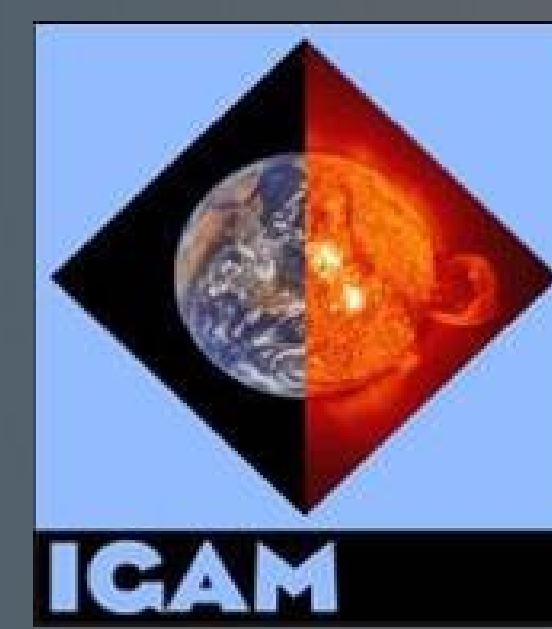# Ground Based Wide-Field Photometry with the Zeiss BMK

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Abstract

The Zeiss BMK has been converted to a multi versatile robotic telescope system. Its optics with an aperature of 300 mm and a focal length of 750mm results in a field of view 2.75°×1.83°. The data processing is performed by a set of IDL routines by using GSFC's IDL AstroLib.

Introduction

The Zeiss Ballistische Messkammer BMK 75/18/1:2,5 was reactivated in the frame of a diploma thesis (Weingrill, 2007). The plate-changer for the photochemical glassplates was replaced by an astronomical CCD camera. The mount drive and its control unit has been replaced by a computer controllable device.

Instrument

The Zeiss BMK is located in a separate dome at the Observatory Lustbühel Graz (OLG) and was originally used for geodetic measurements. The telescope mount is driven by a Pulsar Commander and allows a pointing accuracy within several arc seconds.

Figure 1. *Zeiss BMK 75/18/1:2,5 with SBIG STL-11000M; insert: Pulsar Commander hand control box.*

The telescope has a focal length of 750 mm and an aperature of 300 mm. The FWHM of the PSF is smaller than 5 μm for wavelengths of 540 nm and above. The optics consists of 10 lenses and provides a flat, distortion-free image of 180×180 mm. The SBIG STL-11000M CCD camera with 4008×2672 pixels has a field-of-view of 2.75°×1.83° at a resolution of 2.475 arcsec/pixel. This is well beyond the average seeing between 2 and 3 arcsecs.

Three optical filter sets allow various observational campaigns:

- LRGBC-filterset for astrometry, observation of galaxies, photometry of transits
- UBVRI-filterset for photometry of planetary transits and active stars.
- L/HII/S[II]/O[III]/CLS-filterset for imaging of planetary nebulas and observation of comets. Especially the CLS (City-Light-Supression) filter is useful due to the light pollution of the nearby city of Graz.

The site is operated automatically as a robotic telescope. The software CCDAutoPilot4 controls the dome, the mount and the CCD camera. The observation campains are controlled by a script which can be generated either locally or remotely at the institute.

Data Processing and Analysis

The data storage and processing pipeline was designed in order to provide full data integrity on one hand and high processing speed on the other hand.

All aquired images are stored immedity on a RAID located at the dome control PC. On the following day they are transferred to the main storage- and processing-server. The data analysis is performed by IDL routines based on the GSFC's IDL Astronomy User's Library.

The software packages AstroArt4 and CCDStack are used for visualisation and quick-look of the data.

Since the astrometry and plate-solving is performed automatically by CCDAutoPilot due to inclusion of WCS keywords in the FITS files on aquisition of the images, only the photometry has to be performed in the post-processing pipeline.

A single frame can contain up to 3000 stellar sources to be extracted, verified and measured. Due to very low exposure times between 2 and 360 seconds, an observation run in a single night can produce between 300 to 600 images. This large computational task is handled by a small computer cluster consisting of eight nodes.

The processed data can be accessed via FTP.

