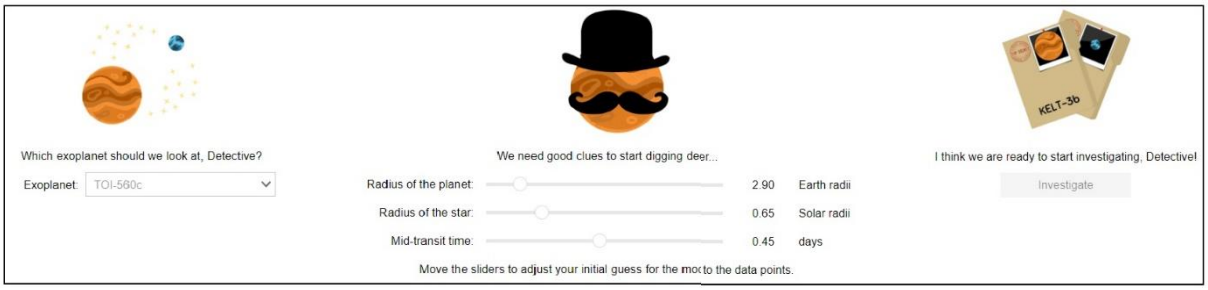
Abstract:

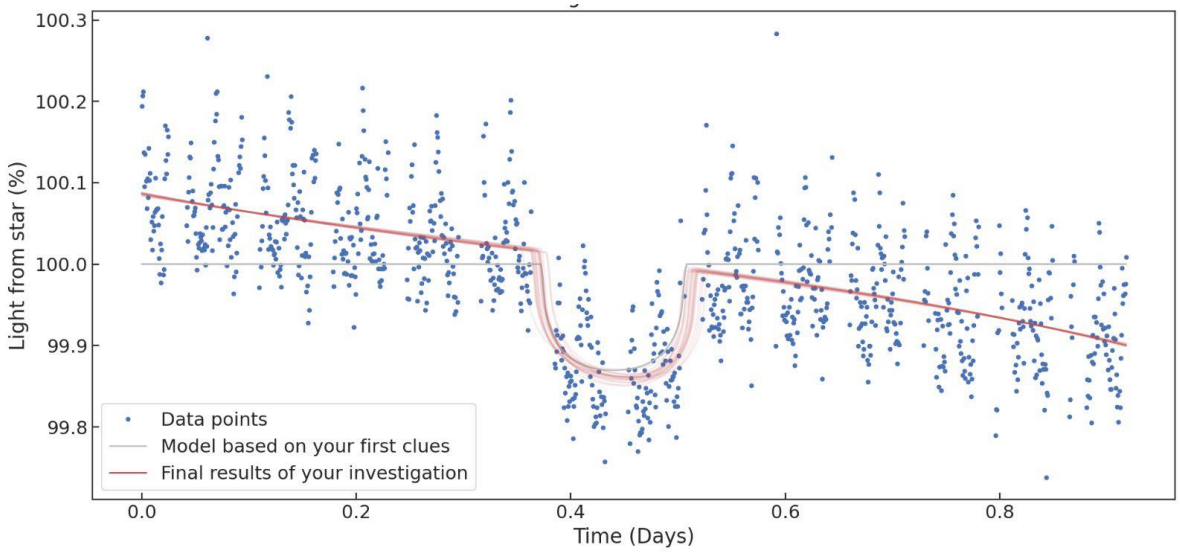
We are from an elementary school in Kolín and we are 14 years old. We were very interested in this hack an exoplanet challenge. Our team has already solved a similar task. The exoplanet XO-6 b and the pulsating variable star RR Lyrae TV Lyn. With the help of Mr. Petr Kabáth and Mr. Marek Skarka from the Academy of Sciences of the Czech Republic, we used the Munivin program to search for parameters and create graphs. This challenge is handled very nicely, and we were happy to add data about the exoplanet TOI-560C and uncover its secrets.

Results

First, we got acquainted with the rules and watched sample videos. According to these samples, we then proceeded to analyze the data. We tried and use the sliders to set the best possible parameters. And we succeeded. We entered the "Radius of the star" parameter from the documentation and set the other parameters to best describe the curve.



