Roman Galactic Exoplanet Survey (RGES): Summary and Future Work

Roman Science Team Community Briefing

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(On behalf of the RGES-SIT)
Statistical Power of the RGES Survey

- For a $W149_{AB} \sim 21.15$ star:
  - Photon-noise relative photometric precision of $\sigma \sim 0.01$ mag per exposure.
  - Total of $\sim 10^9$ photons over the survey.
  - Saturation @ $W149_{AB} \sim 14.8$.

Root N: $\sqrt{41,000} \sim 200$

Penny et al. 2019
Number of Stars and Microlensing Events

<table>
<thead>
<tr>
<th>Stars (W149 &lt; 15)</th>
<th>( \sim 0.3 \times 10^6 )</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stars (W149 &lt; 17)</td>
<td>( \sim 1.4 \times 10^6 )</td>
</tr>
<tr>
<td>Stars (W149 &lt; 19)</td>
<td>( \sim 5.8 \times 10^6 )</td>
</tr>
<tr>
<td>Stars (W149 &lt; 21)</td>
<td>( \sim 38 \times 10^6 )</td>
</tr>
<tr>
<td>Stars (W149 &lt; 23)</td>
<td>( \sim 110 \times 10^6 )</td>
</tr>
<tr>
<td>Stars (W149 &lt; 25)</td>
<td>( \sim 240 \times 10^6 )</td>
</tr>
<tr>
<td>Microlensing events</td>
<td>Microlensing events</td>
</tr>
<tr>
<td>( \mid u_0 \mid &lt; 1 )</td>
<td>( \sim 27,000 )</td>
</tr>
<tr>
<td>( \mid u_0 \mid &lt; 3 )</td>
<td>( \sim 54,000 )</td>
</tr>
</tbody>
</table>

Penny et al. 2019
Photometric and Astrometric Precision. (Relative, Poisson Noise Only)

<table>
<thead>
<tr>
<th>W149$_{AB}$</th>
<th># of Stars</th>
<th>Relative photometric precision (per exp.)</th>
<th>Astrometric precision (per exp.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>19</td>
<td>$6 \times 10^6$</td>
<td>~0.8%</td>
<td>~0.6 mas</td>
</tr>
<tr>
<td>21</td>
<td>$40 \times 10^6$</td>
<td>~1%</td>
<td>~1.5 mas</td>
</tr>
</tbody>
</table>

Penny et al. 2019
“Auxiliary” Science with the Roman Galactic Exoplanet Survey

- Measurement of the mass function of condensed objects of 10 orders of magnitude, including remnants and binarity
- Detection of $\sim 10^5$ hot and warm Jupiters & Neptunes via transits (Montet+2017)
- Asteroseismology of $\sim 10^6$ bulge giants (Gould+2014b)
- Parallaxes and Proper Motions of $\sim 6 \times 10^6$ Bulge and Disk Stars
- Detection of $\sim 5 \times 10^3$ Trans-Neptunian Objects (Gould+2014a)
- Variable stars
- Much, much more..
Citizen Science

- The microlensing, transit, and variable star science of the Roman Bulge Variability Survey lend themselves well to “Citizen Science”, e.g.,
  - Classifying variable stars and identifying exotic systems
  - Identifying transiting planets
  - Finding planetary microlensing events, including:
    - Free-floating planets
    - Bound planets
    - Exotic systems
Thank you!
~$10^5$ Transiting Planets!

- WFIRST will detect ~$10^5$ transiting planets with radii down to ~$2R_\oplus$.
- Most host stars will have measured distances.
- Several thousand can be confirmed by the detection of their secondary eclipses.
- Some systems will have measured transiting timing variations.

Expected yield of transiting planets orbiting dwarfs with W149 $A_B < 21$
(Montet et al. 2017)

Bennett & Rhie 2002
Montet et al. 2017