DESCRIPTION FOR THE GENERAL PUBLIC

Up to date (may 2017), thanks to Kepler spacecraft mission, there were over 2300 confirmed planets (exoplanets) found to orbit other stars. A comparable number of candidates for exoplanets (2250) await confirmation.

In most cases the information on exoplanets comes from indirect measurements in which exoplanets are not directly observed. The presence of another body around a star is usually deduced from tiny effects the object has on the star. Therefore, it may happen that, due to measurement errors or incorrect interpretation of the observations, exoplanet candidates are announced whereas subsequent observations and analysis do not confirm their existence.

In this project we are going to search for pulsation frequencies below the so called cutoff frequency and verify the presence of candidates for exoplanets around pulsating blue subdwarf stars (and also around faint stars in the field of view of bright ones) which have been observed with the Kepler spacecraft. We will use Fourier transform analysis (FT), the time-delay method, as well as the light reflection/radiation caused by hypothetical planets orbiting stars to confirm or deny the existence of an exoplanet. We will also perform n-body gravitational simulation (if necessary) of expolanetary systems where more than one exoplanet was found on tide orbits, to check the stability of such systems.

The idea of the project came about in recent years when candidates for “extreme planetary systems” orbiting blue pulsating subdwarfs (sdBV) were announced. The sdBVs are low mass stars of 0.5 solar masses from the extreme horizontal branch of the H-R diagram. Therefore, the presence of planetary systems around such stars is controversial because the planets would have to survive the red giant phase of the central star. The following analysis of the Kepler data performed on the one of these stars (KIC 5807616) brought some doubt regarding the previous interpretation. It showed that the signals visible in the low frequency region of the FT of the star's light curve might not be due to the reflection/radiation effect of the light from the planet around the star. Instead, the signals are pulsation frequencies observed below the cutoff frequency. According to the new interpretation, pulsations below the cutoff frequency are not completely dumped and low amplitude frequency peaks can be visible in the FT of the stellar light curves.

In this proposal will be using the above methods for analysis of the low frequency region of the FT of the star light curves of a chosen set of pulsating blue subdwarfs and faint stars in the field of view of the bright ones. We expect our investigations will help to determine whether the low frequency signals are stellar pulsations below the cut-off frequency or are caused by reflected and/or radiated light from the planets orbiting a star, and how to distinguish these two signals.

Our analysis will allow verification of known candidates for planets, search for new planets and more massive bodies around pulsating and non-variable stars. We will use simulated light curves containing both the flux from a star and the flux reflected/radiated from the planets to estimate the exoplanet sizes as well as their orbital parameters.