The Disappearing White Dwarf Survey

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Queens College, City University of New York

KITP Conference “White Dwarfs from Physics to Astrophysics”

November 14, 2022

The CUNY Queens College Astronomy Group

Observational time domain stellar astronomy:

- Asteroseismology
- White dwarf exoplanets
- Analysis methods and software

Andrew Dublin
PhD Student

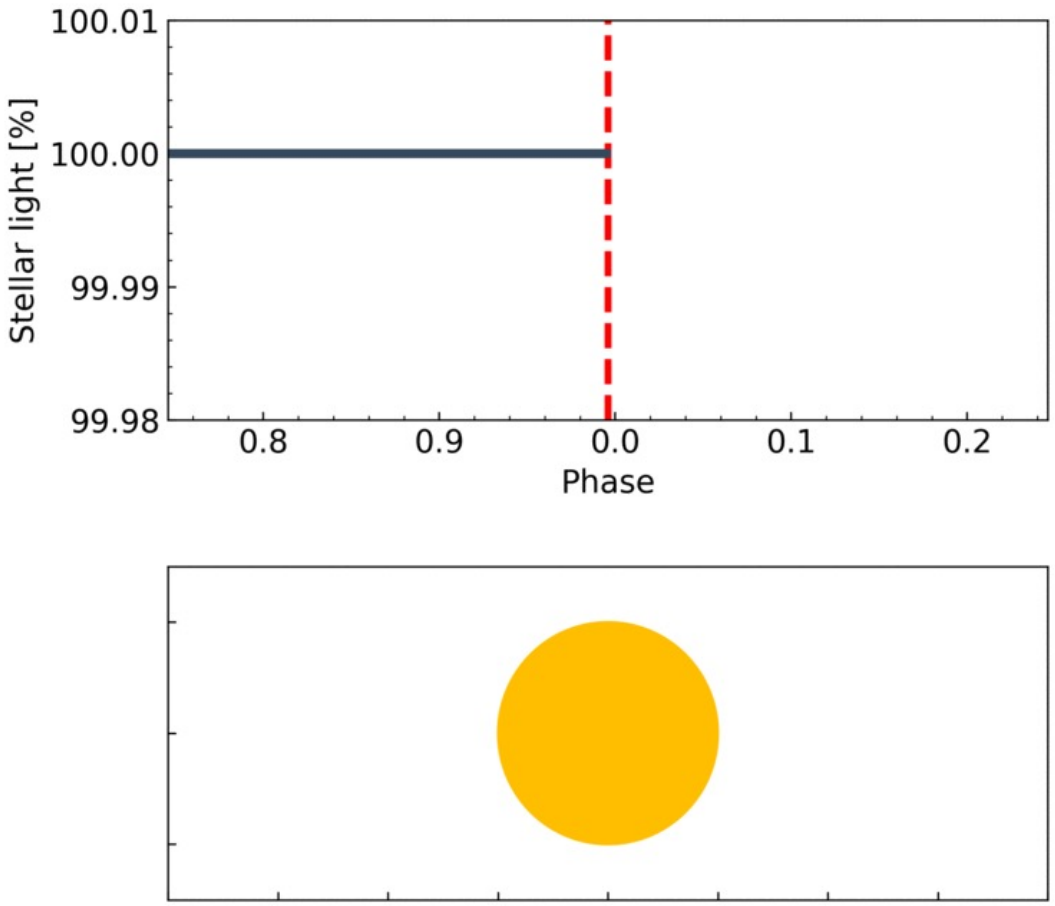
Nikoo Hosseininejad
PhD Rotation

Andrew Ayala
Masters Student

Ling Xuan Yao
Masters Student

Swan Yi Htet
Undergraduate

Earth Transiting Sun



Earth Transiting WD

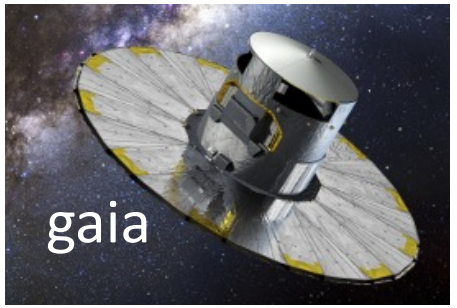
Animations made with (modified) Tango:
github.com/oscaribv/tango

