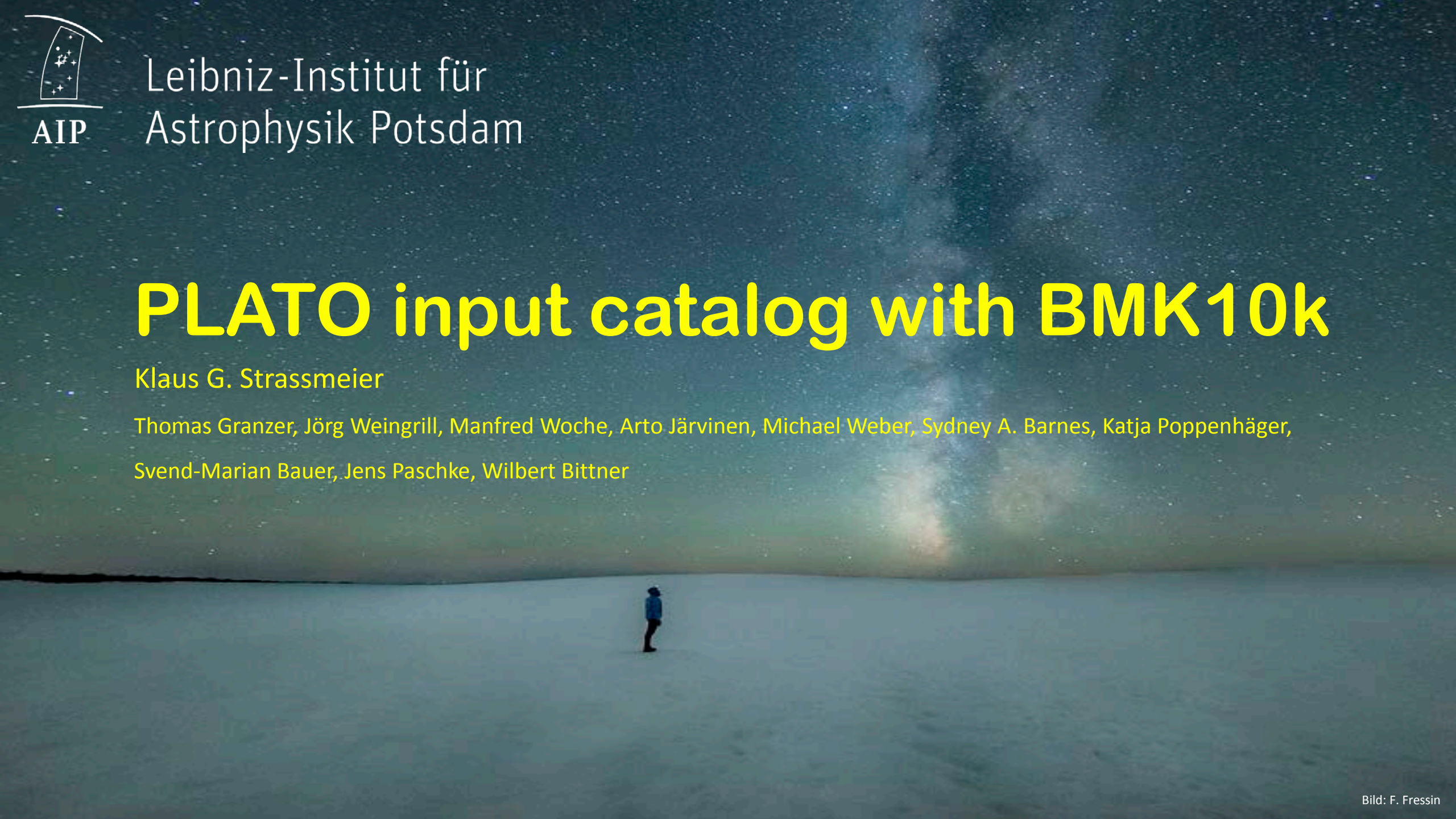


Leibniz-Institut für Astrophysik Potsdam

AIP

PLATO input catalog with BMK10k

Klaus G. Strassmeier

Thomas Granzer, Jörg Weingrill, Manfred Woche, Arto Järvinen, Michael Weber, Sydney A. Barnes, Katja Poppenhäger,

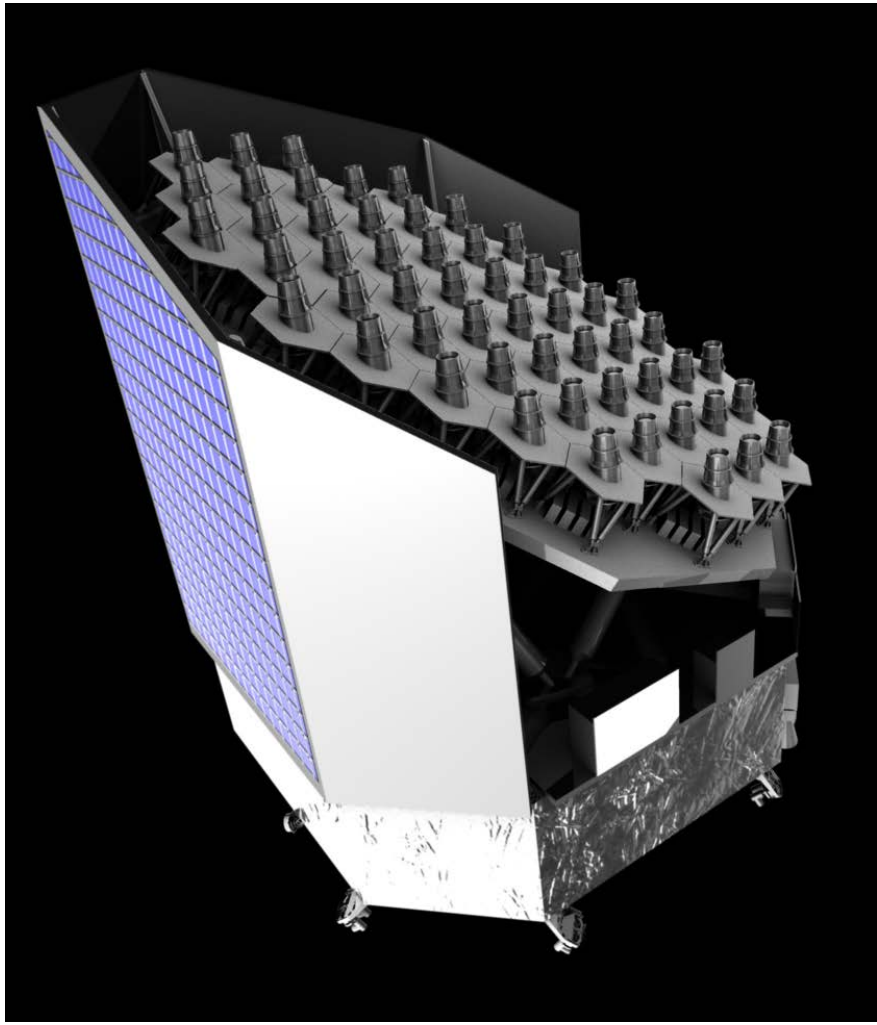
Svend-Marian Bauer, Jens Paschke, Wilbert Bittner

