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Joint Planet Hunting with ASTEP and BEST II

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Abstract

During the first season of the antarctic telescope ASTEP400 in the southern winter 2010, two target fields have been monitored in a joint observational campaign by BEST II (Berlin Exoplanet Search Telescope II) and ASTEP (Antarctic Search for Transiting ExoPlanets). We present the results of the data reduction and transit search, and compare the photometric quality of both sites. We summarize the lessons learned towards an optimization of future network observations including an Antarctic site.

1. ASTEP

ASTEP is a pilot project for exoplanet transit search from Antarctica. Located at Dome C, it consists of two small aperture telescopes. ASTEP South (10cm) and ASTEP400 (40cm) are designed to access the photometric quality of Dome C and to obtaining long time series data in order to detect extrasolar planets [1]. The 3-month continuous night during the Antarctic winter and the clear sky, outstanding seeing conditions and low wind-speeds make this location to one of the most suitable for transit search in the world.

2. BEST II

The BEST II system operates as photometric ground based support to the CoRoT space mission. Located at the Observatorio Cerro Armazones, Chile, the 25cm aperture telescope performs a precise photometric variability characterization within the selected CoRoT stellar fields ([3], [4], [5]).

3. Observation

Apart from several observations of the transiting planet WASP-18b from each location the focus of this project were two fields: ASTEP-Exo2 and ASTEP-Exo3. These fields were observed in a joint observation mode during July and August 2010 (see example Figure 1). An overview of the acquired data can be found in Table 1.

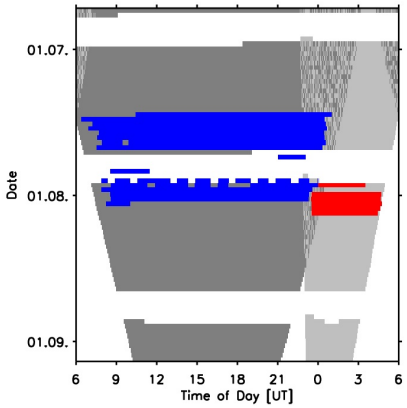

Figure 1: Example of a joint BEST II/ASTEP field observation shown for the field ASTEP-Exo2 in 2010. Blue areas denote ASTEP time series, red denote BEST II observations. The y-axis shows the first day of the month in 2010. For comparison, gray areas indicate the maximum astronomical visibility of the field from each location.

Table 1: Overview of the joint observations

Telescope	Field	t_{exp} [s]	# Nights	# Frames
ASTEP	Exo2	70	16	5895
	Exo3	70	16	3418
BEST II	Exo2	120	6	391
	Exo3	90	11	360
		10	12	437

4. Results

We will present the high photometric quality of the ASTEP400 data and how it can be compared to telescopes on observing sites installed at usual latitudes like BEST II (see the Transit of WASP-18b in Figure 2).

The focus will be the joint observations of two fields observed in July and August 2011 from the two observing sites in Antarctica and Chile. We will show that the photometric measurements can be combined easily, although the two systems are photometric different. One result of the combination is that stars at the bright end in the ASTEP data show a lower scatter than the same stars in the BEST II data set, probably caused by a lower level of red noise [6] in the ASTEP400 data set.

Furthermore, we will discuss how a telescope network including an antarctic telescope can improve the planet search by increased photometric quality and increase observing time lines. At the end, we will present which lessons we have learned from this observations and what we can improve for the next observing season.

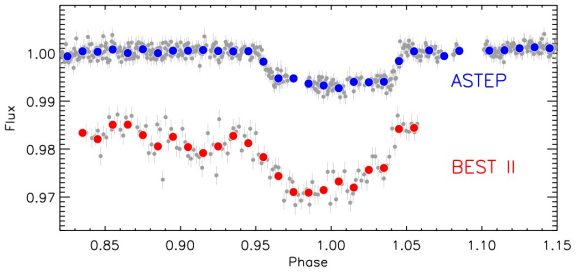

Figure 2: Comparative transit observations of WASP-18b obtained with ASTEP400 and BEST II. The colored points show the binned measurements with a sampling of 14 minutes. The BEST II light curve is shifted in flux for clarity.

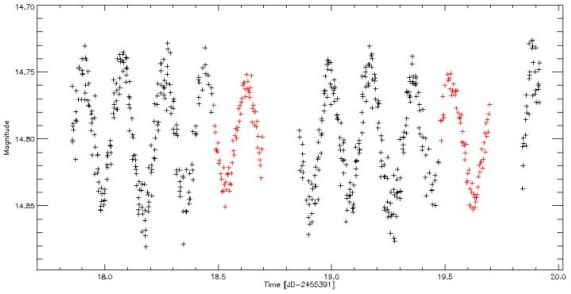

Figure 3: Example of a combined light curve obtained by ASTEP400 (black) and BEST (red) for a short period variable star. It shows, how the measurements fit well in the observational gaps of the ASTEP400 observations and therefore increase the observed time line.

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