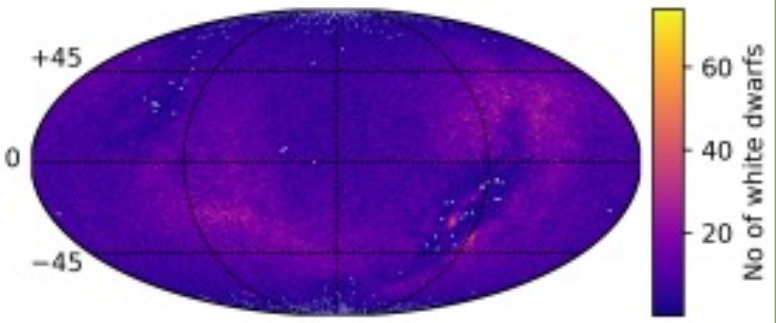
The Disappearing White Dwarf Survey

An effort to systematically identify and characterize all the WDs that dim significantly.

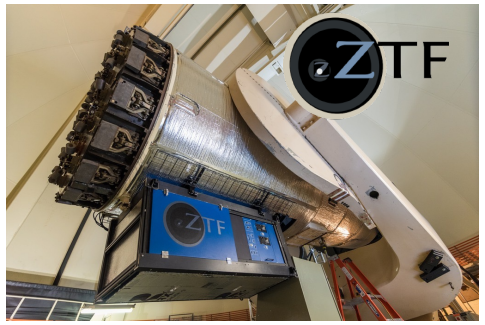
- Transiting Exoplanets and Debris
- Eclipsing Systems:
  - WD+WD
  - WD+dM
  - WD+BD

Where to look for WD dips:

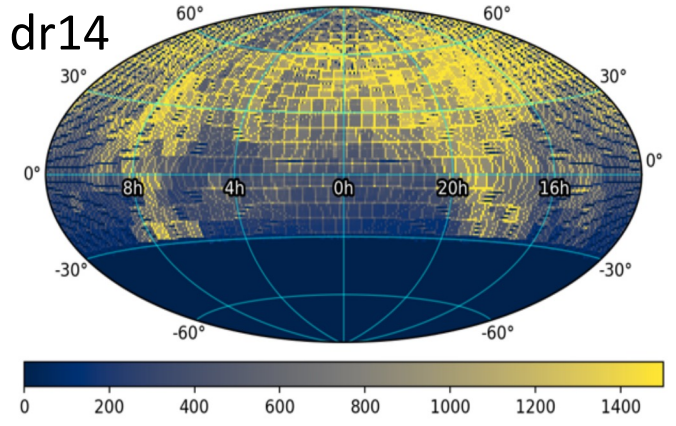




Gentile Fusillo et al. 2021 *MNRAS* **508** 3877

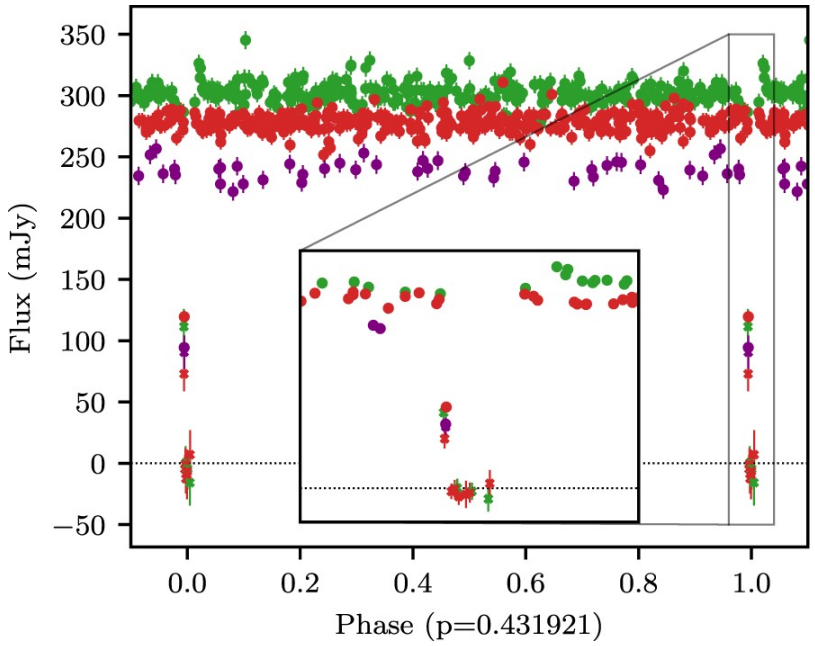


Credit: Caltech Optical Observatories



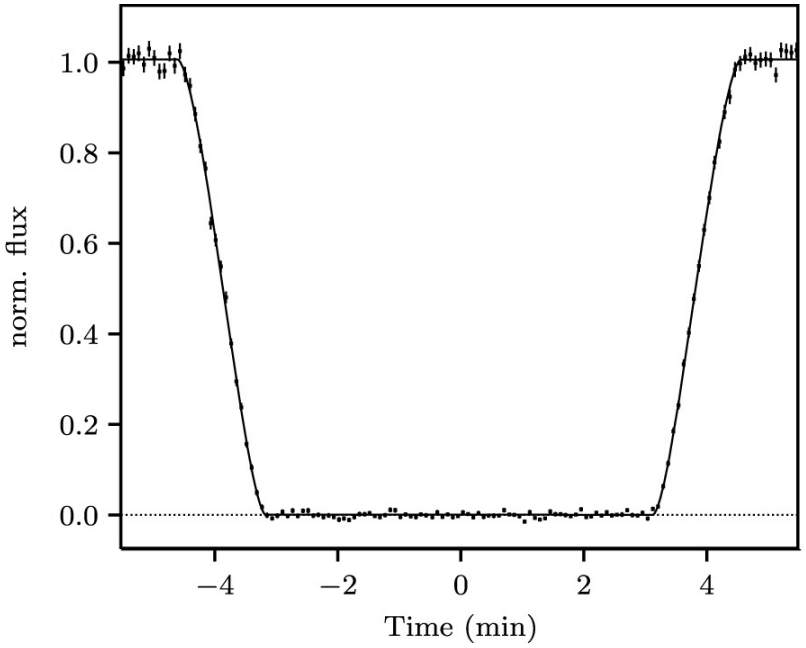
Approach: Characterizing White Dwarf Companions

I. Identify candidate transits in ZTF data.

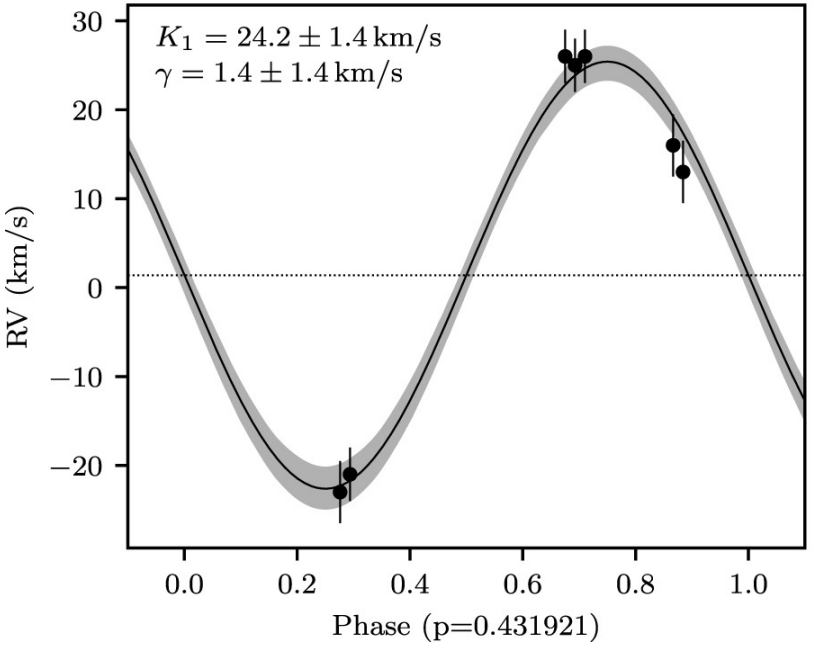


(van Roestel, Kupfer, Bell, et al. 2021, ApJL, 919, 26)