Bild: F. Fressin

PLATO - PLAnetary Transits and Oscillations

(Rauer et al. 2014, Exp. Astr. 38, 249)

- Launch 2026, 4 – 8.5 year duration
- Transit monitoring of ≈1 Mill. stars (λ500-950nm)
- 24 telescopes with cadence 25 sec (V≈8-16^m)
- 2 telescopes with cadence 2.5 sec (V≈4-8^m)
- Each telescope has 1100 deg^2 FoV
- Arranged in 4 groups (=2250 deg^2 per pointing)
- Photometry done from 90″×90″ CCD windows
- Pixel sampling is 15″/pix (TESS has 21″/pix)
- can‘t download all of this → you better weed out false positives early on → BMK10k

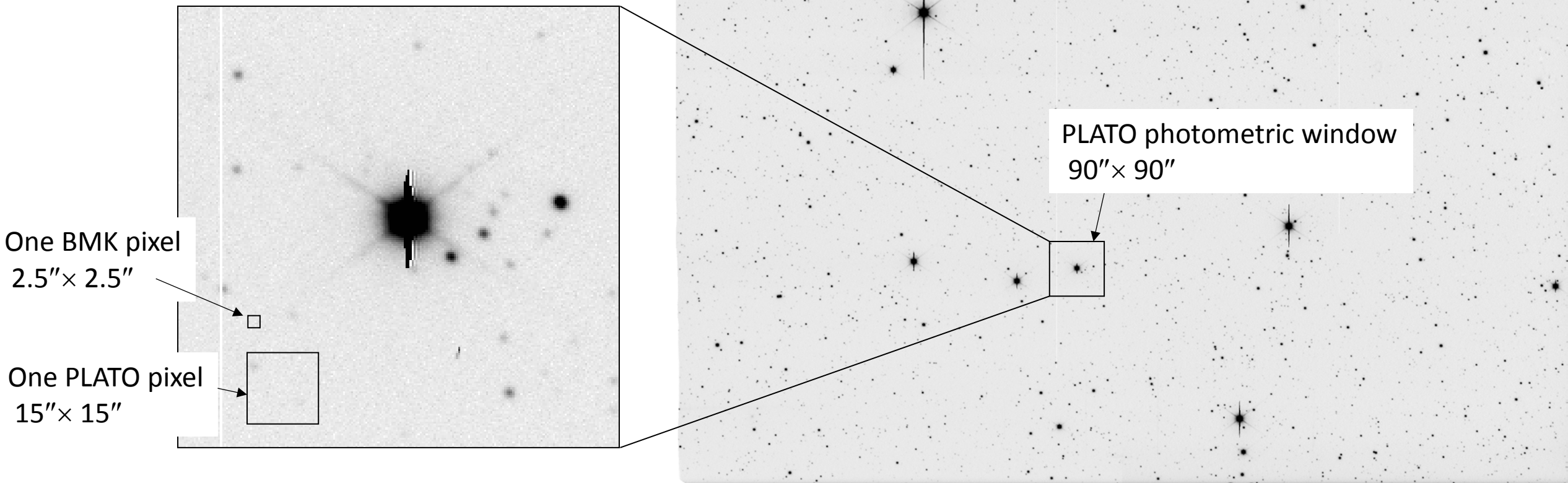


Star field at

RA 21h31m DEC +48d26‘

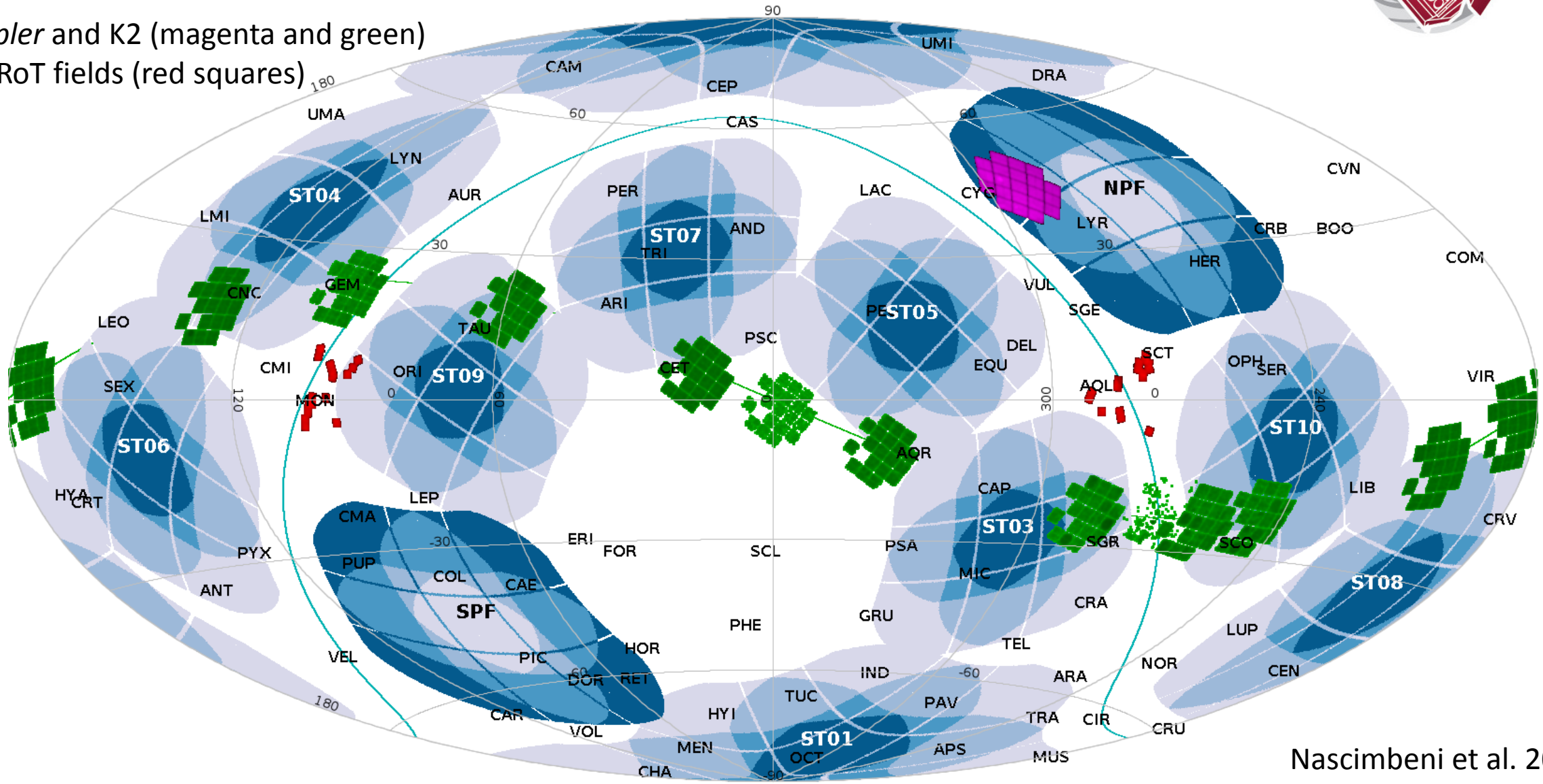
Gal Long 92° lat -2°

Within PLATO field ST09 (Orionis)



PLATO deep field south (SPF)

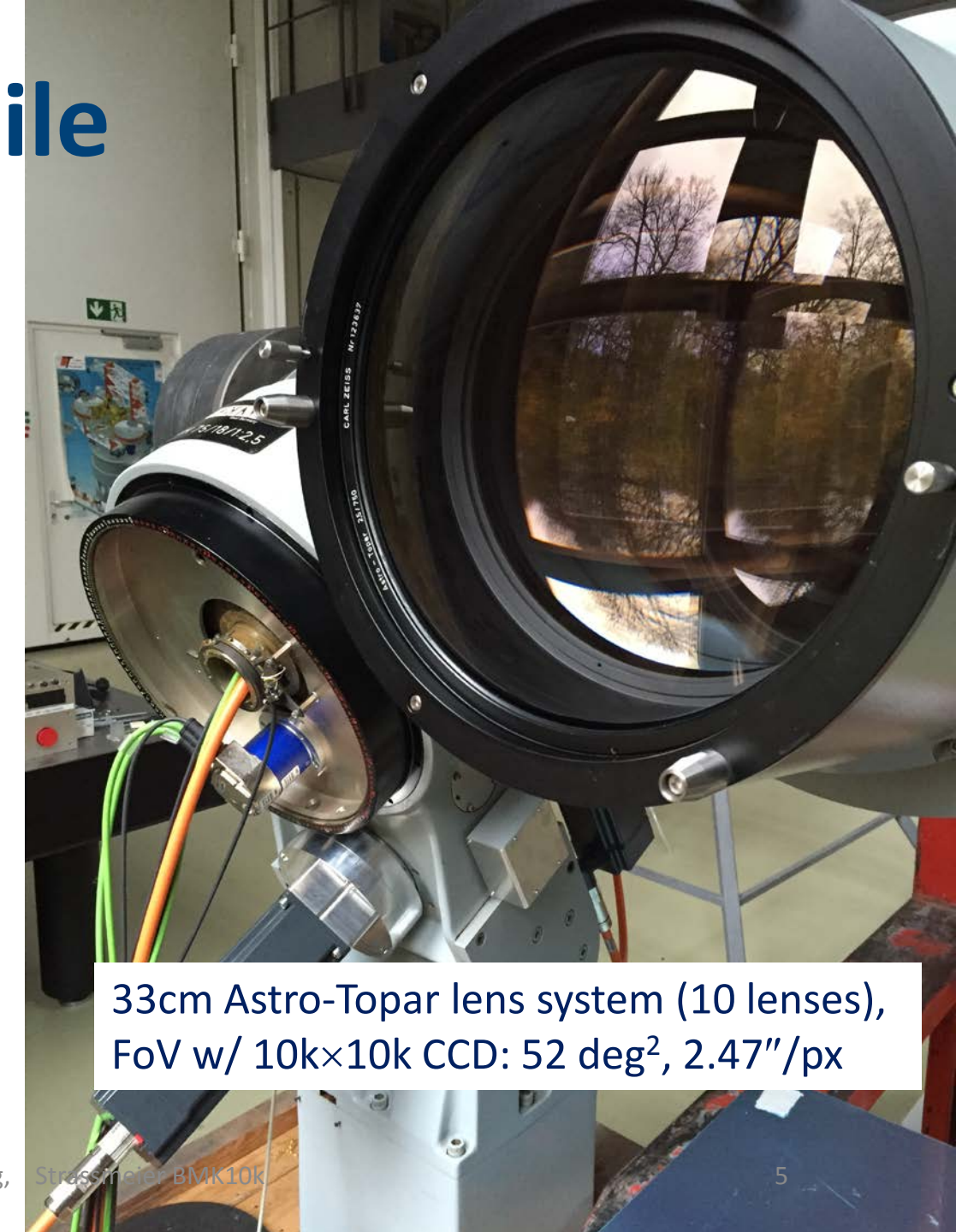
Kepler and K2 (magenta and green)
CoRoT fields (red squares)



