

HOPS: the photometric software of the HOlomon Astronomical Station

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Abstract

HOPS (HOlomon Photometric Software) is a python-based package which includes a user interface and it is compatible with Linux, OS X and Windows. It is open-source (github.com/HolomonAstronomicalStation/hops) and it is designed to analyse data from small and medium class telescopes. A significant factor of any citizen science (CS) project is the meticulous development of dedicated tools. In this direction, HOPS is a user-friendly photometric software for exoplanets, where graphical representations, statistics and models are brought together into a single package. HOPS can be used by amateur astronomers individually or as part of a CS project in analysing transiting exoplanets and producing light-curves. In this way, it could contribute to the scientific data analysis but it could be used also as an educational tool for learning and visualizing photometry analyses of transiting exoplanets, where the everyone can engage with exoplanetary research and data analysis.

The basic features included in HOPS, are: a) reduction, which includes the calculation of master bias/dark/flat frames and the correction of the scientific frames, b) frame selection, which provides interactive graphs for selecting the damaged images, c) alignment, an automatic detection of star patterns in the field of view, despite large shifts or meridian flips, d) photometry, which includes an interactive window for selecting the target and comparison stars and extracts the light-curves using both aperture and PSF photometry, e) transit fitting, which provides the fitting of the transit model on the relative light-curve using MCMC sampling. HOPS makes use of the python package PyLightcurve which is completely developed in Python and provides routines for: a) finding planetary parameters from the open exoplanet catalogue, b) calculating limb darkening coefficients, c) calculating the planetary orbit, d) calculating the transit light-curve model using numerical integration. The PyLightcurve package can be found on github: <https://github.com/ucl-exoplanets/pylightcurve>.