Observations

Since first light on May 9th, 2006 several observational campaigns have been performed so far:

- Observation of comet C/2006 M4 SWAN and 17P Holmes
- Photometry of NGC 6341, NGC 598, NGC 628, IC 434, PGC 32115, Messier 96, Herschel H 28, Messier 42, NGC 6205 (see Figure 2), IC 4592, NGC 7000
- Photometry of the Lunar Eclipse March 3rd, 2007
- Observation of the Moon in frame of the SMART-1 impact
- Photometry of asteroid Astrea (5)

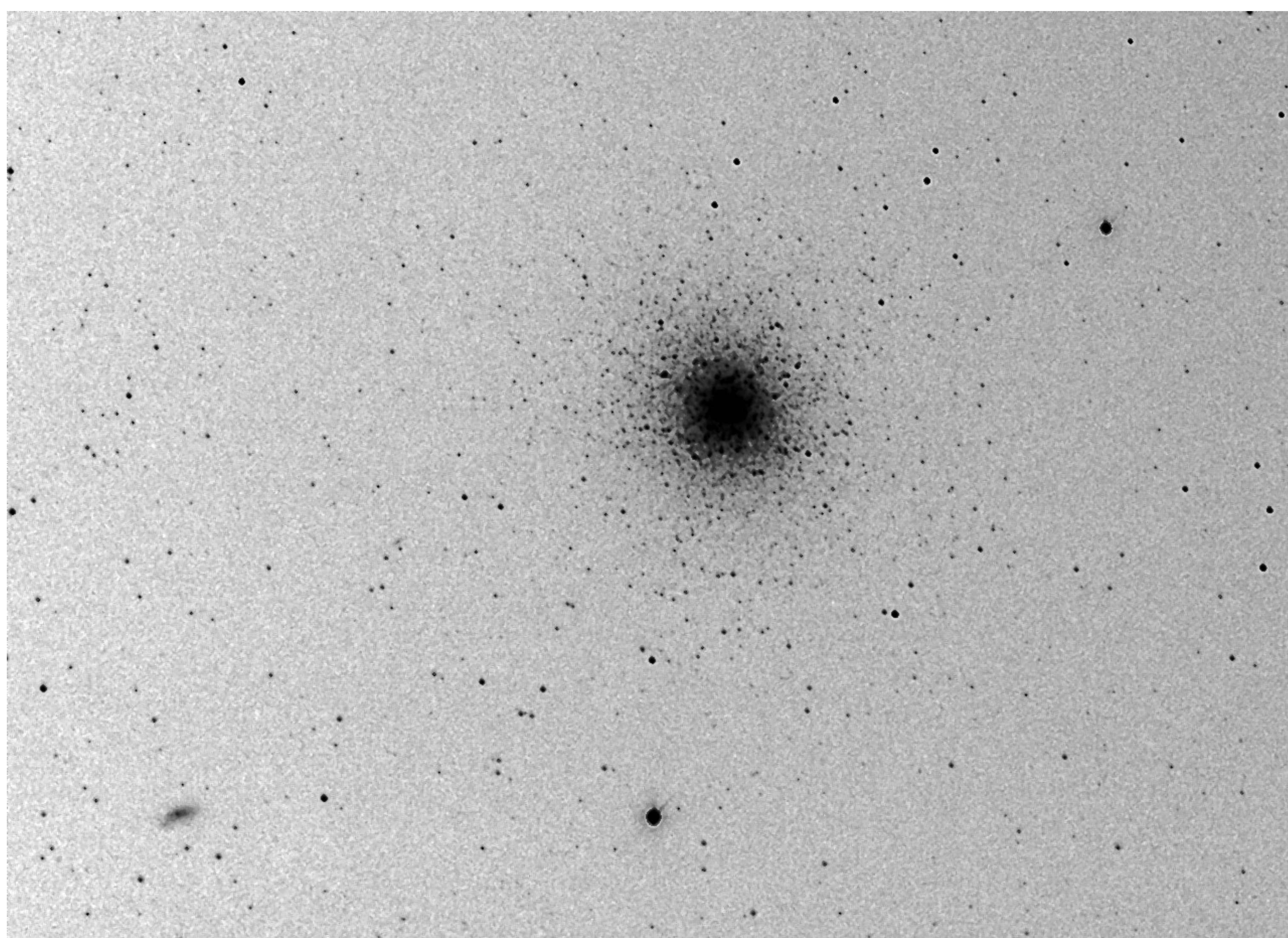Photometry of the extrasolar planet TrES-2b on photometric follow-up for the CoRoT space mission. (see Figure 3)