We made the calculation and saved all the calculated data. In the following calculations, we worked with this data. We then compared the generated histograms with the values we entered or calculated. We found the Radius of the planet 2.90 that we entered differs from the calculated values of 2.397.
We were the first to calculate the radius of an exoplanet.



$$R_p = \sqrt{Rs^2 * \frac{depht\ tranzit}{100}} \qquad R_p = \sqrt{0{,}4225 * \frac{0.15}{100}} \quad = 0{,}025174$$

0,025174 * 109 = 2,744009 %
2,744009 * 6378 = 17 501,29 Km = 17 501 287,5 m

We originally set 2.90 percent and calculated 2.744009 percent

The correct value given by the allesfitter calculation is 2.397%

In the second step, we took the orbital period from the allesfitter program, which is 18.8797 days, and calculated the distance to the parent star. We used Kepler's law 3 to calculate it.

$\sqrt[3]{\frac{G\,M_S T^2}{4\pi^2}} = \sqrt[3]{\frac{6{,}6743x10^{-11} * 1{,}45x10^{30} * 1631206^2}{4\pi^2}}$ = 1,86843x10^{10} Km = 0,1249 Au

We calculated that TOI-560C is moving in an orbit 0.1249 Au away. This value differs from the value in the allesfitter program, which counted 0.1242Au.

In the third step, we took into account the stated temperature, which is 225 °C, and calculated the density based on weight and volume:

$V=\frac{4}{3}\,\pi\,R^3$ = 4,186666667 $*$ 17501287^3 = 2,24429E^{22} m^3

$\rho = \frac{M}{V} = \frac{9{,}70 * 5{,}9722^{24}}{2{,}25^{22}}$ = 2572kg/m3=2,57g/cm3

Conclusions

When determining the radius size ratio, we had the largest deviations. We originally set 2.90% and calculated 2.744009%. Allesfitter calculated 2.397%. In other calculations, however, we based ourselves on our values.
Next, we calculated that TOI-560C is orbiting 0.1249 Au. There we were very close to the value in the allesfitter program, which calculated 0.1242Au.

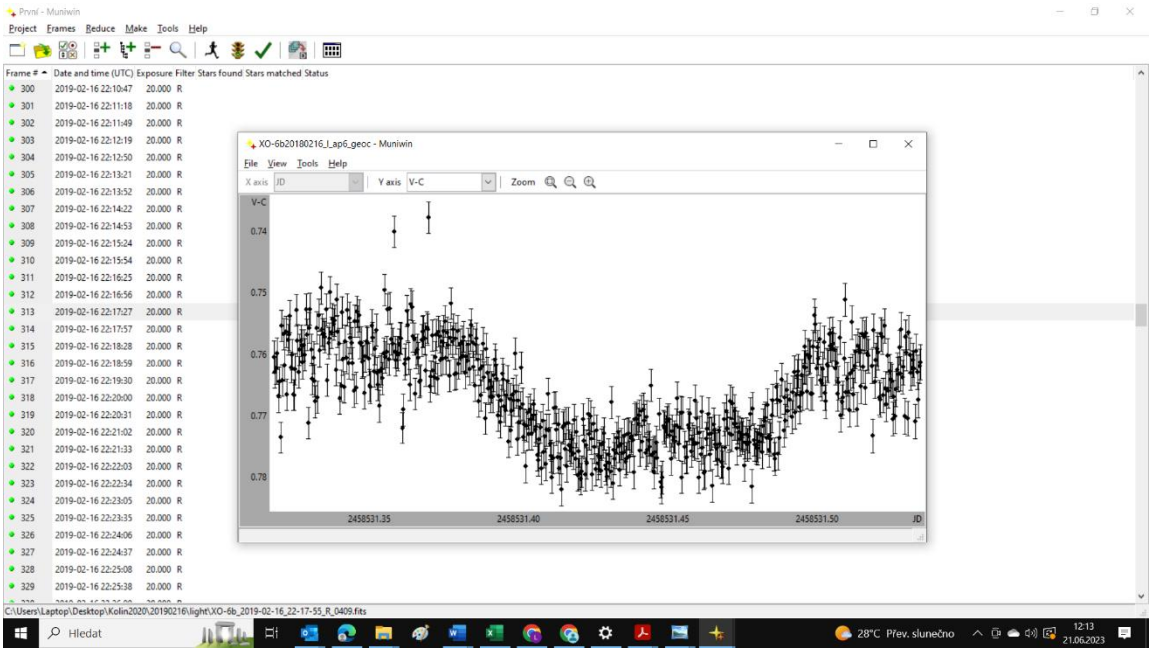
From these values, we found that TOI-510C is somewhere between Earth and Neptune. We also found that it is very close to its host star with a short orbital period. About half the distance of the planet Mercury in our solar system. From this it is clear that the planet cannot be habitable, it is not in the habitable zone. In this vicinity, in addition to the temperature, there will also be considerable radiation from the parent star.