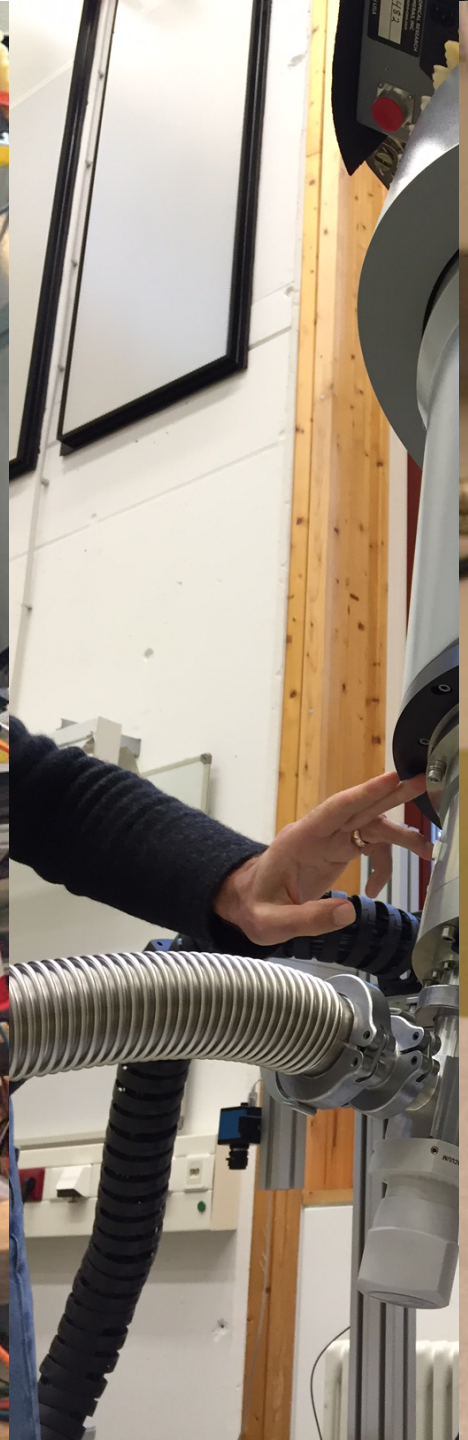
Nascimbeni et al. 2016

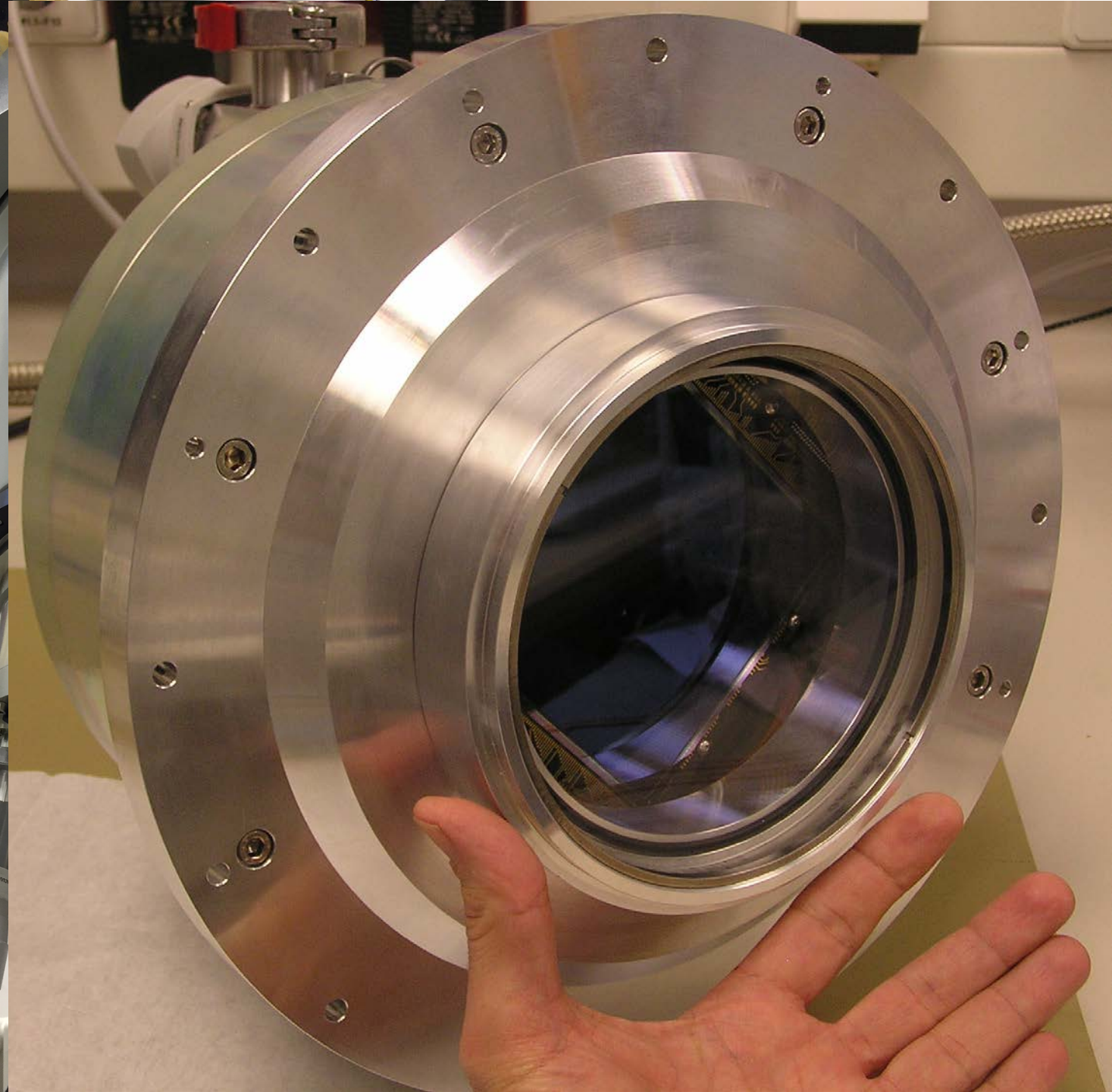
BMK10k telescope for Chile

- Ballistische Messkammer from Carl Zeiss Jena c/o 1974 (Univ. Munich, DFG SFB78)
- Overhaul at AIP incl. robotics
- Observe entire PLATO southern deep field with 1d time resolution
- 2250 square degrees (50 pointings)
- All season long with 3 expos (10, 60, 200s)
- Provide lightcurves for all PLATO targets prior to CCD windowing between 6-18^{m}
- Identify and characterize target contaminants of up to $\Delta m \approx 5^{m}$



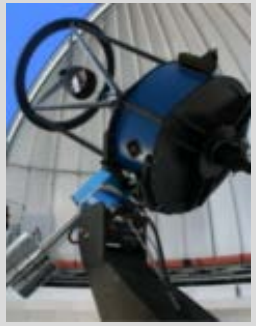
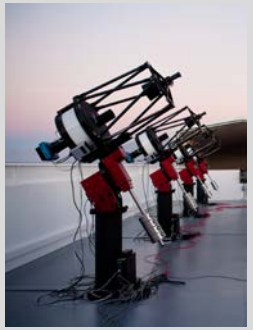
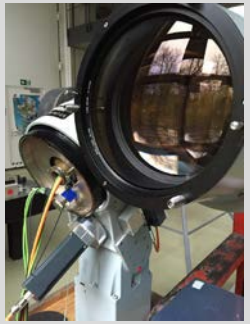
33cm Astro-Topar lens system (10 lenses), FoV w/ 10k×10k CCD: 52 deg^2, 2.47″/px