II. Confirm and resolve transit details with high-speed photometry.



III. Constrain companion mass from radial velocity measurements.



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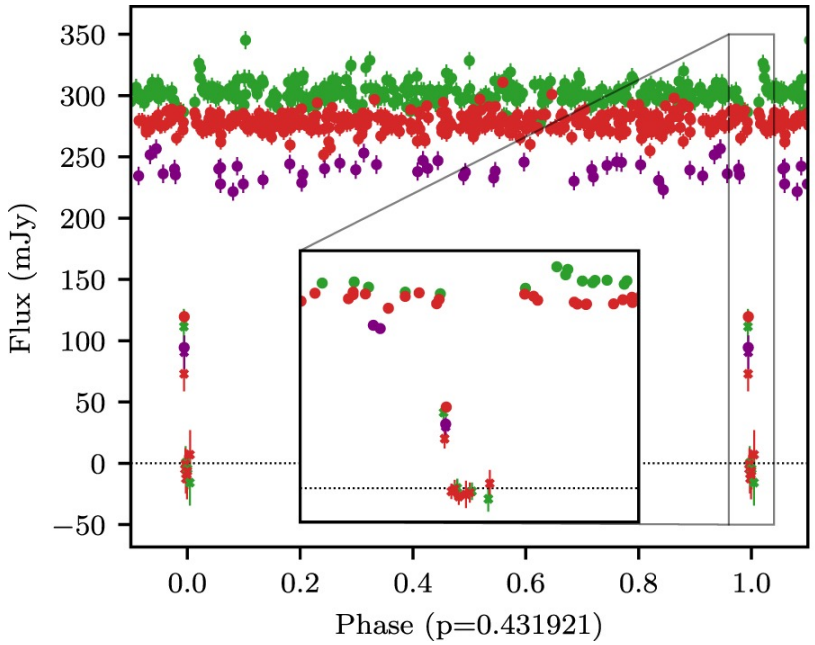

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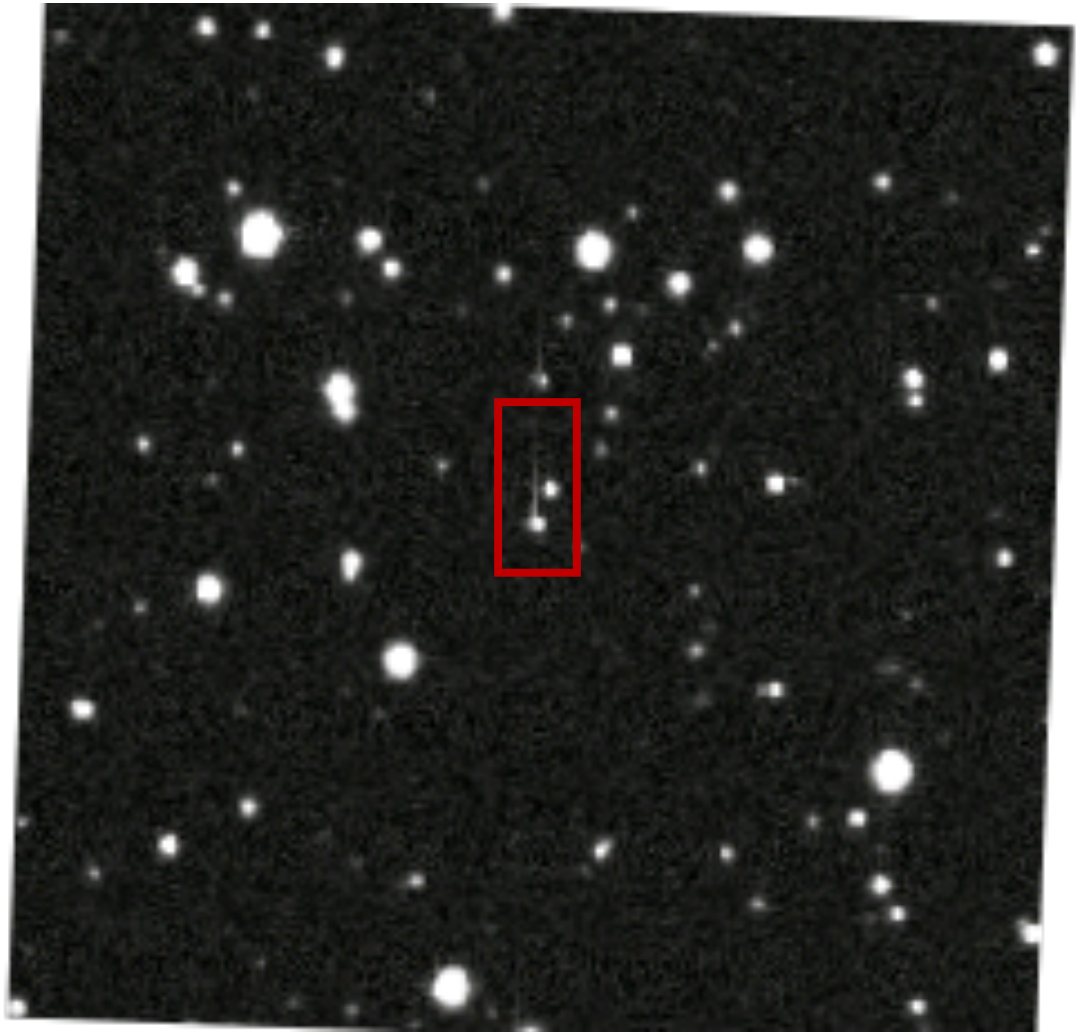

