Transiting brown dwarfs from the TESS mission

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TESS Science Conference I

Image credit: Mark Garlick
Brown dwarfs and where to find them

- Objects between 13 and 80Mj
Brown dwarfs and where to find them

- Objects between 13 and 80Mj
- 22 transiting brown dwarfs
Brown dwarfs and where to find them

- Objects between 13 and 80Mj
- 22 transiting brown dwarfs
- One eclipsing brown dwarf binary
The transiting brown dwarf population

![Graph showing mass and period of brown dwarfs](image)

- Mass (M_J)
- Period (days)

Key:
- M dwarf
- K dwarf
- G dwarf
- F star
- A star

Carmichael et al. 2019
Why are transiting brown dwarfs so uncommon?

![Graph showing the distribution of mass and period for different types of stars, including brown dwarfs, M dwarfs, K dwarfs, G dwarfs, F stars, and A stars. The mass is plotted on the y-axis in log scale, and the period is plotted on the x-axis in days. The graph highlights the scarcity of brown dwarfs in comparison to other star types.](image-url)
The big questions

● Why haven’t more transiting brown dwarfs been discovered?
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  - What clues are there in the mass distribution or mass-radius diagram?
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  ○ Like stars?
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  - What clues are there in the mass distribution or mass-radius diagram?

- How to brown dwarfs form?
  - Like stars?
  - Like planets?
What do transiting brown dwarfs reveal about their formation?

Šubjak, Sharma, Carmichael et al. (in prep)
TIC 231736113 orbital solution

M = 46Mj
R = 0.86Rj

P = 10.6 days

Carmichael & TFOP team et al. in prep
M = 63Mj
R = 0.74Rj

P = 6.6 days
$M = 53 M_j$

$R = 1.3 R_j$

$P = 3.7$ days

Šubjak, Sharma, Carmichael et al. in prep
The TOI-503 system
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- Host star is a metallic-line A star (Am star)
The TOI-503 system

- Host star is a metallic-line A star (Am star)
- First Am star known to host a brown dwarf
The TOI-503 system

- $[\text{Fe/H}] = +0.6$
- $[\text{Ca/H}] = -0.4$

Analysis by Ján Šubjak; poster #20
The TOI-503 system

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Depleted in Ca I
The TOI-503 system

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Van Eylen, Winn, Albrecht 2016
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Van Eylen, Winn, Albrecht 2016
The TOI-503 system

- Did TOI-503b form in-situ?

Van Eylen, Winn, Albrecht 2016
Final thoughts

- TESS has found 3 new brown dwarfs
- Transiting brown dwarfs tells us about their evolution
- Expect this population to grow for TESS Science Conference II
What do transiting brown dwarfs reveal about their formation?
Why are transiting brown dwarfs so uncommon?
Van Eylen, Winn, Albrecht 2016
EBLM project