

Using Proper Motions From CatWISE2020 To Uncover New Objects In The Solar Neighborhood

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Highlights

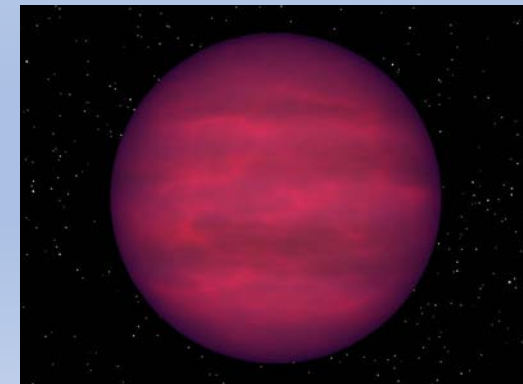
- Searching for previously missed objects
- Focused on faint motion objects
- **Discovered:**
 - Two nearby M dwarfs (14.5,22.5 pc).
 - T2 Dwarf with high velocity.
- Discoveries near the sun are **still to be made** .

Artist renditions of:

M Dwarf



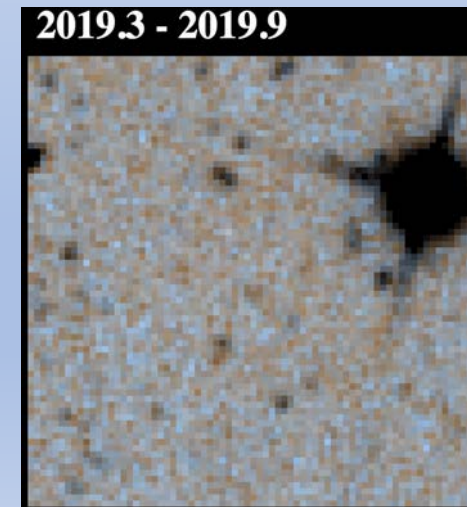
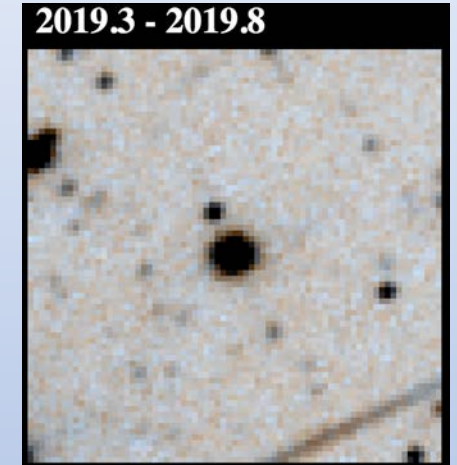
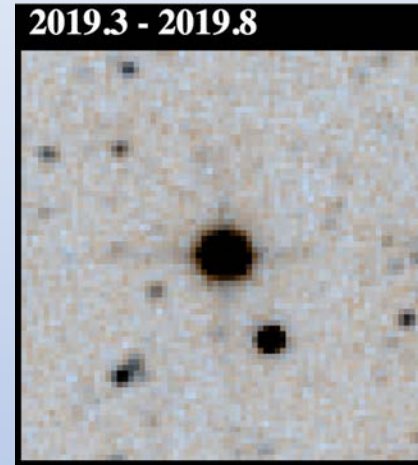
T Dwarf



What are the objects found?

Discoveries in center of gif

- M Dwarfs are the most common stars.
 - Our Two M's missed earlier due to **small motion**.
 - Even Gaia hasn't yet determined proximity.
- Cold brown dwarfs are hard to find.
 - Our object missed because of **exceptional faintness**.
 - The coldest objects **may** be rare.



Credit: Caselden 2018

Who are we and what did we use?

- Spearheaded by:
 - Tarun Kota
 - Dan Caselden
 - Dr. J Davy Kirkpatrick
- Collaboration made possible by:
 - Backyard Worlds: Planet 9
 - Student Astrophysics Society
- Trio used CatWISE2020
 - Unparalleled motion accuracy from 8 years of WISE data
 - How to search through 1.9 billion objects?