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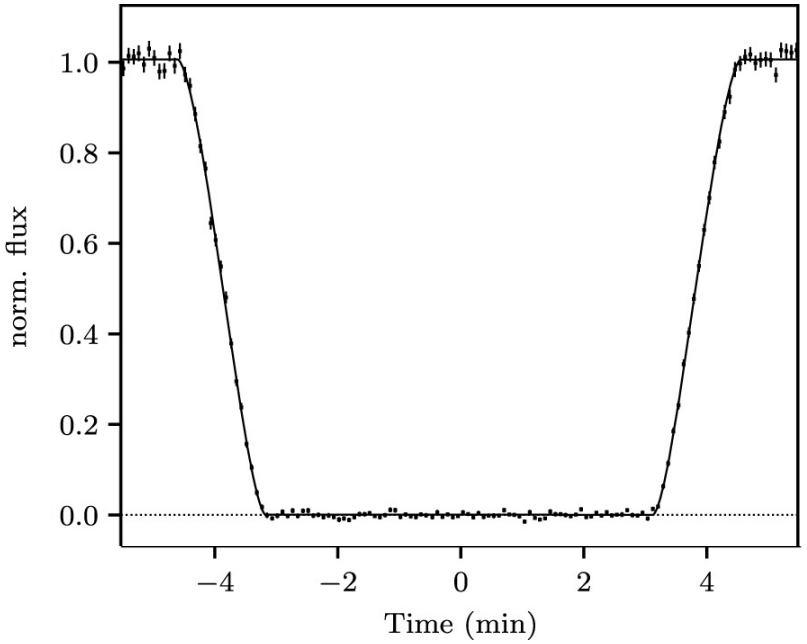

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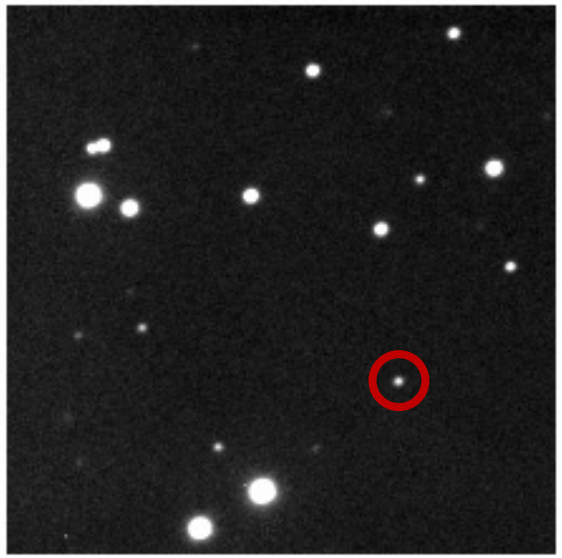

