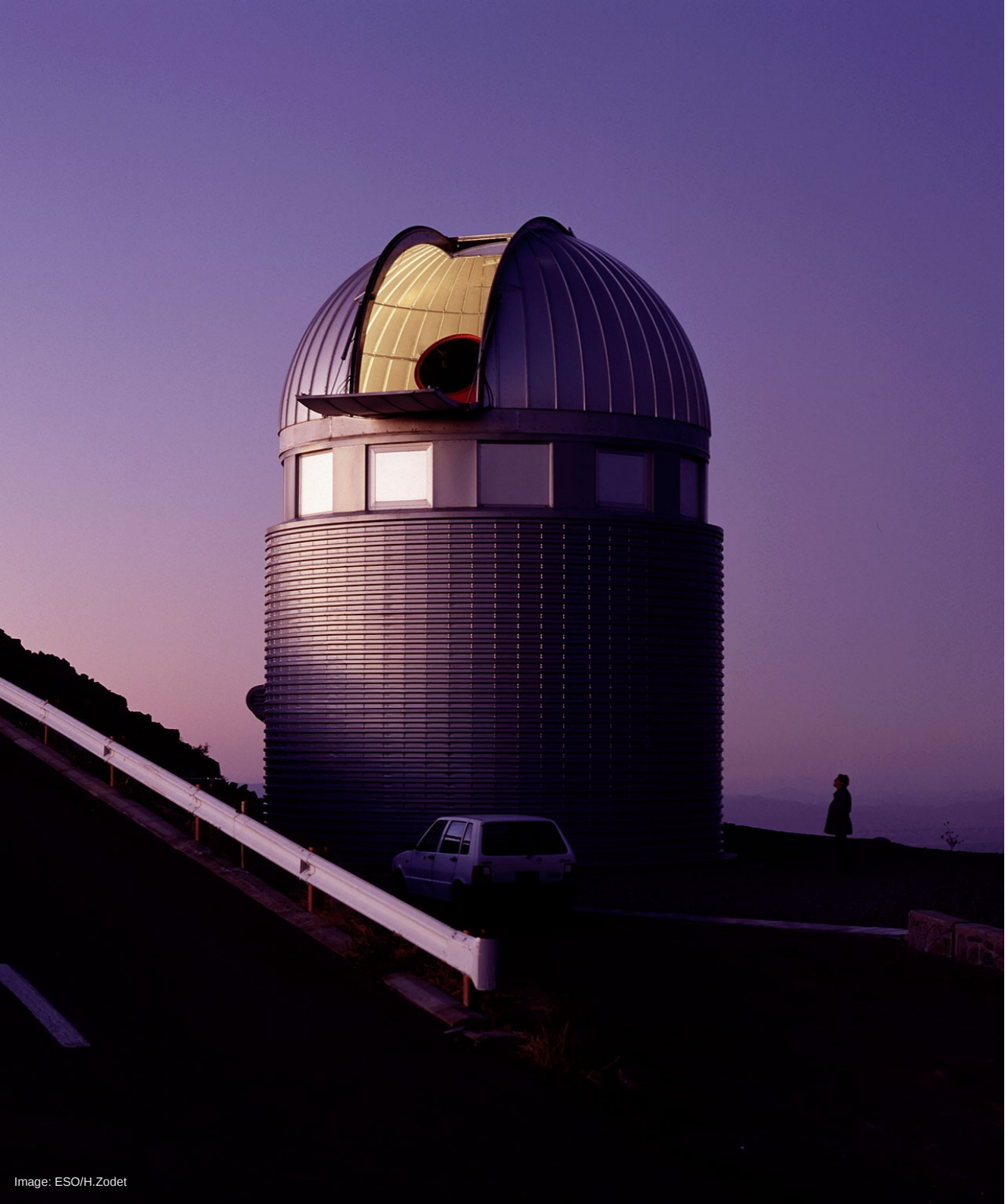
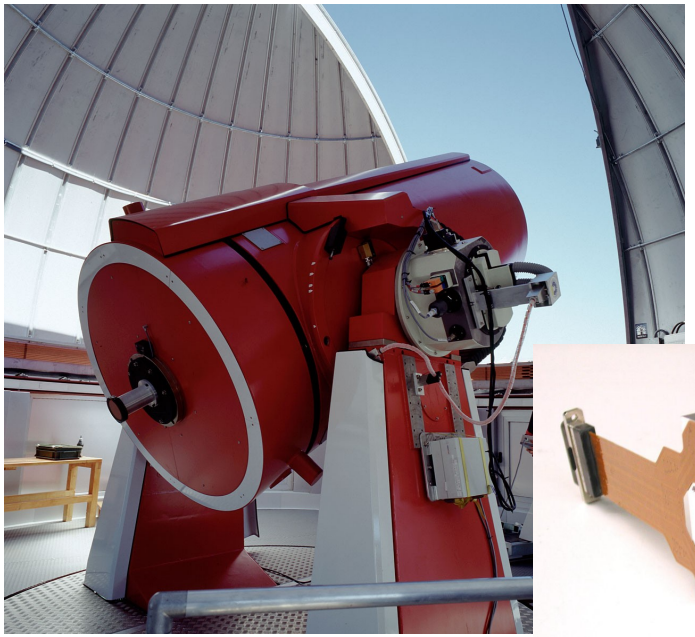


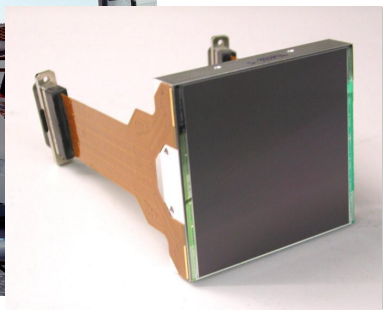
Image: ESO/H.Zodet

EulerCam

High precision photometry
with the
Euler-Swiss telescope

Monika Lendl
Observatoire de Genève
November 2011





Telescope:

Mirror: 1.2 m

Location: La Silla (Chile)

Instruments:

CORALIE (since 1998)

