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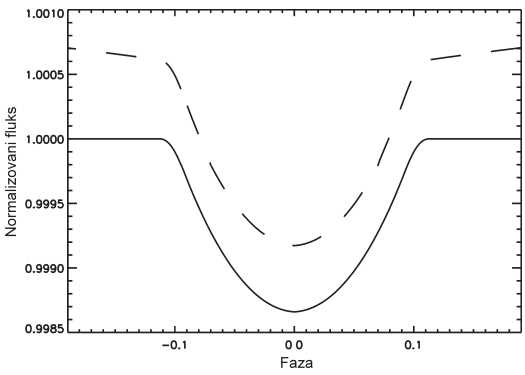
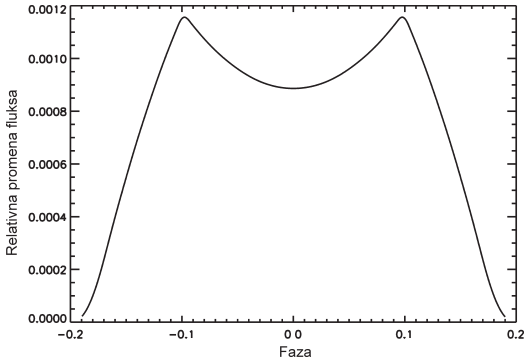
Uticaj niskoamplitudnih periodičnih varijacija na krivu sjaja planetarnog tranzita

Cilj ovog rada je ispitivanje uticaja niskoamplitudnih varijacija detektovanog zvezdanog fluksa na oblik krive sjaja planetarnog tranzita. Ove varijacije nastaju usled sekundarnih uticaja planete na ukupan sjaj sistema zvezda-planeta. Ti efekti su: refleksija svetlosti sa površine planete, Doplerov efekat čiji je uzrok radijalna brzina zvezde usled gravitacionog uticaja planete i relativistički efekat (tzv. „Doppler Boosting"), čiji su uzrok vremenska dilatacija i svetlosna aberacija. Uticaj ovih efekata je ispitan na primeru relativno atipičnog sistema zvezda-planeta HAT-P-2B kojeg karakterišu veliki ekscentricitet orbite planete i velika masa planete. Dodatni efekti su modelovani, pridodati na krivu sjaja tranzita, i zatim je ispitan je njihov uticaj na krivu sjaja u različitim fazama tranzita. Rezultati sugerišu da je uticaj ovih efekata reda veličine jedne milimagnitude što je više nego moguće detektovati modernim teleskopima i svemirskim misijama kao sto su COROT i KEPLER. Kako se za interpretaciju krivih sjaja uglavnom koristi model koji pretpostavlja samo promenu prividnog sjaja usled tranzita, ignorisanje ovih efekata bi moglo da uvede sistematske greške u interpretaciju krivih sjaja planetarnih tranzita. Analiza uticaja ovih efekata na fitovanje krivih sjaja tranzita je sledeći korak u ovom istraživanju.



Slika 1. Kriva sjaja tranzita bez (puna linija) i kriva sjaja tranzita zajedno sa dodatnim efektima (isprekidana linija)

Figure 1. Transit light curve (full line) and transit light curve with all the low-amplitude flux contributions (dotted line)



Slika 2. Relativna razlika između krive sjaja tranzita i krive sjaja tranzita zajedno sa simuliranim efektima

Figure 2. Relative difference between pure transit light curve and the light curve with all the low-amplitude effects taken into account

Influence of Low-Amplitude Periodic Variations on the Light Curve of Planetary Transit

This work proposes an analysis of the influence of low-amplitude stellar flux variations on the transit light curve of extrasolar planets. The detection and characterization of transiting extrasolar planets has been the predominant goal of the Kepler and CoRoT space missions. These programs are based on high-precision photome-

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try, and are sensitive to high, as well as low-amplitude stellar photometric flux changes caused by the influence of an orbiting planet – i.e. light reflected from the surface of the orbiting planet, relativistic effects such as Doppler beaming (boosting), and measured flux variations caused by the Doppler effect corresponding to the change in stellar radial velocities due to the gravitational influence of the orbiting planet. These effects were investigated on a relatively atypical, high-mass and eccentricity system, HAT-P-2b. The effects were modeled, and then added to the transit light curve, enabling an estimation on their impact on the curve for different phase values. The analysis of periodic changes in the stellar light curves yields important information on exoplanet parameters (such as radius, inclination, eccentricity etc.). Unfortunately, the low amplitude effects not being taken into account can lead to misinterpretations of the transit light curve, causing systematic errors in exoplanet characterization. The results suggest that the order of magnitude of these effects is more than enough to be detected by modern telescopes.

** Naspramna strana:*

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