March, 2019

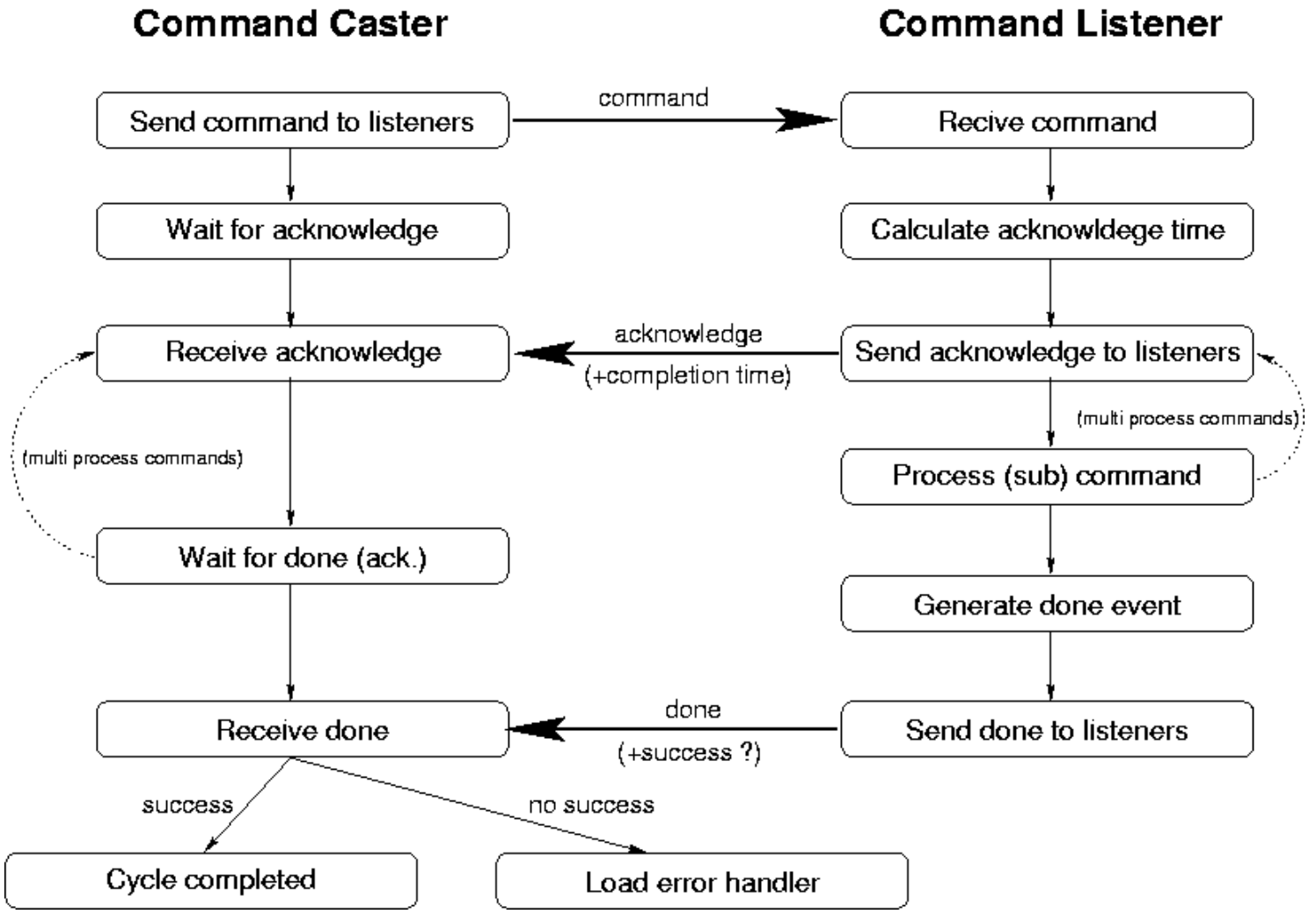
Exoplanet transits (very) wide field surveys in operation

Telescope	SuperWASP	HAT	TRAPPIST	KELT	Mearth	NGTS	BMK10k
							
Telescope diameter (cm)	11	11	60	4.2	40	20	33
# of telescopes	2 × 8	1×5 + 1×2	2	2	2 × 8	12	1
FoV (square degrees)	2 × 482	320 + 128	2 × 0.1	2 × 676	16 × 0.19	12 × 64	52
Pixel sampling (″/pix)	13.7	13.7	0.64	23	0.84	5	2.5
Site(s)	LaPalma + SA	AZ + Hawaii	Morocco+Chile	AZ + SA	AZ + Chile	Chile	Chile

AZ = Arizona; SA = South Africa

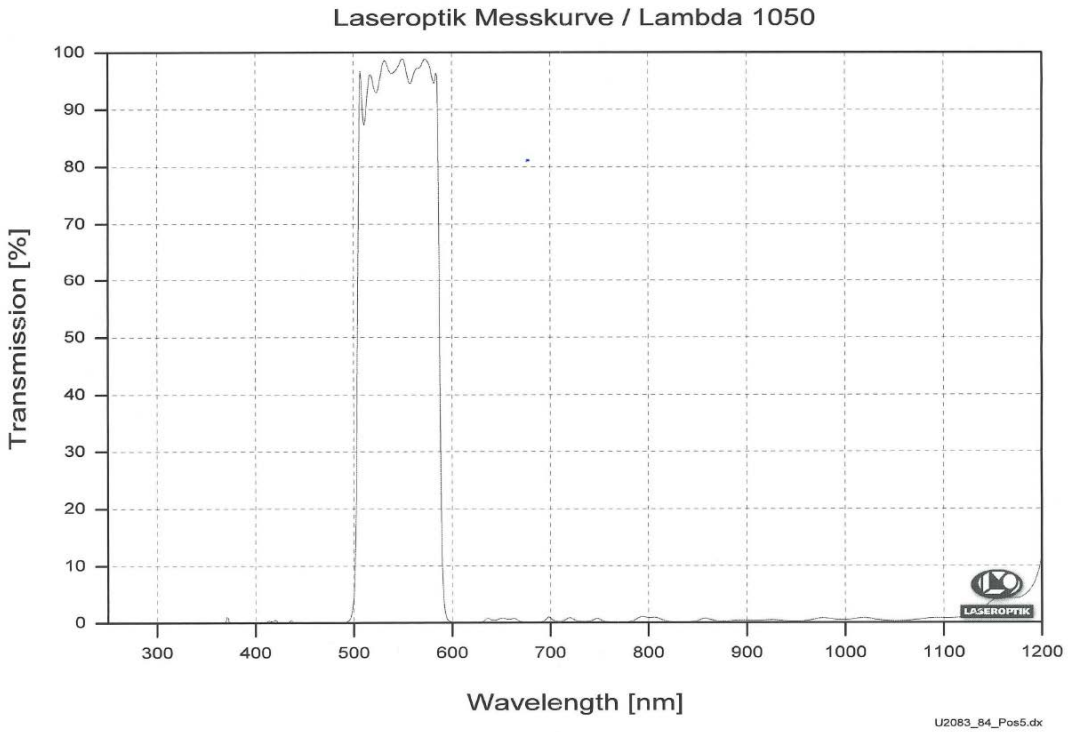
Robotization based on STELLA Control System