EulerCam (since 2011)

e2V, back-illuminated CCD

EulerCam specs:

FOV: 15 x 15 arcmin

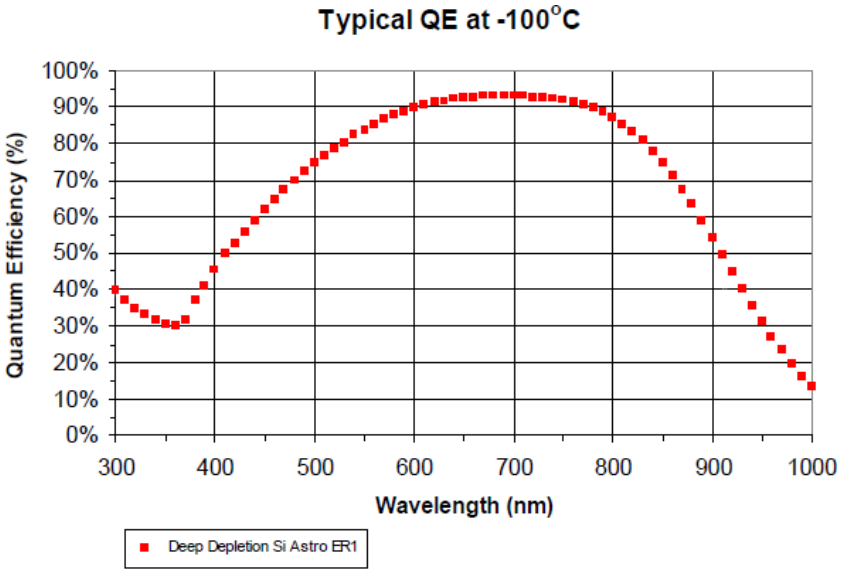
4k x 4k pixels

Scale: 0.23 arcsec/pix

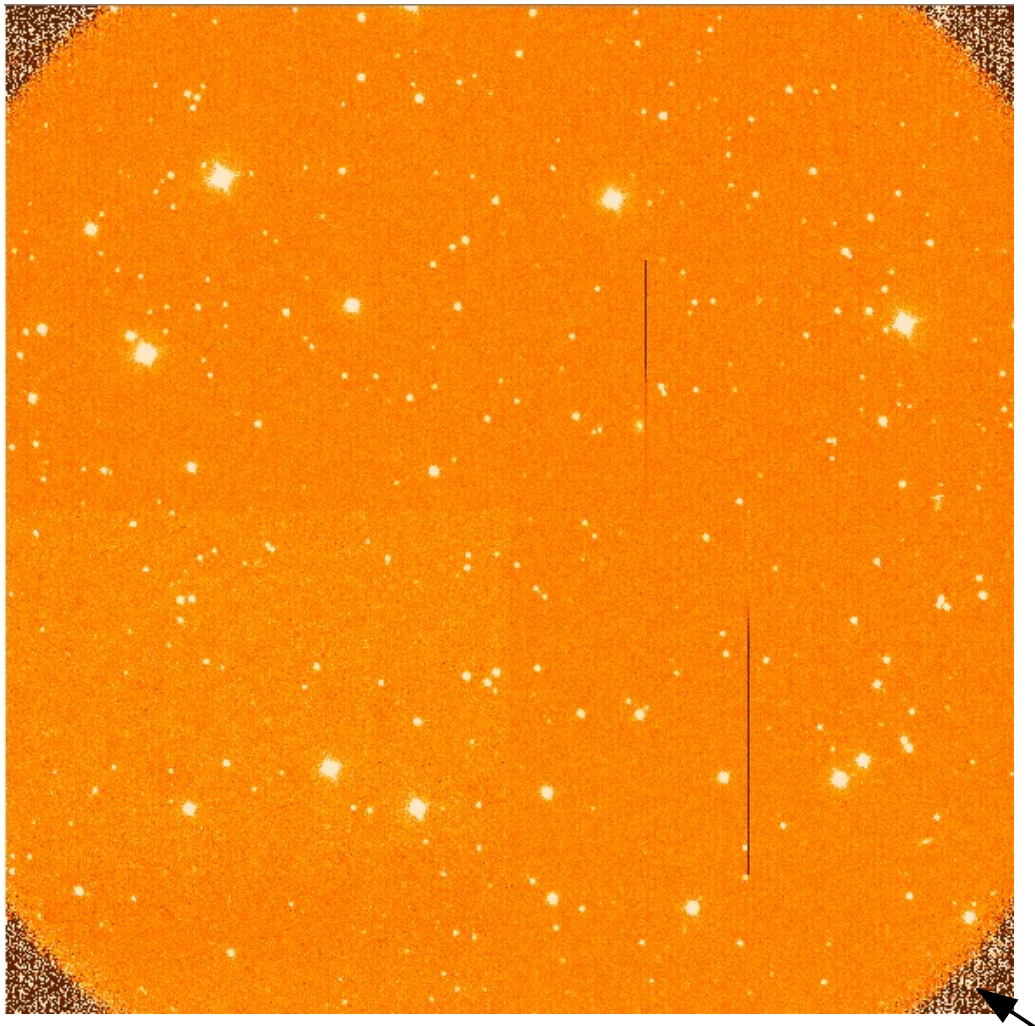
4 readout ports

Readout time: 6s

Filters: UBV + Gunn r', z' + IC + Geneva system + transparent



EulerCam



„Absolute tracking“

Sources on the images are matched with a catalog

Offsets are sent back to the telescope

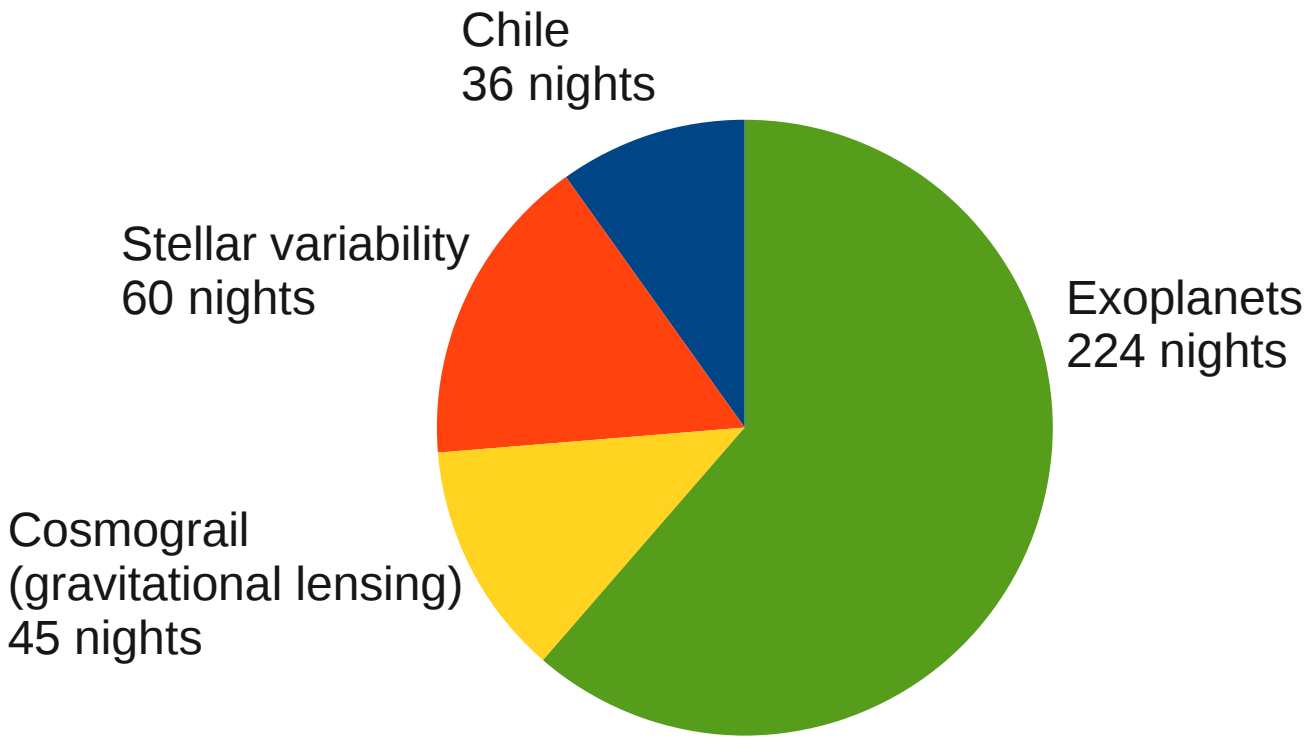
Noise levels

Readout: ~5 e^-
Dark: tiny (less than 3 e^- in 1/2 hour)

