 pixels. (4p)

Seeing is S = 2.9 pixels × 1.5"/pixel (from Q3 and 1024 pixels) = 4.4".

5) Theoretical (Airy) diffraction disc is 2.44λ/D radians in <u>diameter:</u>

$$A = 2.44 \times 550 \times 10^{-9} / 0.61 \text{ rad} = 0.45'' \sim 0.3 \text{ pixels}$$

A << S (seeing).*(Accept all reasonable wavelengths: 450-650nm)* (4p)

6) Seeing = FWHM × 1.5"/pixel (from Q3) =1" . So, FWHM=1/1.5 pixel=1pixel

Printed image of star would then be s2=3.5×FWHM =3.5 pixels. (3p)

Note: if use : s2=1"*10 pix/4.4"=2.3 pix, 2 points.

7) For object 1, the trail of the object is about 107" (measured from pic 1, 300s exposure). It's angular velocity is:

$$\omega_1 = 107''/300s = 0.36\ ''/s$$

Note: accept to v±10% . (3p)

For object 2, it's moves about 8 pixels between pic 2A and 2B. 8 pixels ~ 12", and the time between exposures is 17m27s. It's angular velocity is: (3p)

$$\omega_2 = 12''/1047s = 0.012\ ''/s \text{ (accept } \pm 10\%)\ .$$

a) **wrong**: different masses of the objects, (+2/-1p)

b) **right**: different distances of the objects from Earth, (+3/-1p)

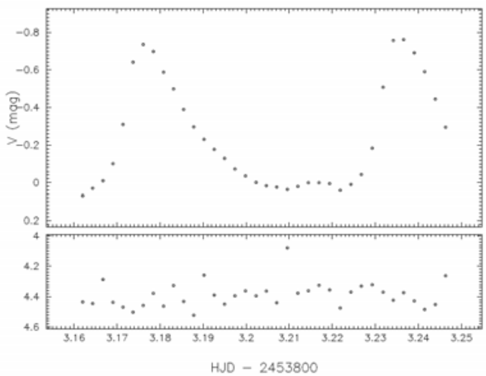
c) **right**: different orbital velocities of the objects, (+3/-1p)

d) **wrong**: different projections of the objects' velocities, (+2/-1p)

e) **rejected**: Object 1 orbits the Earth while Object 2 orbits the Sun. (0p)

Solution:

1)



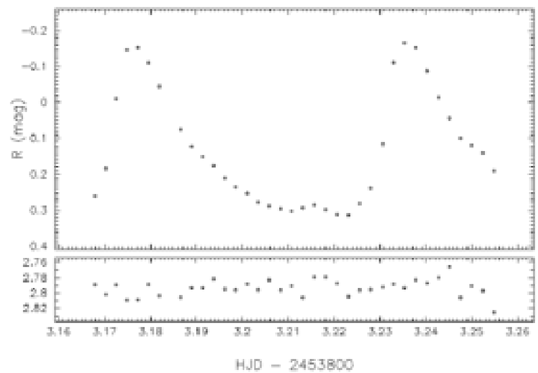


Fig.1. Light curves of KZ Hya in V.

Fig. 2. Light curves of KZ Hya in R.

6p

2) $\langle \Delta V \rangle = \frac{1}{n}\sum_{i=1}^{n} \Delta V_i = -0.248 mag$ 4p

$\langle \Delta R \rangle = \frac{1}{n}\sum_{i=1}^{n} \Delta R_i = 0.127 mag$ 4p

3) $\sigma_{\Delta V} = \sqrt{\frac{1}{n-1}\sum_{i=1}^{n} (\Delta V_i - \langle \Delta V \rangle)^2} = 0.083 mag$ 4p

$$\sigma_{\Delta R} = \sqrt{\frac{1}{n-1}\sum_{i=1}^{n}(\Delta R_i - \langle \Delta R \rangle)^2} = 0.011 mag$$ 4p

4) measured from the differences of times at the maximum values of the fits of the two peaks in V and R, respectively: 0.06 days, 0.06 days.

4p

5) measured from the differences of magnitudes at the maximum values of the fits of the two peaks in V and R, respectively: 0.79 mag, 0.49 mag.

4p

6) measured from the differences of times at the maximum values of the fits of the first peaks in V and R: 0(±0.025) P.

5p