First Brown Dwarfs from the UKIRT Infrared Deep Sky Survey (UKIDSS)

Ramaro Tata¹, Eduardo L. Martin¹, T. Kendall³, R. Jameson⁴, A. Magazzu⁵, D. Barrado y Navascues⁶, N. Phan Bao¹


Introduction
UKIDSS began in May 2005 and will survey 7500 square degrees of the northern sky, extending over both high and low galactic latitudes, in JHK to K=18.3. This depth is three magnitudes deeper than 2MASS. Four of the principal qualities of UKIDSS are: the coolest and nearest brown dwarfs, high-redshift dusty star-forming galaxies, elliptical galaxies and the galaxy clusters at redshifts 1<z<2, and the highest-redshift quasars, at z=7. UKIDSS aims to discover the nearest objects to the Sun (outside the solar system) as well as some of the faintest known objects in the Universe.

UKIDSS searches for the nearest and smallest objects in the solar neighborhood. This survey is deep enough to detect brown dwarfs and young free floating planets with as little as 5-Jupiter masses within a distance of a few tens of parsecs. The UKIDSS should find brown dwarfs even cooler than T dwarf, Te >700K, a new spectral class tentatively named Y dwarfs (Leggett et al 2005). The combination of IR and optical colors, and large expected proper motions will allow the UKIDSS to find halo brown dwarfs if they exist, testing the universality of star formation processes and the formation history of the Milky Way.

Aim
- To obtain spectral classification of the BD candidates selected from the Large Area Survey of the UKIDSS.
- To improve photometry and measure proper motions of the first UKIDSS L, T, and Y dwarf candidates using ISP1 at the Blanco 4m telescope.
- The discovery of the first Y dwarfs would be an obvious high priority for us, but more importantly, we will be able to rapidly and efficiently mine the UKIDSS database for large samples of these objects. The knowledge of actual Y dwarf colors will allow us to employ optimal color-magnitude criteria, as the observing strategy of UKIDSS is still flexible.
- The first Y dwarfs may provide the key to modify exposure times so as to maximize Y dwarf sensitivities.

Observations and Data Reduction
The survey instrument is WFCAM on the UK Infrared Telescope (UKIRT) in Hawaii. WFCAM has four 214x214 pixel Rockwell devices.

UKIDSS is a set of five surveys. The areas are as follows:
1. Large Area Survey (LAS) 4000 sq arcminute
2. Galactic Plane Survey (GPS) 1800 sq Galactic
3. Galactic Clusters Survey (GCS) 1400 sq Galactic
4. Deep Extragalactic Survey (DXS) 53 sq
5. Ultra Deep Survey (UDS) 0.77 sq arcminute

We have obtained proper motions and photometry for 15 UKIDSS BD candidates with the ISPI on CTIO 4m telescope.

We have also obtained optical spectra for 1 BD candidate using the 3.5m Galileo Telescope with DOLORES confirming it as an L dwarf. The near IR spectra obtained using the 4.2m William Herschel Telescope with LIRIS confirms 2 L dwarfs and 1 T dwarf.

Results and Conclusions

Table 1. Measured and proper motion measurements of BD program objects using UKIDSS survey and CTIO observations

<table>
<thead>
<tr>
<th>Name</th>
<th>J Mag</th>
<th>Proper Motion</th>
<th>Proper Motion</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>RA (mas/yr)</td>
<td>Dec (mas/yr)</td>
</tr>
<tr>
<td>UBD1</td>
<td>19.24±0.13</td>
<td>+1 ± 10</td>
<td>-169 ± 10</td>
</tr>
<tr>
<td>UBD2</td>
<td>17.53±0.03</td>
<td>-21 ± 10</td>
<td>+80 ± 10</td>
</tr>
<tr>
<td>UBD3</td>
<td>18.68±0.06</td>
<td>-23 ± 10</td>
<td>-29 ± 10</td>
</tr>
<tr>
<td>UBD4</td>
<td>19.19±0.10</td>
<td>+27 ± 10</td>
<td>-54 ± 10</td>
</tr>
</tbody>
</table>