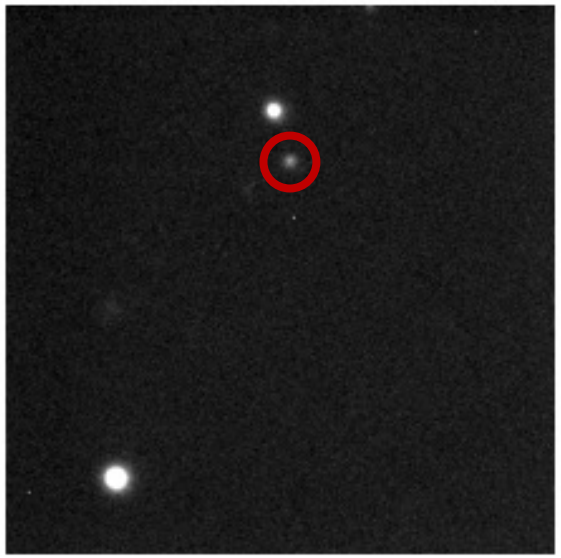

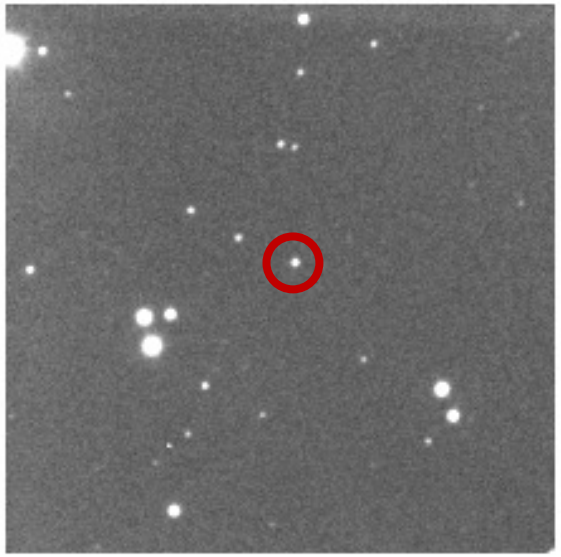

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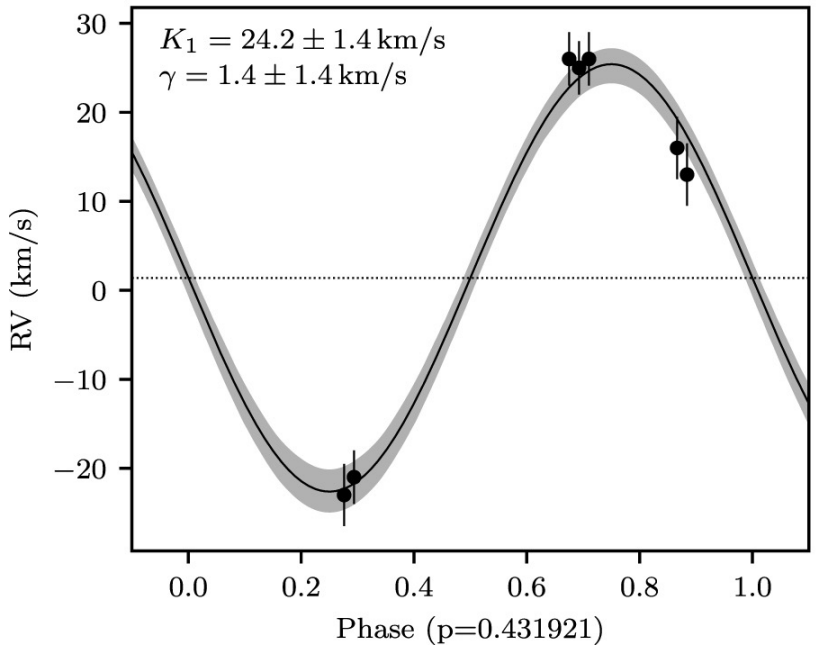

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GEMINI OBSERVATORY
Exploring the Universe, Sharing its Wonders

SDSS-V
White Dwarf Chronicle?

Contrasting Other ZTF Eclipse Searches

Other efforts:

- Periodogram based
  - Burdge et al. 2020/2021
  - Keller et al. 2021
  - Kosakowski et al. 2022

Disappearing White Dwarf Survey:

- Focused on individual dips
- Looking for dropouts
- Utilizing the Astronomy eXtensions for Spark (AXS) framework at UW
- Visual vetting of candidates with team of high schoolers and undergraduates
- Aim to recover underlying populations

Looking Forward to Vera Rubin Observatory

Legacy Survey of Space and Time

- 1000 observations over 10 years
- Six filters: *u,g,r,i,z,y*
- Beginning 2024

Tens of Millions of WDs!!

