Citizen Scientists Discover Extremely Cold Brown Dwarfs

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Backyard Worlds: Planet 9 Collaboration
CatWISE Team
the time-honored quest to find our Sun’s closest neighbors
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discovered recently by NASA’s Wide-field Infrared Survey Explorer (WISE) mission

WISE 0855-0714
(distance 2014)

WISE 1049-5319
(distance 2013)

Barnard’s Star
(distance 1916)

Alpha Centauri
(distance 1839)

Proxima Centauri
(distance 1917)

2 LIGHT YEARS

OORT CLOUD

Sun
DESI imaging processed a quarter petabyte of raw WISE data to create the deepest, most comprehensive all-sky infrared maps.
the Backyard Worlds: Planet 9 citizen science project

• Launched in February 2017 via Zooniverse

• More than 7 million user ‘classifications’

• Over 64,000 registered users

• Roughly 150,000 unique contributors

• Participants from all 50 states, plus Puerto Rico and DC

• 167 countries represented

“I do citizen science with BACKYARD WORLDS: PLANET 9 because it’s an amazing opportunity to contribute to an important scientific project while working with great people from all over the world.”

– Michaela Allen

backyardworlds.org
today's news: best ever 3D map of brown dwarfs in the Sun's cosmic neighborhood

Lead author: J. Davy Kirkpatrick (Caltech/IPAC)

Video: Jackie Faherty (AMNH)/OpenSpace
3,000 Backyard Worlds brown dwarf discoveries: more than 2 per day!

Video: Jonathan Gagné (Rio Tinto Alcan Planetarium)
surprise: Sun’s nearest neighbors even weirder than previously thought

WISE 0830+2837, discovered by Backyard Worlds citizen scientist Dan Caselden – the second coldest known brown dwarf?

WISE 0855, the coldest known brown dwarf, still stands alone!

identified Y dwarfs ($T_{\text{eff}} \leq 450$ Kelvin)

prior literature
Backyard Worlds, CatWISE

0830+2837
WISE 0855

warmest
technology
coolest

Bardalez Gagliuffi et al. (2020)
observing citizen scientist discoveries with premier telescopes

crucial distance estimates are based on Spitzer Space Telescope follow-up (Kirkpatrick et al., in press)
conclusion

• With help from DESI imaging sky maps and citizen scientists, we’ve published the best ever 3D census of nearby brown dwarfs.
• Our discoveries would not have been possible without WISE and DESI Legacy Surveys ‘open data’ practices.
• We could still use much more help from members of the public!

https://noirlab.edu/public/news/noirlab2105/
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