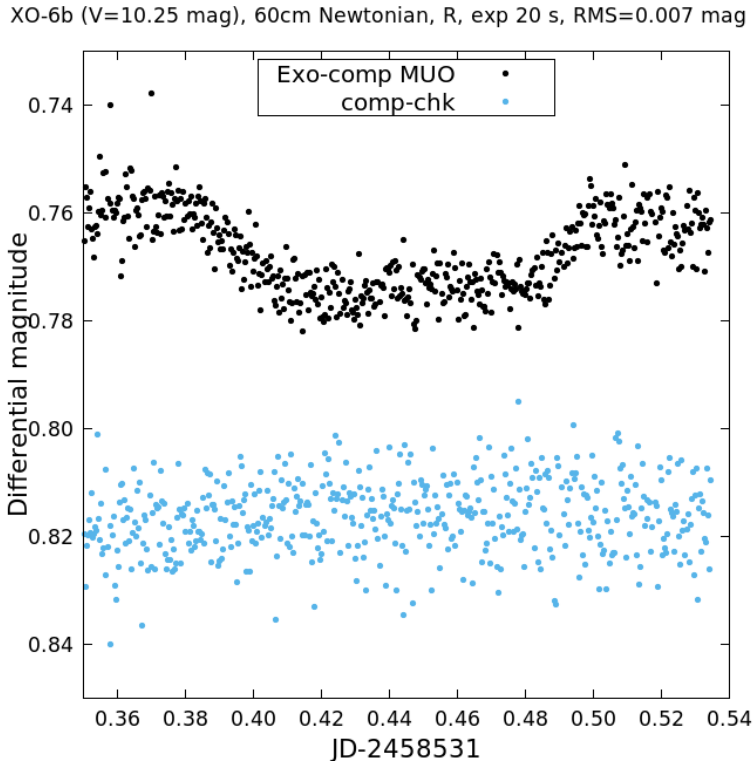
The density of the planet is 2.57g/cm3, which is somewhere between the density of planet Earth and Neptune. From this we conclude that it will have a stone core and a gas envelope. There is no such planet in our solar system. It deviates in many parameters. One could say with great exaggeration "hot Neptune"

We deepened our knowledge of exoplanets. We enjoyed our work very much. We gained experience with the allesfitter program. Our knowledge was with the program Muniwin, which also processes the results of exoplanet observations.

It is a pity that we could not examine and evaluate, for example, a spectral analysis of a star from these data, which would certainly be interesting. We dealt with examples of shifting spectral lines of star motion and exoplanet motions at the Astronomy Olympiad recently this year.

Our team has been dedicated to astronomy for a long time. We created two projects in the Mission Space Lab: one addressed the amount and changes of phytoplankton in marginal seas, and the other focused on growing plants in space. We cooperate with the observatory in Brno on a 600mm telescope. That's where our idea to observe exoplanets came from. That is why we teamed up with the workplace of the Academy of Sciences of the Czech Republic in Ondřejov and under the kind guidance of RNDr. Petr Kabáth, Ph.D. and Mgr. Marek Skarka, Ph.D. we also investigated the exoplanet XO-6b - one of the largest ever discovered.





We also wanted to try to explore the exoplanet WASP-189 b. We were unable to download the data. So we only got to the initial setup and editing of the chart.