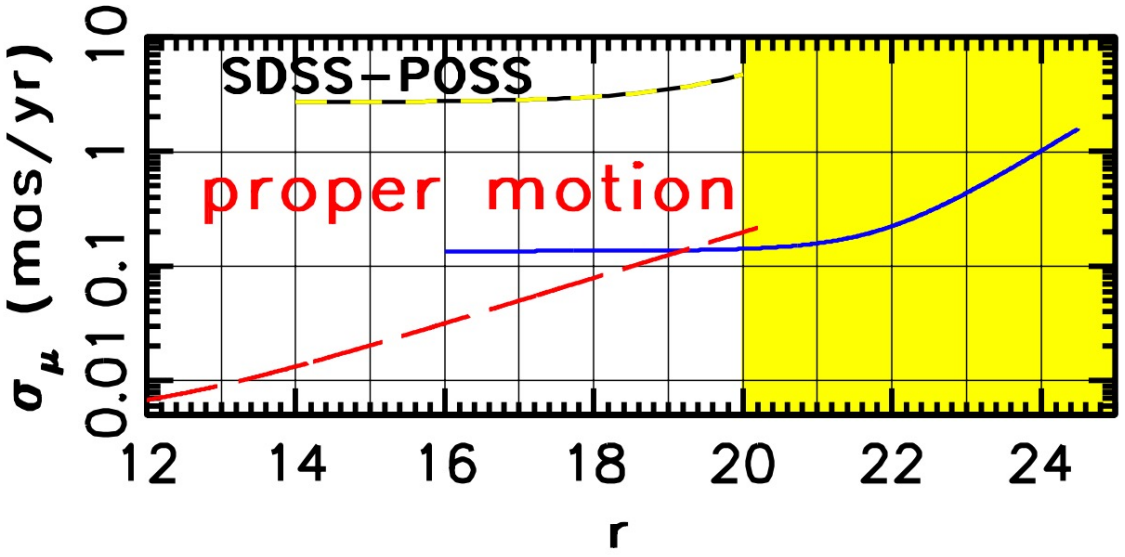
to r 24.5 mag

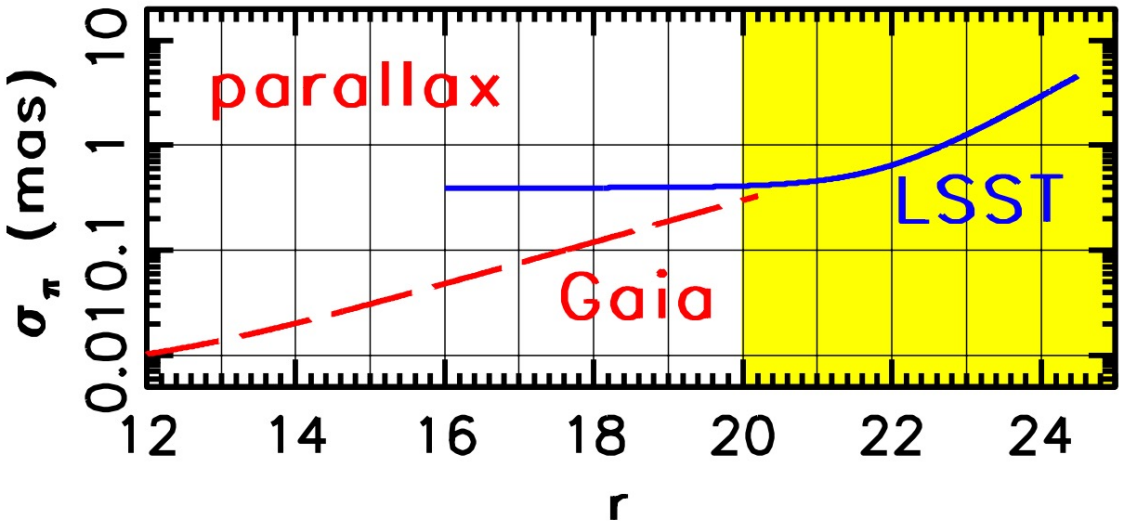
Thousands of WD transits??