- STELLA Control System SCS w/ Java messenger kernel
- Dispatch scheduler
- Telescope and CCD control
- Dome control
- Data management
  - Nightly data rate ≈50 GB
  - Yearly sum ≈15 TB
  - Transfer rate ≈1.8 MB/s

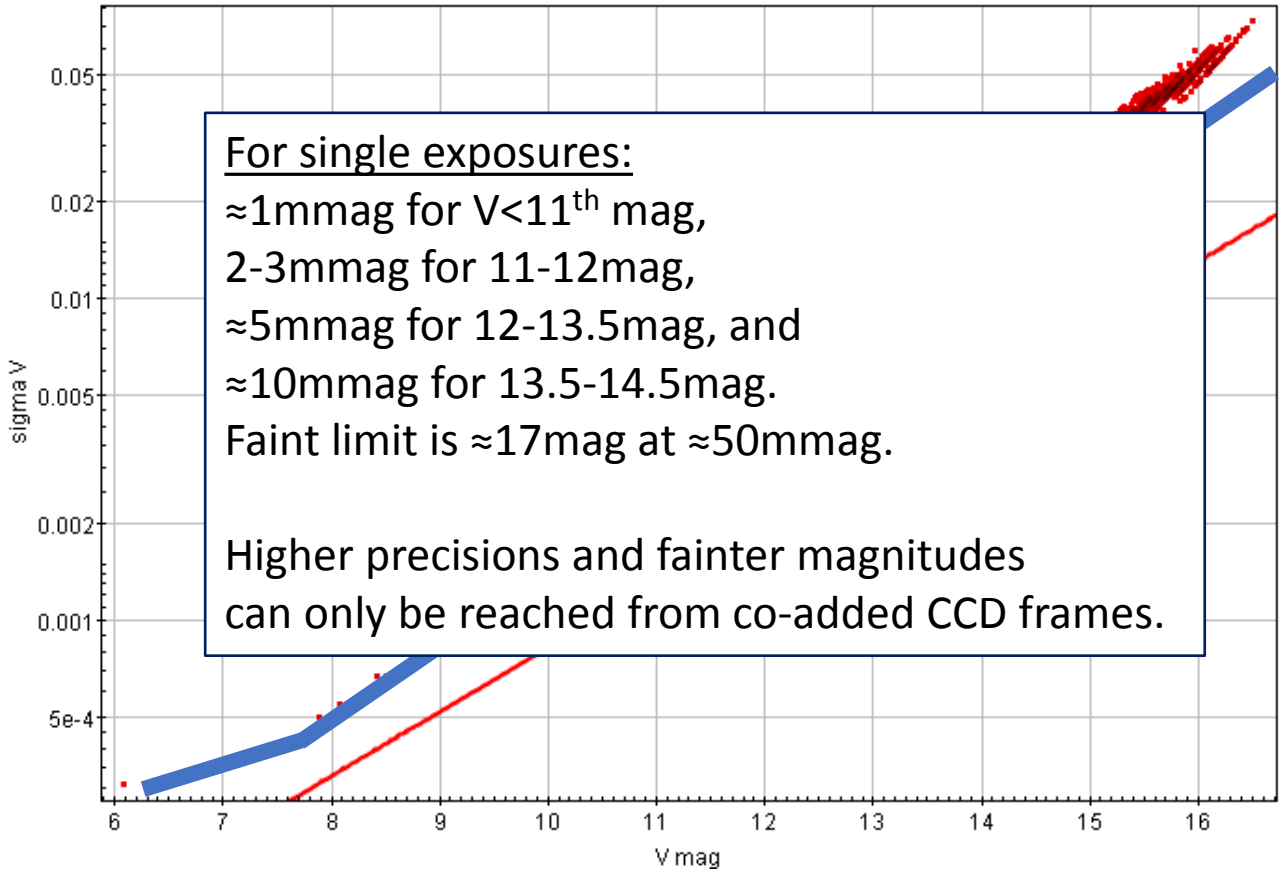


BMK10k performance prediction

Photometric bandpass: 500 - 590 nm
(smart coating on CCD window)



Photometric precision as measured (near Graz, Austria):
Single 120-s exposure.



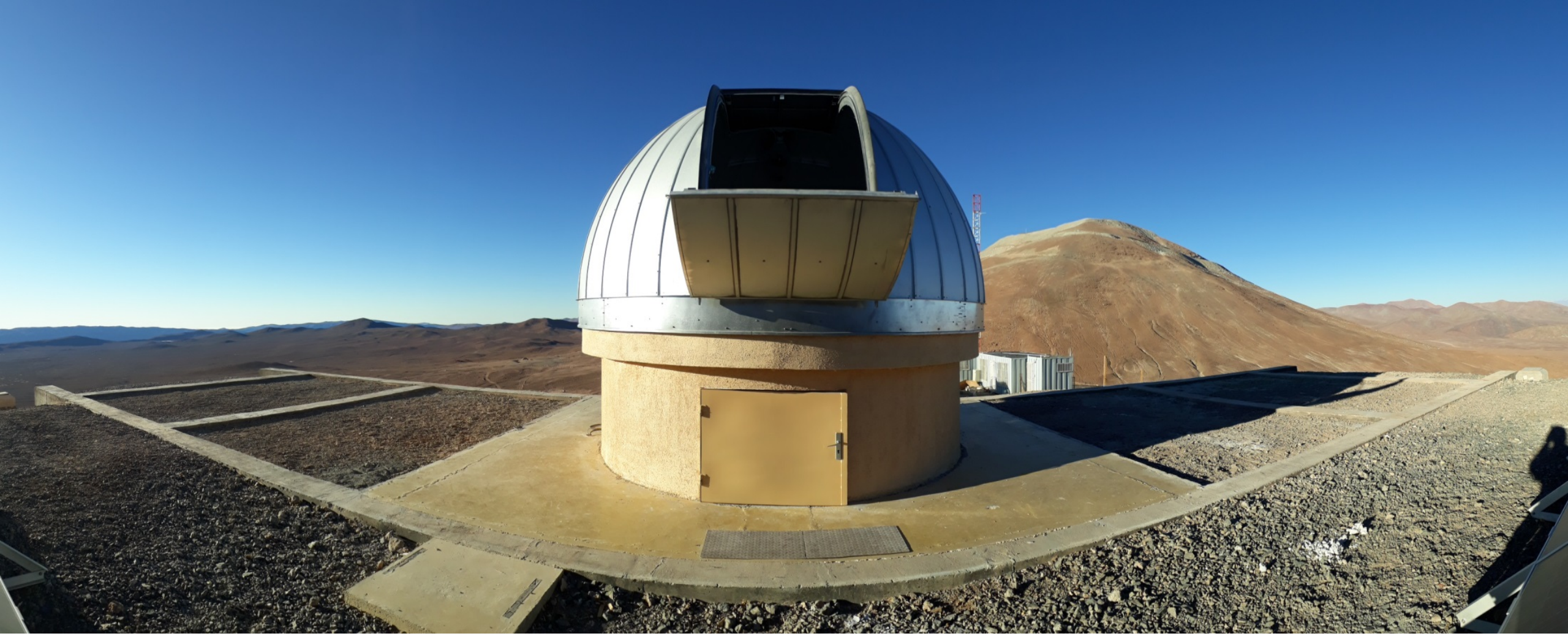
For single exposures:
≈1mmag for V<11th mag,
2-3mmag for 11-12mag,
≈5mmag for 12-13.5mag, and
≈10mmag for 13.5-14.5mag.
Faint limit is ≈17mag at ≈50mmag.