Corners obscured by the filter wheel

EulerCam science

Distribution of telescope time

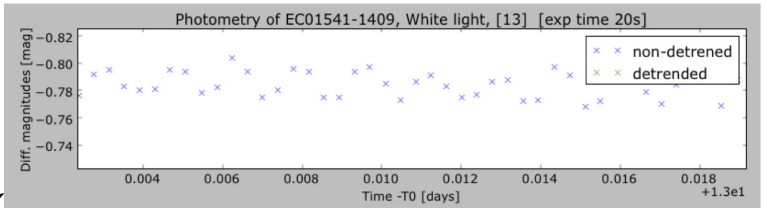


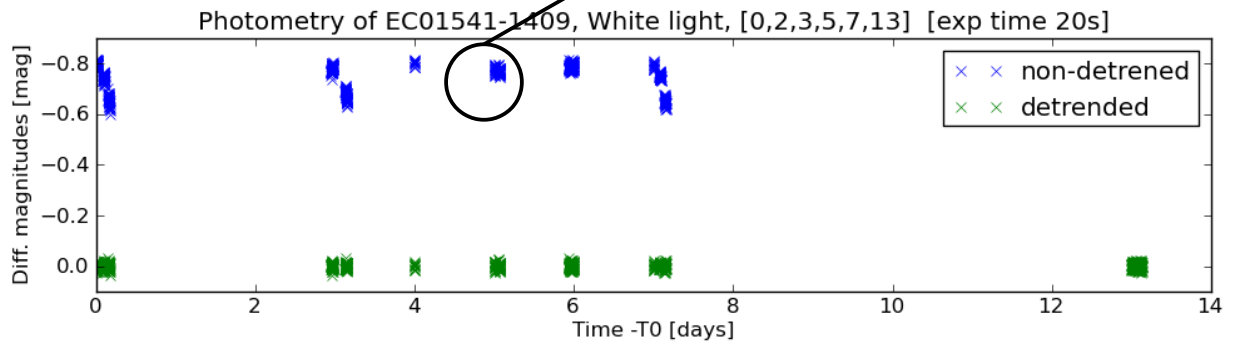
Non-planet science - Asteroseismology

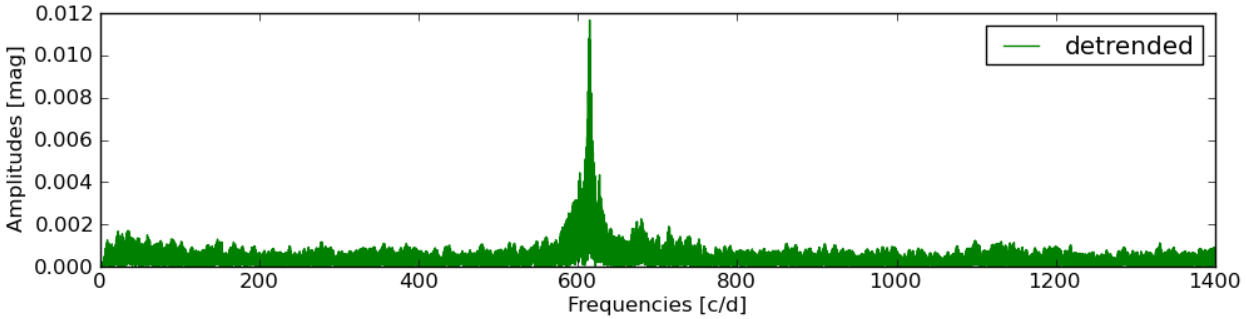
SDB Pulsator

mag_R = 12.6

White Filter, 20s exposures

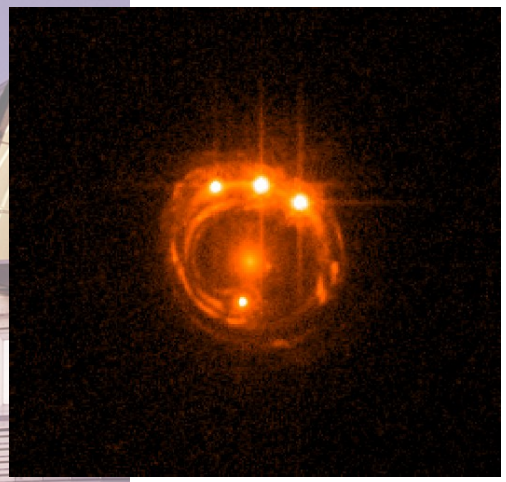


