Forty seven new T dwarfs from the UKIDSS Large Area Survey

ISHII, Miki, TAMURA, Motohide
(NAOJ)

KUZUHARA, Masayuki
(University of Tokyo)

BURNINGHAM, Ben, PINFIELD, David
(University of Hertfordshire)

and the UKIDSS Cool Dwarf Science Working Group

Observations in the 1980–90s have established that the conventional spectral sequence from O to M stars is followed by even cooler dwarf stars—Some L dwarfs and all T dwarfs ($T_{eff} \lesssim 1300$ K) correspond to "brown dwarf" whose mass is below 0.075 solar masses. Previous large area surveys (e.g., 2MASS, SDSS) have discovered about 600 L dwarfs and 100 T dwarfs so far. On the other hand, a deeper large area survey is necessary to detect more and cooler (i.e., intrinsically fainter) brown dwarfs, which will extend our understanding of star and planet formation, both through detailed study of individual systems and through statistical population studies. Ongoing UKIDSS Large Area Survey (LAS) meets the requirement. The UKIDSS/LAS will cover 4000 sq. degrees using the UKIRT Wide Field Camera (WFCAM), with 4 mag deeper detection limit than 2MASS. From the resultant data, the coolest T dwarfs and, further more, a new class of dwarfs cooler than T (Y dwarfs) are expected to be found.

The Cool Dwarf Science Working group, an international collaboration including UK and Japanese astronomers, has developed the selection method using UKIDSS *Y JHK* colors and the combination of SDSS *z-J*, *i-z* to select L/T and Y dwarf candidates. Followup spectroscopy using large telescopes such as Subaru and Gemini is adopted to determine their spectral types finally. As a result, (1) we have discovered 80 T dwarfs from 980 sq. degrees of sky, which means that the number of known T dwarfs have been almost doubled (as of 2010)[1]; (2) the coolest star ever known has been discovered by the UKIDSS[2] (Figure 1); (3) we have identified spectrally peculiar objects, which may represent hitherto unrecognised tracers of composition and/or gravity[1] (Figure 2). We have used our sample to estimate space densities for T6-T9 dwarfs. Our analysis suggests that the substellar mass function is declining at lower masses, which is at odds with results for young clusters.

After the completion of UUKIDSS/LAS, we expect to discover Y dwarfs together with hundreds of T dwarfs, which will shed light on the formation processes of substellar objects, the Initial Mass Function (IMF) and the formation history.

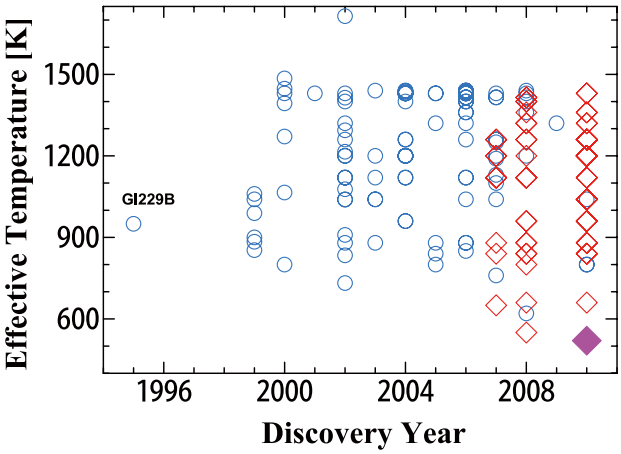

Figure 1: History of the coolest brown dwarf discovered: T dwarfs discovered by UKIDSS (◇) and previous surveys (○) are plotted against their discovery year.

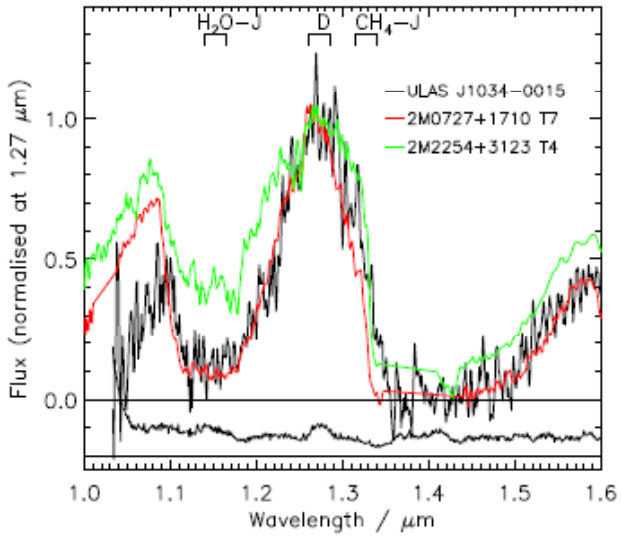

Figure 2: Example of a peculiar spectral type (ULAS J1034). CH_4-J index implies an earlier type than that suggested by the H_20-J index.

References

[1] Burningham, B., et al.: 2010, *MNRAS*, **406**, 1885.
[2] Lucas, P. W., et al.: 2010, *MNRAS*, **408**, 56.