PLATO input catalog with BMK10k

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PLATO - PLAnetary Transits and Oscillations

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

- Launch 2026, 4 – 8.5 year duration
- Transit monitoring of \( \approx 1 \) Mill. stars (\( \lambda \approx 500-950 \text{nm} \))
- 24 telescopes with cadence 25 sec (\( V \approx 8-16 \text{m} \))
- 2 telescopes with cadence 2.5 sec (\( V \approx 4-8 \text{m} \))
- Each telescope has 1100 deg\(^2\) FoV
- Arranged in 4 groups (=2250 deg\(^2\) per pointing)
- Photometry done from 90"\( \times \)90" CCD windows
- Pixel sampling is 15"/pix (TESS has 21"/pix)
- can’t download all of this \( \rightarrow \) you better weed out false positives early on \( \rightarrow \) BMK10k
Star field at
RA 21h31m DEC +48d26′
Gal Long 92° lat -2°
Within PLATO field ST09
(Orionis)

One PLATO pixel
15″ × 15″

One BMK pixel
2.5″ × 2.5″

PLATO photometric window
90″ × 90″

24′ × 24′
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 6-18m
- Identify and characterize target contaminants of up to $\Delta m \approx 5^m$
## Exoplanet transits (very) wide field surveys in operation

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

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

March, 2019

Large Surveys with Small Telescopes – Bamberg, Strassmeier BMK10k 8
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<11\textsuperscript{th} 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
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What will BMK10k do during the other times?
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• 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≈9-15m.
• 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