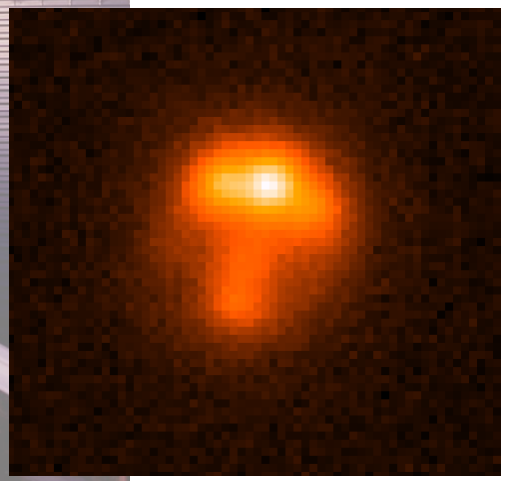




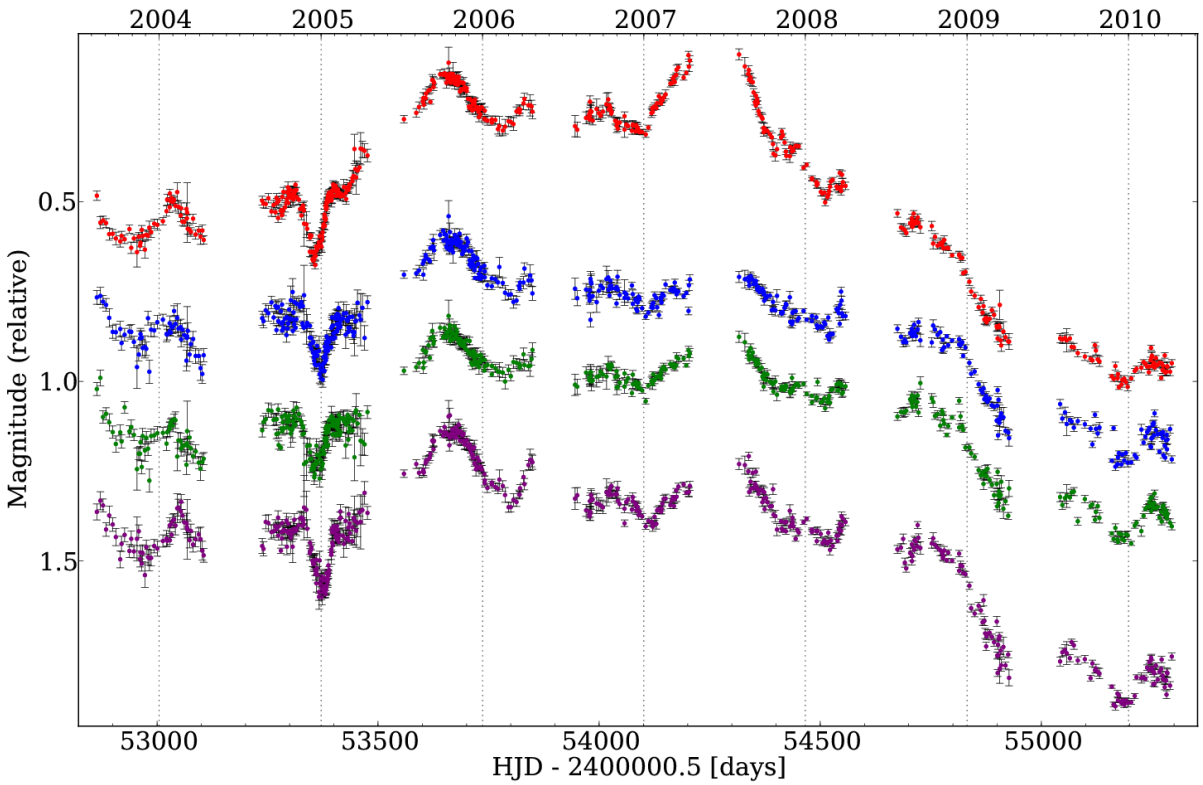
Courtesy Mihaly Varady

Non-planet science – Gravitational Lensing





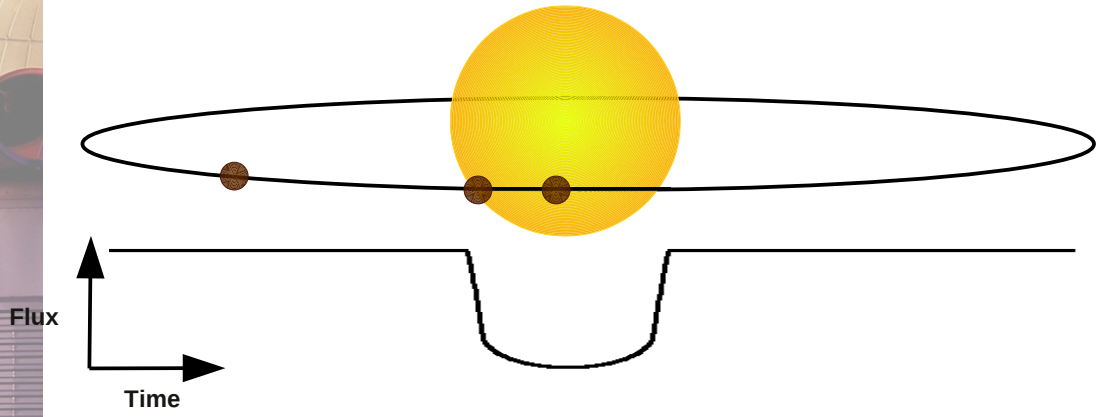
Courtesy M. Tewes / Cosmograil project



Time shifts between the different lens components are used to measure H_0

Planetary transits

Giving detailed insights on planets ...