Credit: Backyard Worlds

Machine Learning

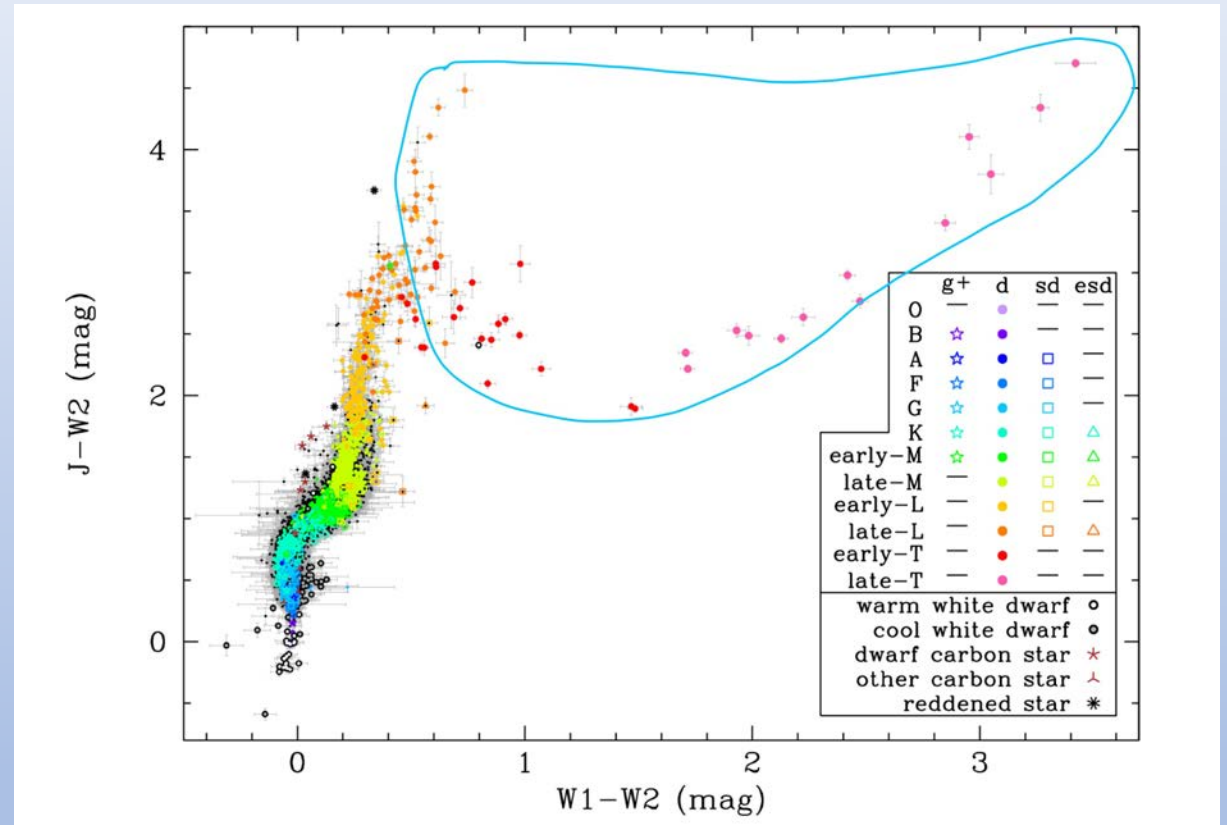
- Built a supervised machine learning classifier
- Trained with known moving T and Y dwarfs.
- Narrowed down 1.9 billion to 6000 high interest candidates
- Saved hours by avoiding manual searching
- Represents a shift from traditional querying.
- Important as databases continue to grow.



Sorting through Data

- CatWISE only has one color (W1-W2)
- Need more colors to **distinguish mundane from extraordinary.**
- Matched to other infrared databases
 - 2MASS
 - UHS
 - VHS
- Found **30 Unique objects** including:
 - Two nearby M dwarfs
 - T2 dwarf with high motion

Color Color Diagram



Credit: Kirkpatrick 2016

Future Work

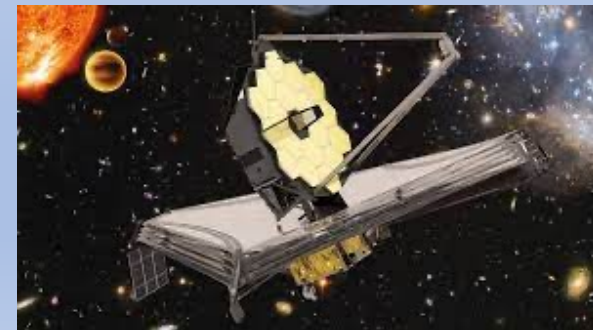
- Need more data on interesting objects
 - Using SALT, we plan to get spectra of M's
 - T2 dwarf needs space- based spectrum
- Still gaps in the census of objects near the sun.
 - Prioritize quest for Y dwarfs
 - CatWISE has **not been fully explored.**

SALT



Credit: Wikipedia

JWST



Credit: NASA

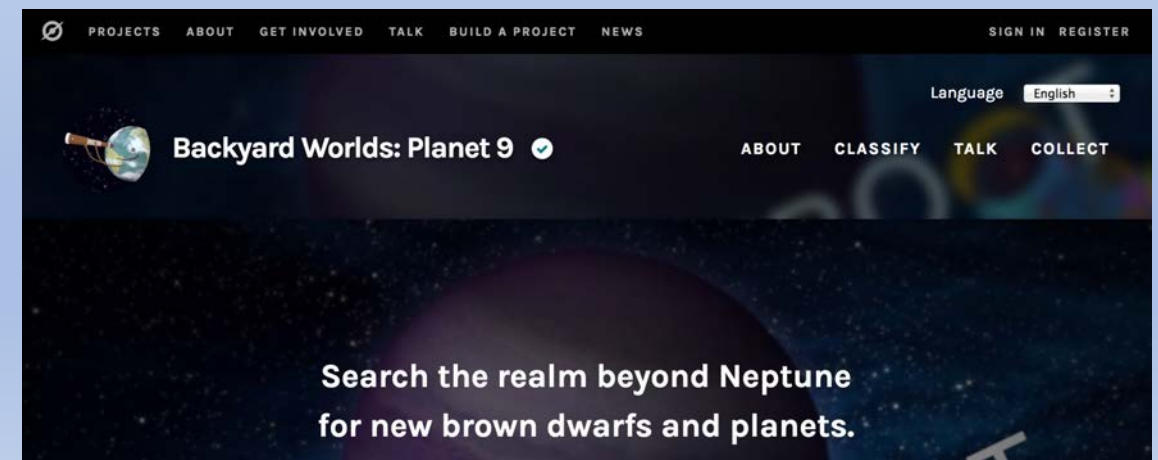
Citizen Science

- We represent the changing phase of Astronomy.
 - Internet gives people access to large datasets and resources.
 - Astrophysics research is available to anyone willing to take the initiative
- The public now has opportunity to do astrophysics research.
 - *Student Astrophysics Society.*
 - *Backyard Worlds: Planet 9*
- Future astrophysics will be spearheaded by **collaborations between astronomers and the public.**

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studentastrophysicsociety.com



Backyardworlds.org