Figure 2. *NGC 6205 in R-band, 120 seconds exposure, NGC 6207 with 12.1 mag can be seen on the lower left, image cropped to a quater. North is left. Limiting magnitude is about 17.4 mag.*
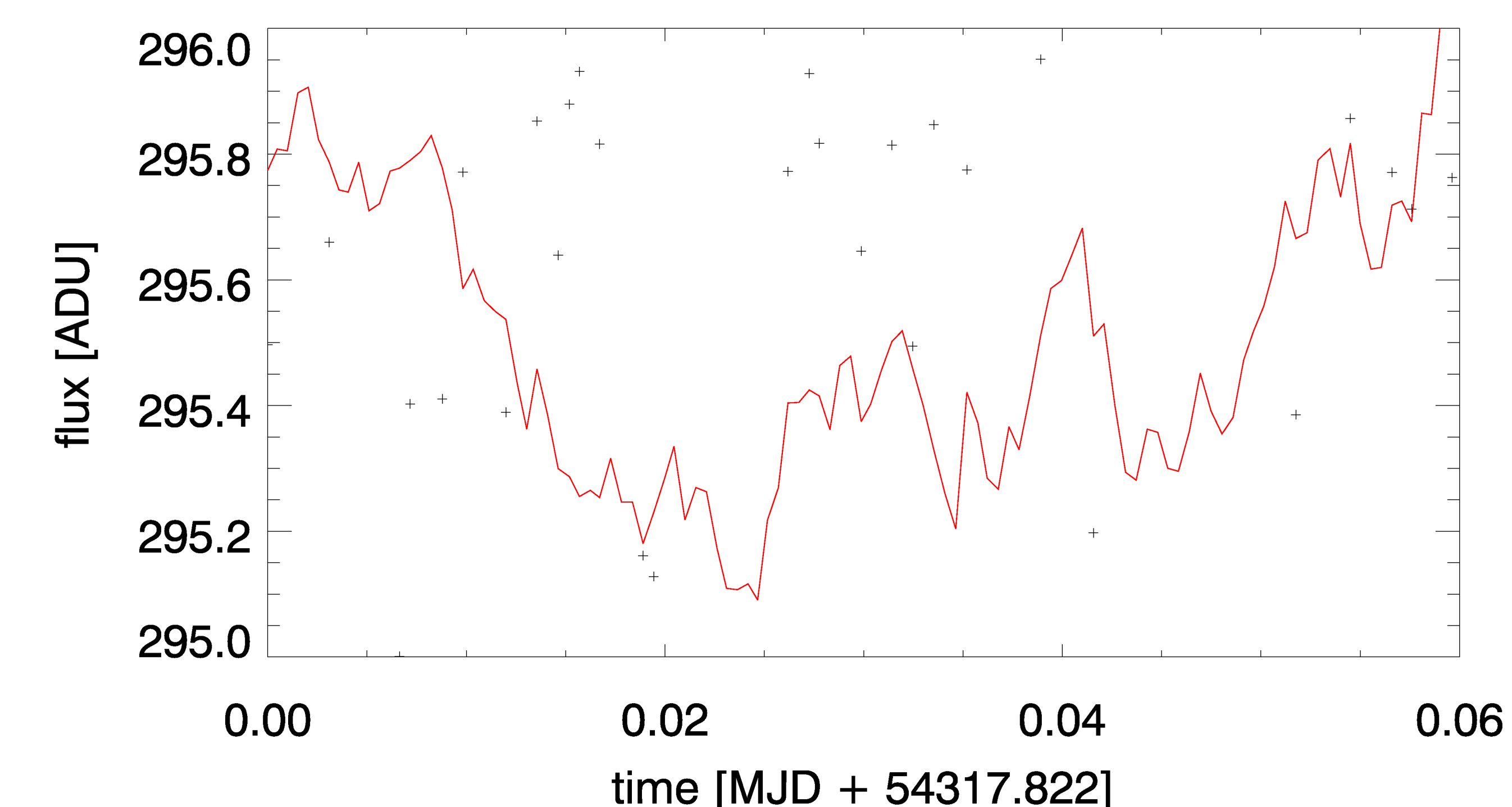

Figure 3. *Measurement of TrES-2b of 5 Aug. 2007 21:27 UT. about 200 frames with 2s for each frame. Astronomik L-filterband. 120 comparison stars used.*

Acknowledgements