Photometry:

- Mass
- Inclination
- Radius
- (Stellar mean density)

Spectroscopy:

- projected spin-orbit angle

Multicolor observations during *transit* and *occultation*:

- Chemical composition
- Albedo
- Precise measurement of the eccentricity

Transit timing:

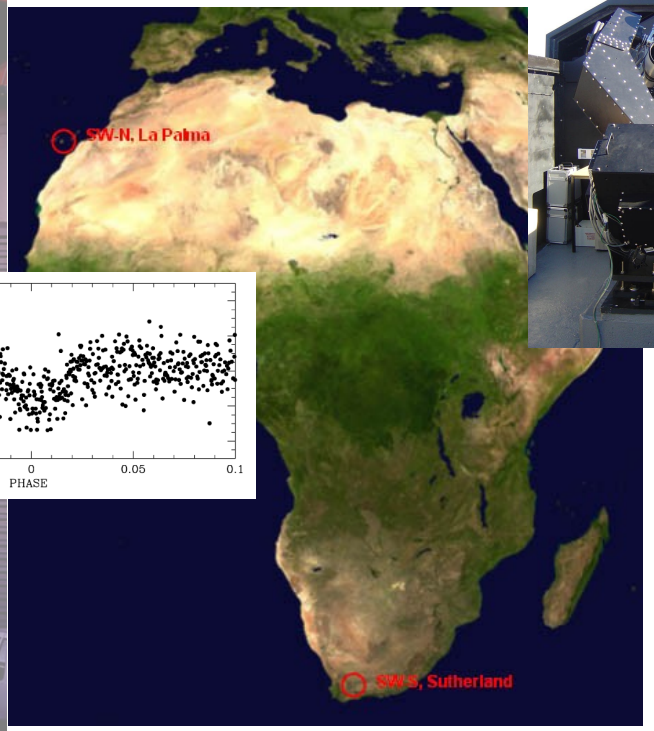
- purely photometric masses
- Additional planets

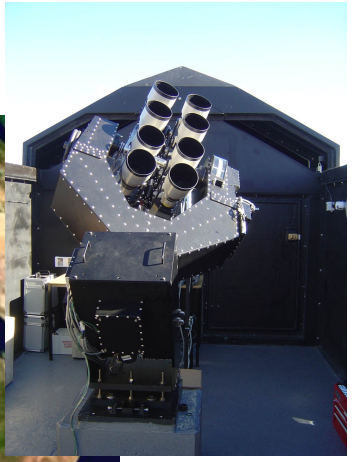
Phase curves

- Rotation
- redistribution of energy from day to night side

Exoplanets with EulerCam

SuperWASP



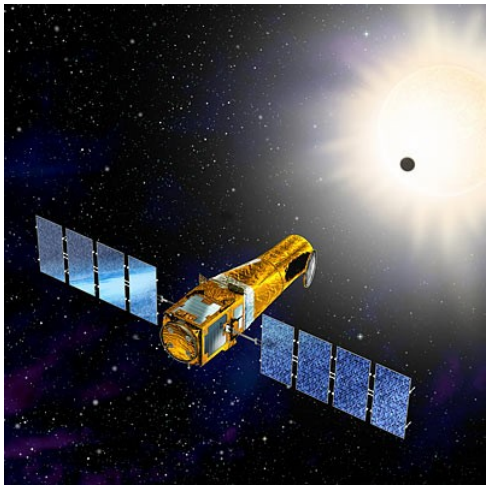


Wasp-50 (Gillon et al. 2011)

Follow-up for ground and space based transit surveys

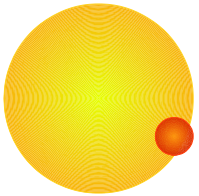
It is essential to eliminate false positives which are mostly due to the large PSFs of the survey instruments

CoRoT

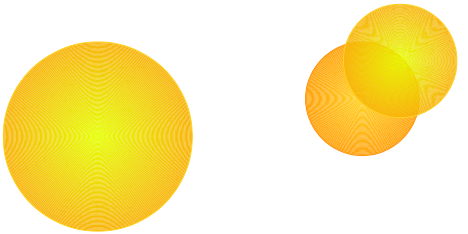


High precision photometry for planets and planet candidates allow to study the systems in greater detail.

