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Precession of the orbital planes and rotational axes in transiting exoplanets

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"Orbital planes of numerous close-in exoplanets are not always perpendicular to the host star spin axis. This means that the current orbital plane of the exoplanet was probably altered after the system was formed. Projected spin-orbit misalignment can be measured in transiting exoplanets using so called Rossiter-McLaughlin effect affecting radial velocity of the host star. For fast-rotating host stars, where the radial velocities cannot be often measured with a sufficient precision, the planet signature can be found in the mean line profiles. Analysis of the profiles during the transit enables us to determine the projected spin axis-orbital plane misalignment. If the inclination angle of stellar spin axis is known from a high-precision photometry, the true misalignment can be determined. Some objects (e.g. Kepler-13Ab) were found to show precession of the exoplanet orbit caused by the tides due to the rotationally-deformed parent star. These cause changes of the transit duration (TDV) due to the shift of the the transit cord across the stellar surface. Exoplanet orbit precession is always connected with precession of the parent's star rotational axis due to the conservation of the total angular momentum. Its analysis brings us information on the internal structure of the star.
The primary goal of the diploma thesis is to predict precession rates for existing close exoplanetary systems and to synthesise long-term evolution of the mean line profiles, transit time duration and transit light curves. Another goal is to search for objects showing TDV combining ground-based and satellite photometry (Corot, Kepler and TESS)."

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