Higher precisions and fainter magnitudes
can only be reached from co-added CCD frames.

Ruhr-University-Bochum Observatory at „Cerro Murphy“ Chile, now part of ESO Paranal

BMK10k site at Cerro Murphy

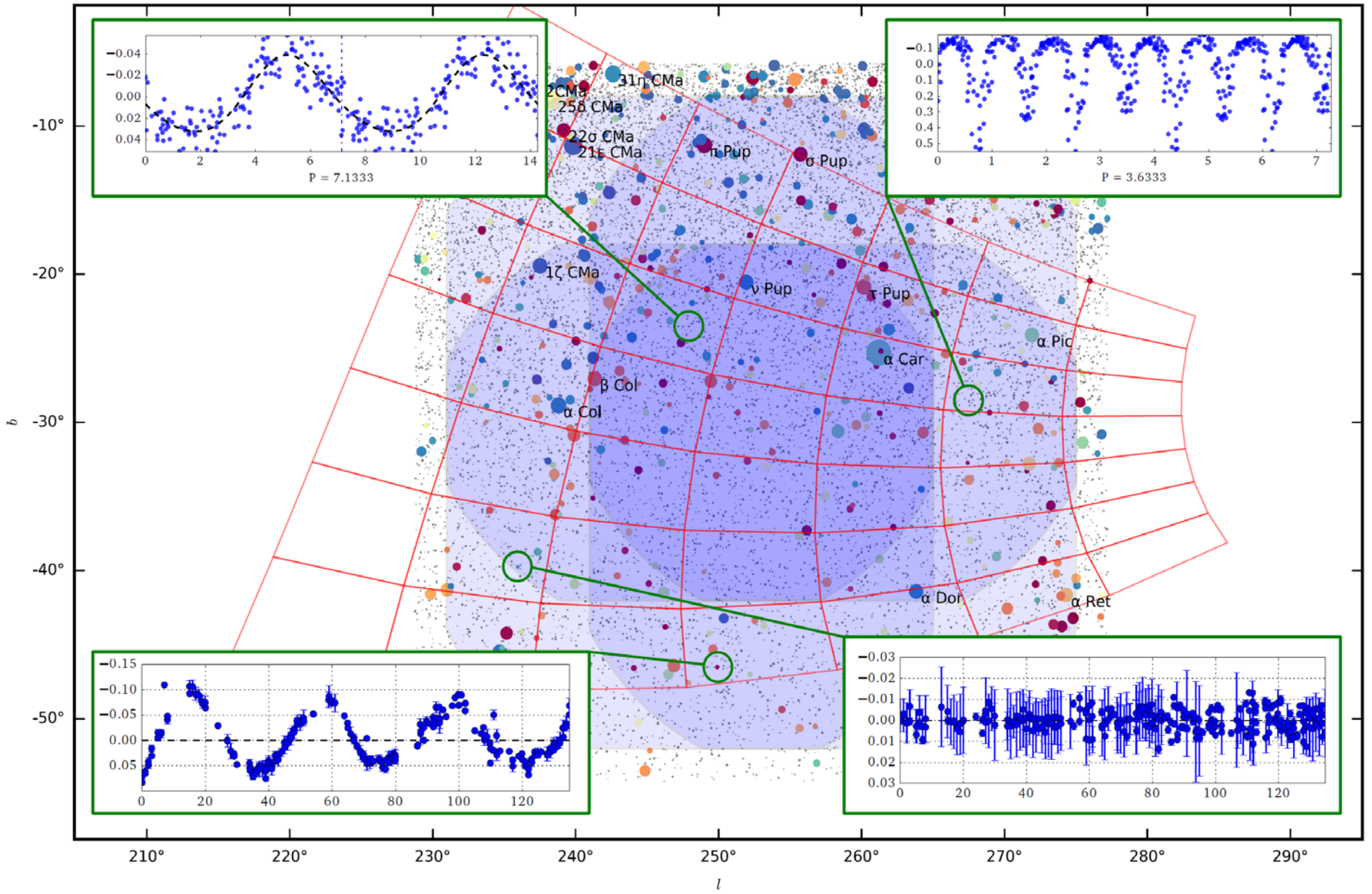
10/2018



Telescope arrival now planned for June 2019

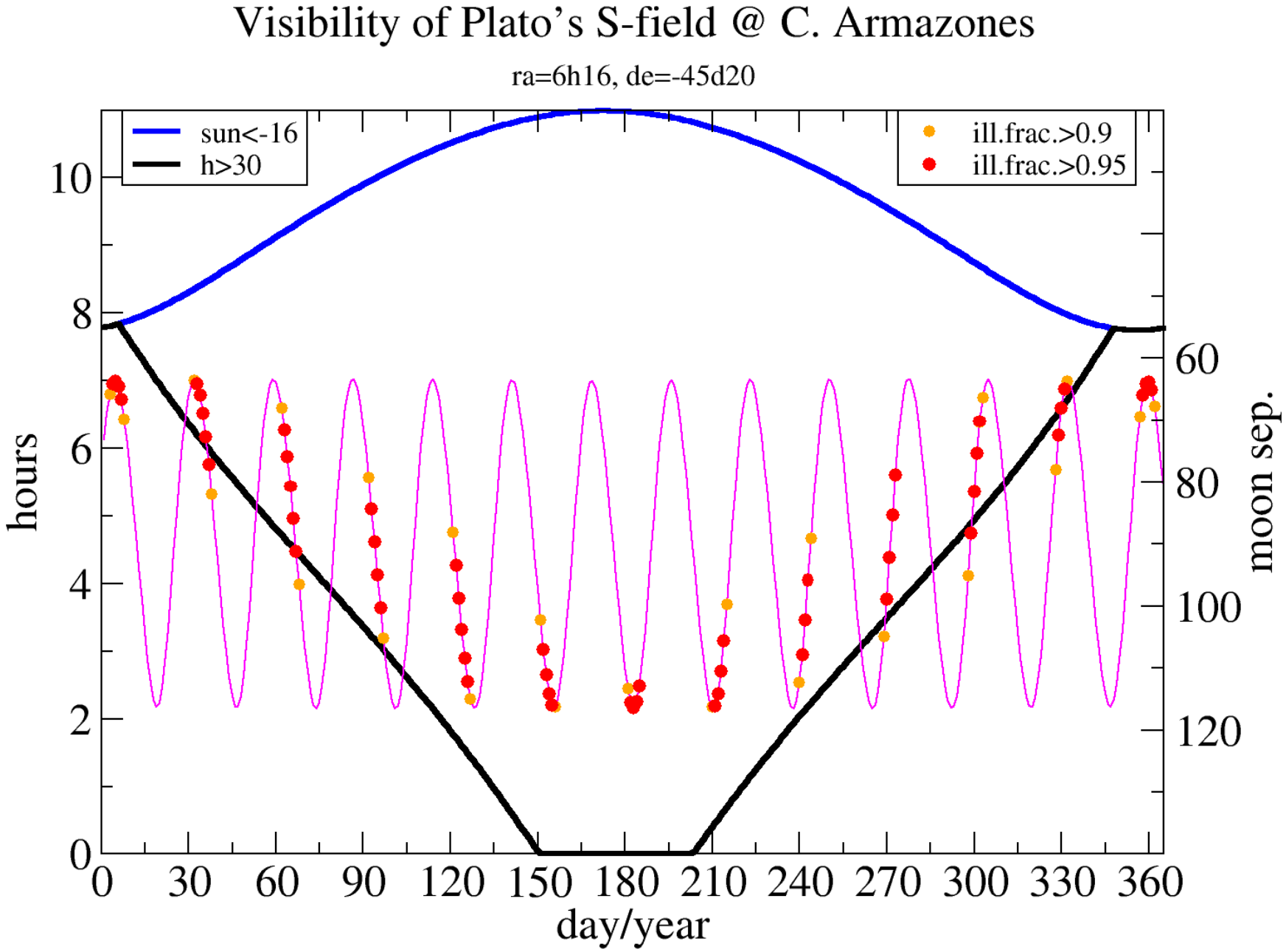
50 pointings for BMK10k

- Observe entire PLATO SPF once per night
- Pointing overlap of 30% in area
- Plan is for 3 years
- Periods 1h – 100d
- Minimum 120 data points per target per season



50 pointings for BMK10k

- Observe entire PLATO SPF once per night
- Pointing overlap of 30% in area
- Plan is for 3 years
- Periods 1h – 100d
- Minimum 120 data points per target per season

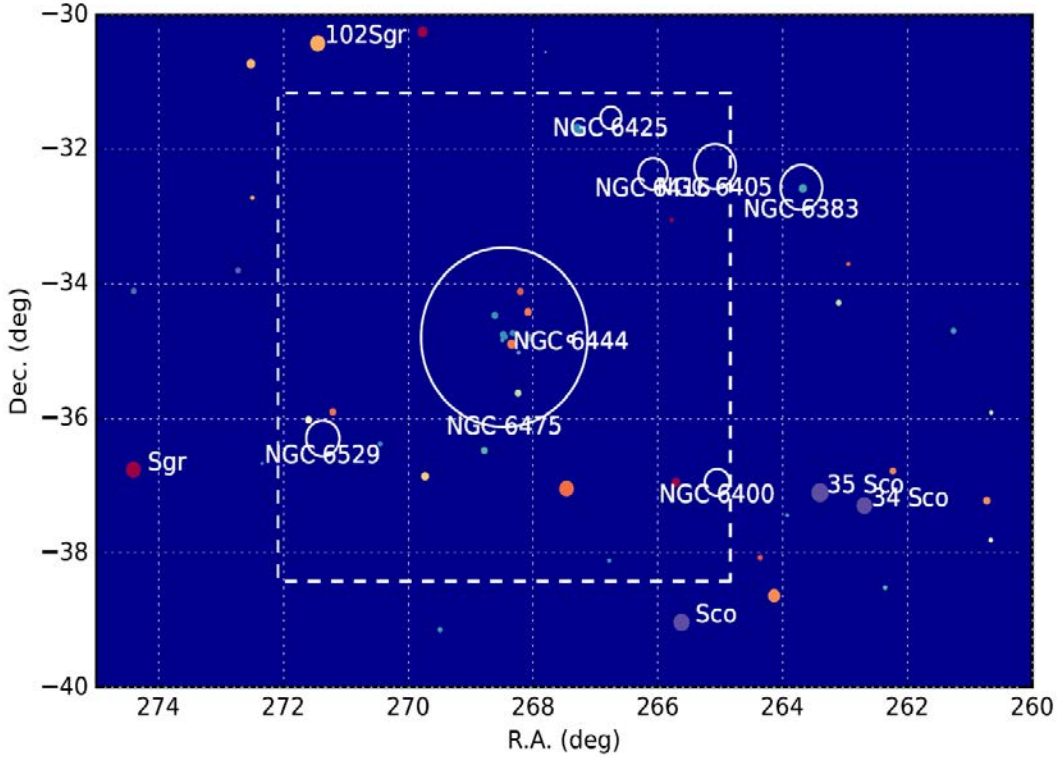


What will BMK10k do during the other times?

What will BMK10k do during the other nights?

- **Ptolemy's cluster (M7=NGC6475, 220Myr)**
  1. **Rotation periods → gyroage-calib**
  2. **Exoplanet transits → planet ages**

  Stare-and-expose w/ 2 exp times (10 & 100s). Cadence of 4 min for V≈9-15^m.
- **GRB optical afterglows**
- **Transients (X-ray binaries, flares, etc.)**



Summary

- Observe entire PLATO southern deep field with 1d time resolution
- 2250 square degrees (50 pointings)
- Provide lightcurves for all PLATO targets prior to CCD windowing between 6-18^m
- Identify and characterize target contaminants of up to $\Delta m \approx 5^m$
- Consensus of all eclipsing binaries in PLATO FOV
- Monitor Ptolemy‘s cluster to recalibrate gyroages