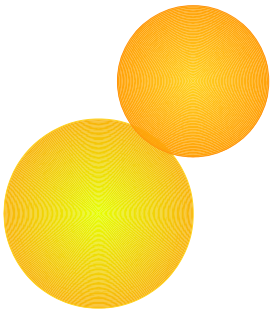
False positive scenarios



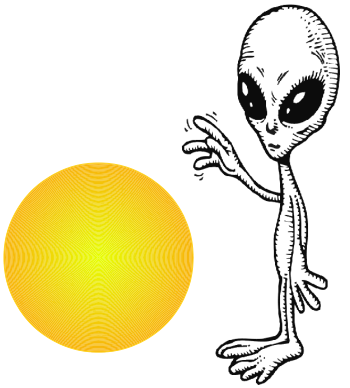
M-dwarf transiting brighter star



Blended eclipsing binary



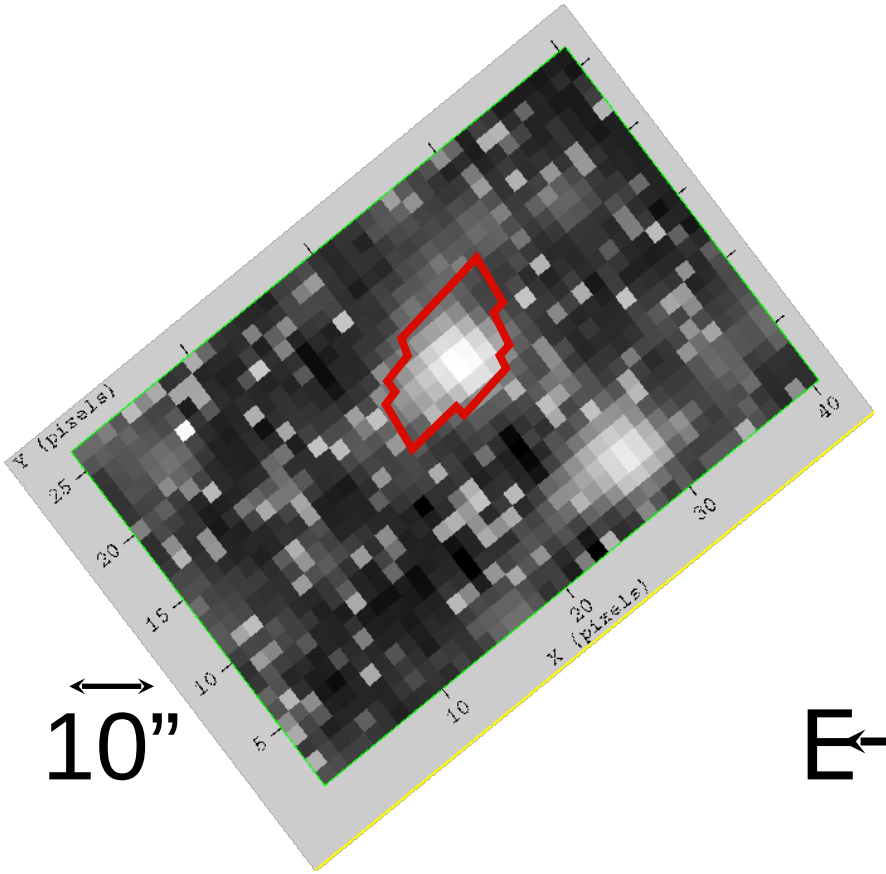
Grazing eclipsing binary



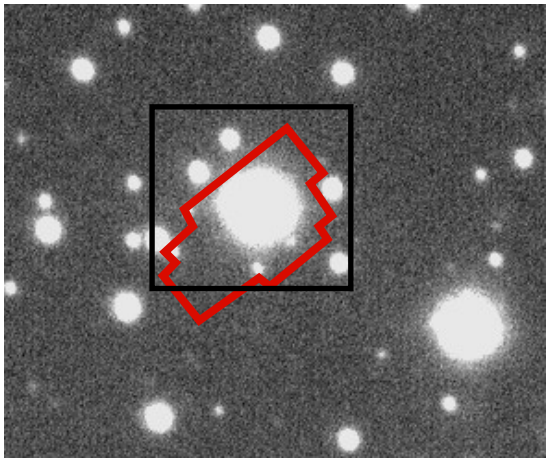
Non-astrophysical effects

On – Off photometry

CoRoT



EulerCam



10”

