## Homework 04

## Problem 1 (5 points)

Find the required precision of the star speed measurement to detect a Mars like planet around a Sun like star at the distance of 1.4 AU .

## Problem 2 (5 points)

Solve problem 7.6 from the textbook (Binary star parameters).

## Problem 3 (5 points)

Observation of a binary system yields that one of the stars is moving along an ellipse like orbit in $x y$ plane. The observed ellipse is stretched along x axis with apparent values of the semimajor axis $a^{\prime}=1.9803 \mathrm{AU}$ and the semiminor axis $b^{\prime}=0.3473 \mathrm{AU}$. A careful observation of both stars yields the location of the center of mass at position $x_{c . m}=0 \mathrm{AU}$ and $y_{c . m .}=0.04862 \mathrm{AU}$ with respect to the center of the observed ellipse.

Find the real eccentricity, semimajor axis $a$, and the inclination angle. Assume that the real semiminor axis direction is orthogonal to the line of sight. Note: the observed data has uncertainty.

## Problem 4 (5 points)

The first star has apparent magnitude $m_{1}=12$ and the peak wavelength of the radiation spectrum at $\lambda_{1}=600 \mathrm{~nm}$, it is located at distance $d_{1}=145 \mathrm{pc}$ from us. The second star has absolute magnitude $M_{2}=6$ and its temperature is $T_{2}=3400 \mathrm{~K}$. Find the ratio of stars radii $R_{1} / R_{2}$. Additionally, express the radius of each star in the units of the Sun radius.

## Problem 5 (5 points)

Solve problem 3.12 from the textbook (derivation of Wein's displacement law).