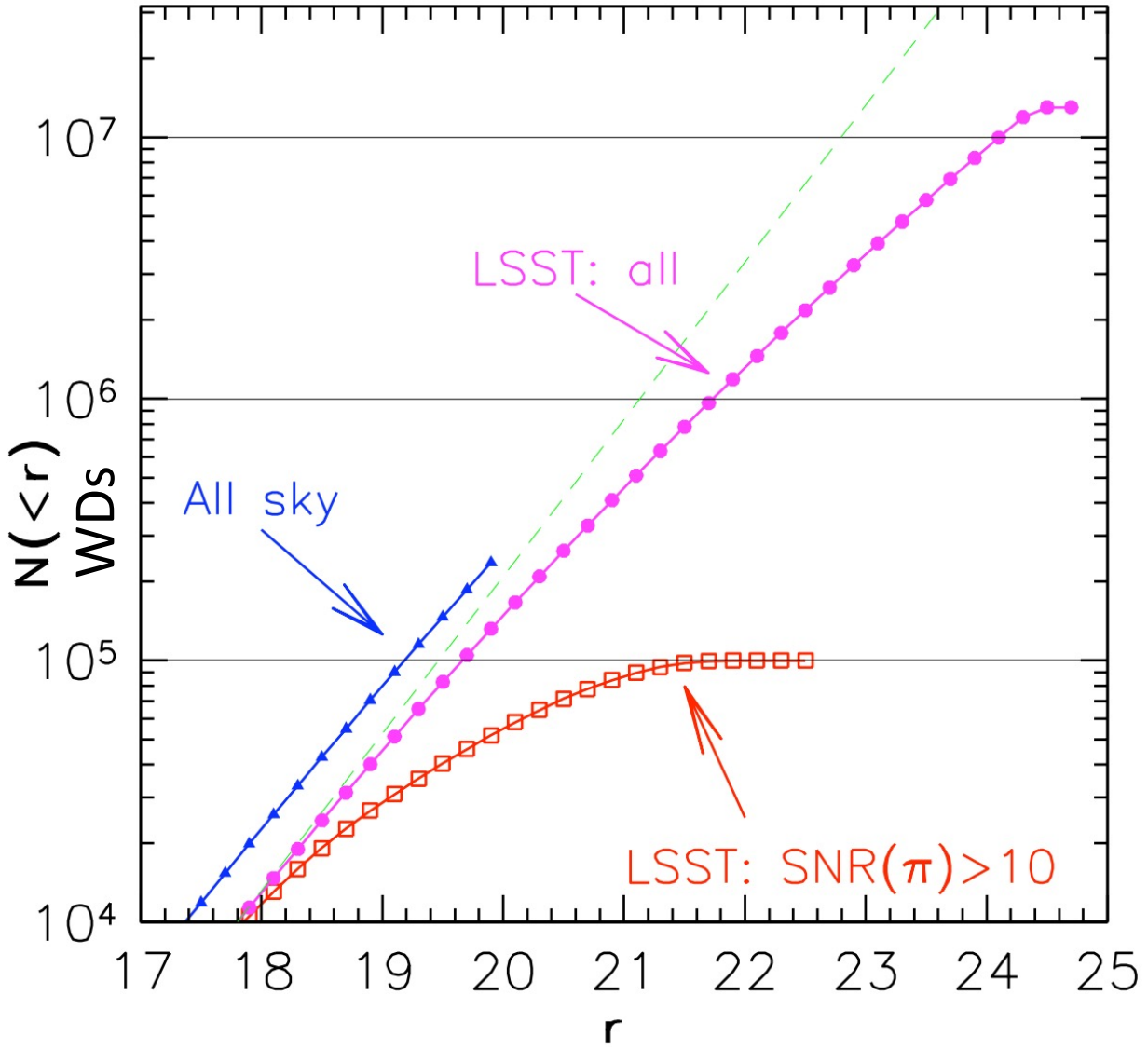
(Cortés & Kipping 2019)

(Lund, Pepper, Shporer, & Stassun 2019)

Looking Forward to Vera Rubin Observatory







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