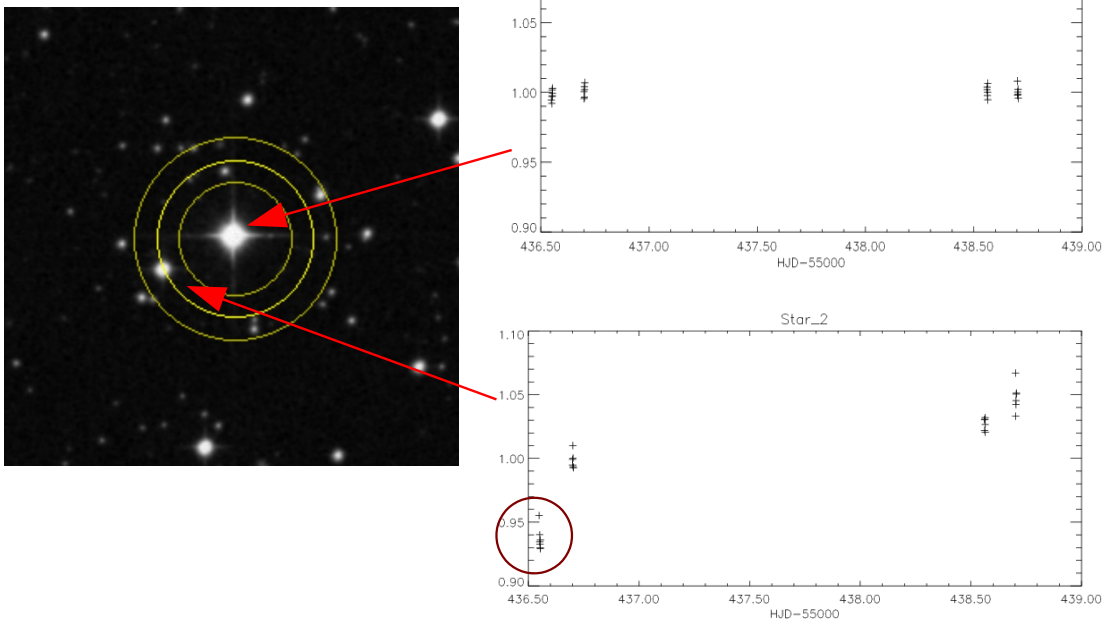
Courtesy Roi Alonso

N

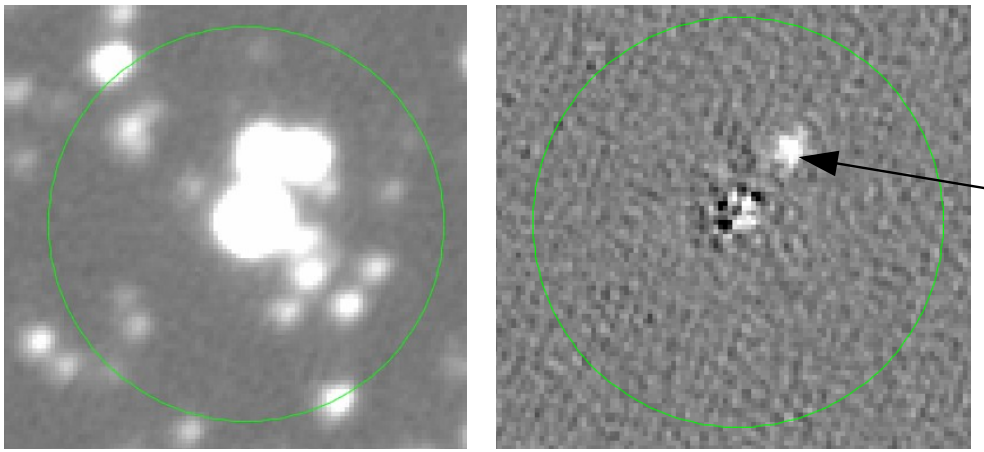
E

On – Off photometry

With aperture photometry



With image subtraction (ISIS)



Transit photometry

Typical targets:

- SuperWASP planet candidates — mag_V 9 – 13
- CoRoT planete cantidates — mag_V 12 – 15
- Recently also known RV planets — mag_V 7.5 – 11

Ephemeris refinement

Search for transits of known RV planets

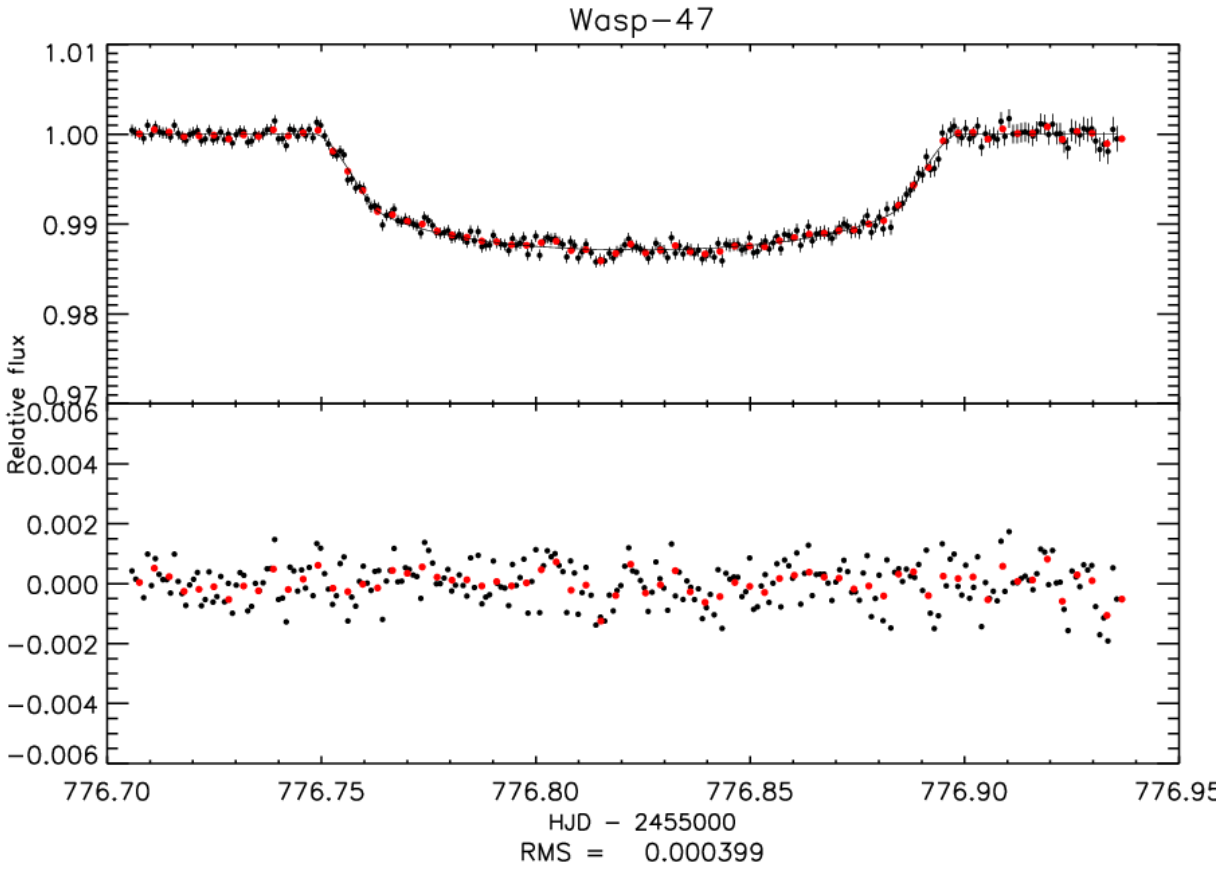
High S/N transits for discovery papers

In depth study of known transiting planets

Simultaneous observations with TRAPPIST

Transit photometry

... an ideal case



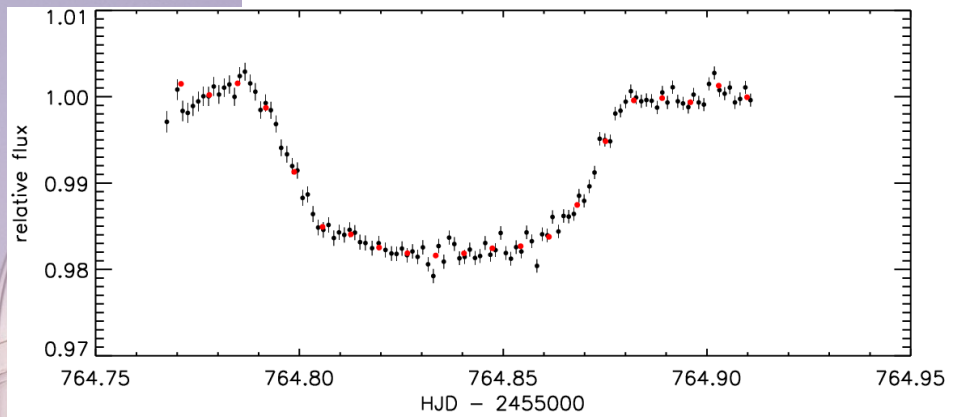
RMS:

