A Volume-Limited Search for L/T Transition Brown Dwarfs with the Pan-STARRS 1 and WISE Surveys

William M. J. Best\textsuperscript{1}, Michael C. Liu\textsuperscript{1}, Eugene A. Magnier\textsuperscript{1}, Kimberly M. Aller\textsuperscript{1}, Niall R. Deacon\textsuperscript{2}, Trent J. Dupuy\textsuperscript{3}

\textsuperscript{1}University of Hawai‘i, \textsuperscript{2}MPIA, Heidelberg, \textsuperscript{3}Smithsonian Astrophysical Observatory

\begin{itemize}
\item We have searched \textasciitilde30,000\ deg\textsuperscript{2} in the Pan-STARRS 1 (PS1) 3\pi and WISE All-Sky surveys for brown dwarfs in the L/T transition.
\item Previous large-scale searches have been incomplete for L/T transition dwarfs because these objects are faint in optical bands, and have near-infrared colors that are difficult to distinguish from background stars.
\item We have cross-matched the PS1 (optical) and WISE (mid-IR) catalogs to produce a unique multi-wavelength database.
\end{itemize}

\section*{Why L/T Dwarfs?}

- Only \textasciitilde20\% of known brown dwarfs are in the L/T transition (spectral types \textasciitilde L6–T5).
- Previous all-sky searches based on 2MASS have found few L/T objects.
- Objects undergo drastic spectral changes across the L/T transition (\textasciitilde 1300–900 K), which models find difficult to reproduce.
- Weather-related periodic variability has been observed in some L/T dwarfs.
- A larger, well-defined sample of L/T transition dwarfs will improve constraints on the substellar mass function, and provide more templates for brown dwarf atmospheric models.

\section*{Volume-Limited at 25 pc}

- We want to characterize the L/T transition population within 25 pc, the same volume as the PMSU M dwarf survey and the Gliese catalog.
- Empirically, we find that ultracool objects with $W1 < 2.833(W1-W2) + 12.667$ have photometric (W2) distances < 25 pc.

\section*{New Discoveries}

- We have obtained near-IR SpeX spectra for 138 candidates and confirmed that 82 are new L/T transition dwarfs, 33 with 25 pc.
- These new discoveries will...
  - substantially improve the completeness of the 25 parsec L/T dwarf census;
  - refine the constraints on the local substellar mass function;
  - help us to better understand and model the evolution of brown dwarf atmospheres through the L/T transition.

\section*{Comparison to Previously Known Objects}

- Colors of spectroscopically confirmed discoveries. The PS1 $y$-band helps to distinguish late L-T dwarfs from earlier-type objects. Shaded regions show colors excluded by our search.

\section*{PS1 3\pi Survey}

PS1 has mapped the entire sky north of Dec = -30\° several times to date in five grizy filters, including $y$ down to \textasciitilde20.3 mag (single epoch), equivalent to \textasciitilde1 mag deeper than SDSS. PS1 3\pi is mapping the entire search area twelve times over 4 years (finishing in March 2014) in five filters, enabling internal proper motion and parallax measurements.

\section*{Search Status}

Our survey is nearly complete, and we expect to finish the remaining observations later this month.

Will Best is a third year graduate student at the University of Hawai‘i.

wbest@ifa.hawaii.edu

AAS, Jan 2014, Washington, DC