SOLUTION

TQ6 [12 points]

6.1 From Wien's law:

$$\lambda_{max} = \frac{2.898\times10^{-3} m\cdot K}{T_{eff}\,(K)} = \frac{2.898\times10^{-3} m\cdot K}{4995\ K}$$

$$\lambda_{max} = 5.8 \times 10^{-7} m = 580.2\ nm$$ [2 point]

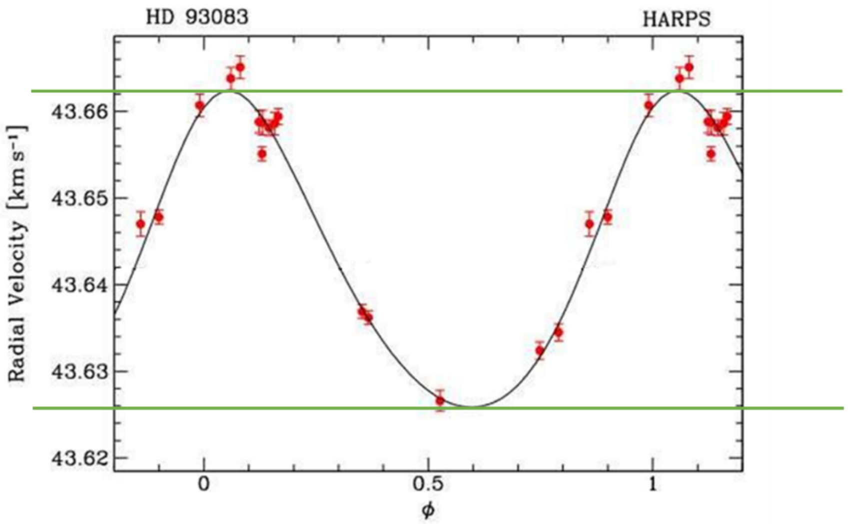
6.2 With the parallax doable to find the distance from Earth:

$$d = \frac{1}{pllx\ (arcsec)} = \frac{1}{0.035\ arcsec} = 28.55\ pc$$ [1 point]

$$M_V = m_v - 5\,log(d[pc]) + 5$$

$$M_V = 8.3 - 5\,log(28.57) + 5 = 6.02$$ [1 point]

6.3 [2 point]



Each division on Y has 0.002 kms^{-1}, so the maximum radial velocity is 43.662 kms^{-1} and the minimus is 43.626 kms^{-1}. Then, the mean radial velocity of Macondo is $v_r = 43.644\ km\ s^{-1}$.

6.4 The tangential velocity of Macondo, from the plot, is its variation from the mean system velocity

$$v_s = 43.662\ km\ s^{-1} - 43.644\ km\ s^{-1} = 0.018\ km\ s^{-1}$$

The masses of the star and the planet are known so it is only needed to find orbital velocity of Melquiades. But first it is important to convert the mass of the star to kg.

$$0.7M_\odot \times \frac{1.989\times10^{30}kg}{1M_\odot} = 1.4 \times 10^{30}kg$$ [1 point]

$$v_p = \frac{m_s}{m_p} \times v_s = \frac{1.4\times10^{30}\ kg}{7\times10^{26}\ kg} \times 0.02\ km\cdot s^{-1} = 40\ km\cdot s^{-1}$$ [1 point]

6.5 As the motion of the planet is circular, the orbital period is:

$$T = \frac{2\pi}{v_p} \times a$$

being ***a*** the distance to the central star.

With the 3rd Kepler's law, the orbital period is $T^2 = \frac{4\pi^2}{Gm_s} \times a^3$

Then, combining both expressions of *T* is possible to find *a*

$$\left(\frac{2\pi}{v_p} \times a\right)^2 = \frac{4\pi^2}{Gm_s} \times a^3$$

$$\left(\frac{2\pi}{v_p}\right)^2 \frac{Gm_s}{4\pi^2} = a$$

$$a = 7.25\times10^{10}\ m = 0.48\ au$$ [2 point]

With the previous solution is able to find the orbital period:

$$T = \frac{2\pi}{v_p} \times a = \frac{2\pi\times(7.21x10^{10}m)}{36000\ m\cdot s^{-1}} = 1.27 \times 10^7 s = 147\ days$$ [2 point]