PLATO: ground-facility observations

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Main science questions:
1. How do planets and planetary systems form and evolve?
2. Is our Solar System special or are there other systems like ours?
3. Are there potentially habitable planets?

Measurements:
- Photometric monitoring of a large number of bright stars (Mv ≤ 11-13) for the detection of planetary transits and determination of the planetary radii
- Ground-based radial velocity observations for the determination of the planetary masses (around 10% accuracy)
- Asteroseismology for the determination of stellar masses, radii, and ages
- Identification of bright targets for spectroscopic follow-up observations of planetary atmospheres with other ground and space facilities

Operational scenario
- Two long duration observations (two years) of a single field
- Optionally, one long duration observation (3 years) and 1 year of step-and-stare phase
**Ground based resource estimates**

- **Caveat:** These estimates are currently being refined: New estimates available by summer 2020

- **Filtering false-positives:**
  - Assume 50% of targets are false-positives (e.g. binary star)
  - During one long-pointing, expect ~1200 exoplanet candidates thereby requiring 2400 ground based observations
  - Therefore, ~5000 possible planetary candidates from both long pointings
    - Of which ~200 are planets in the Habitable Zone (HZ)
# Estimates of ground-based telescope resources

<table>
<thead>
<tr>
<th>Telescope Class</th>
<th>Candidate Confirmation</th>
<th>Radial Velocity Measurements</th>
<th>Total nights</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(nights/year)</td>
<td>(total nights in 7 years)</td>
<td>(total nights in 9 years)</td>
</tr>
<tr>
<td>1-2m, low-resolution spectroscopy</td>
<td>~35</td>
<td>~245</td>
<td>-</td>
</tr>
<tr>
<td>1-2m, high-resolution imaging</td>
<td>~15</td>
<td>~105</td>
<td>-</td>
</tr>
<tr>
<td>1-2m, on-off photometry</td>
<td>~10</td>
<td>~70</td>
<td>-</td>
</tr>
<tr>
<td>1-2m, high-resolution spectroscopy</td>
<td>-</td>
<td>-</td>
<td>~3</td>
</tr>
<tr>
<td>4m, high resolution spectroscopy</td>
<td>~20</td>
<td>~140</td>
<td>~100</td>
</tr>
<tr>
<td>8m, high resolution spectroscopy</td>
<td>~5</td>
<td>~35</td>
<td>~80</td>
</tr>
</tbody>
</table>


Data Policy from PLATO SMP
Conclusions

- PLATO will be the first ESA mission to identify earth-like planets in the habitable zone around solar-like stars
- Statistics on the likelihood of such systems existing is very poor
  - Only a few systems have so far been identified
- Not all PLATO identified sources are suitable for follow-up observations
  - The current ground-based resource estimates only consider the *optimal* systems

- Ground-based facilities resource estimate is currently being updated
  - New estimate expected around summer 2020
  - Not expected to change significantly

- Only ~50 targets (<$2R_{\text{Earth}}$ at ~1AU) will require the longer (>1 year) proprietary period