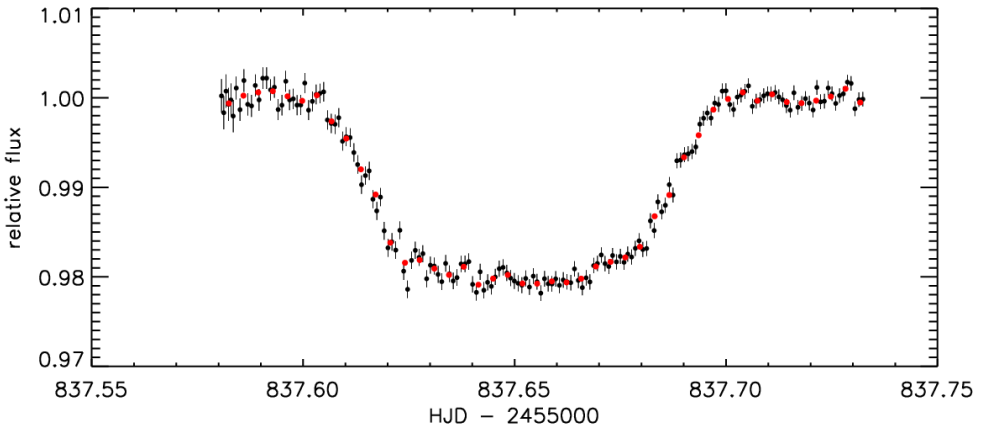
688 ppm (unbinned)

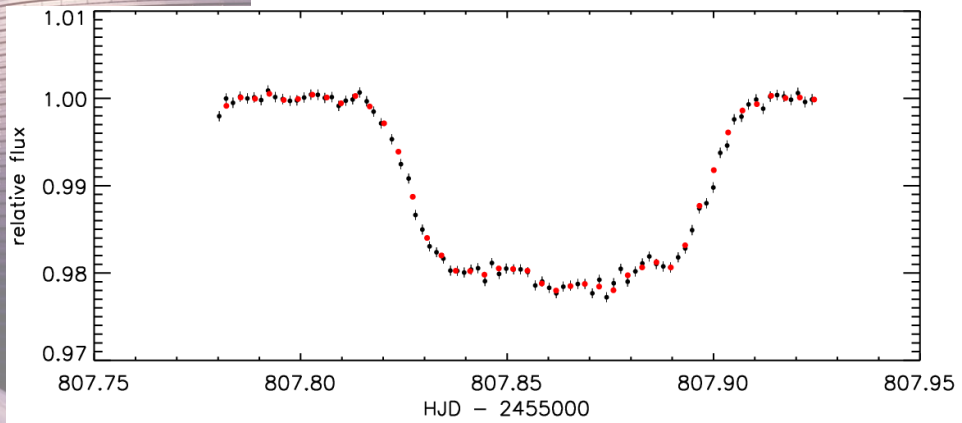
399 ppm (5 min bins)

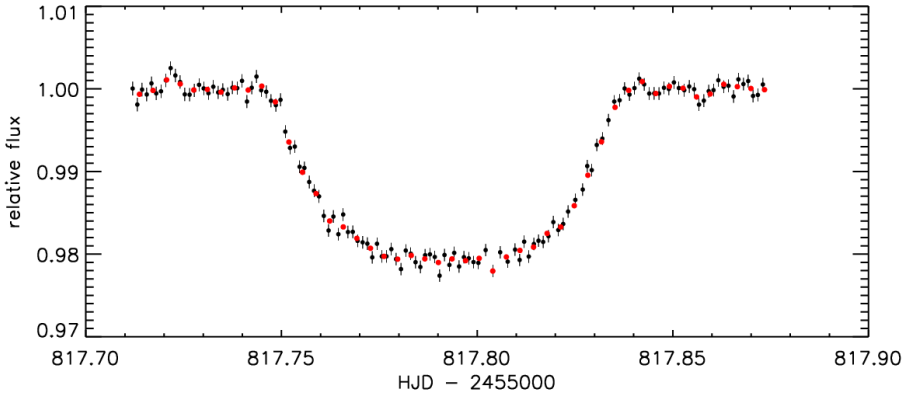
Transit photometry

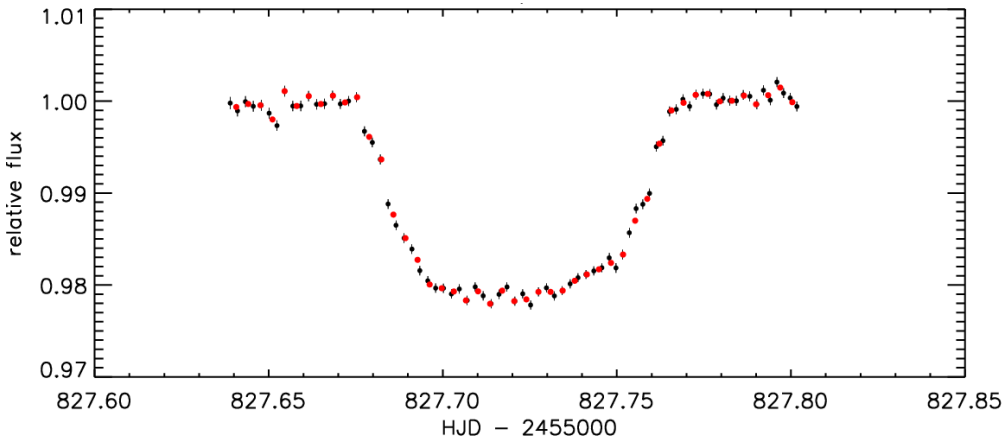
... a little less ideal case











Transit photometry

... combination of 5 transits