

# CFBDSIR J1458+1013B

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# ESO Press Release 10/11

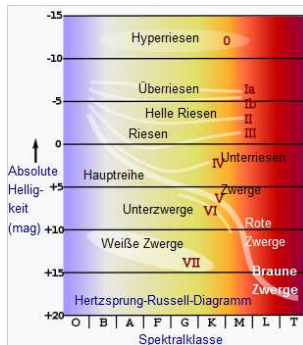
## Text of the ESO Press Release 10/11 in condensed form

- Observations with the European Southern Observatory's Very Large Telescope, along with two other telescopes, have shown that there is a new candidate for the coldest known star in the binary system *CFBDSIR J1458+1013*.
- CFBDSIR J1458+1013B, is the dimmer member of a binary brown dwarf system located just 75 light-years from Earth, has now been found to have a temperature of **about  $370 \pm 40\text{K}$** .
- The powerful XSHOOTER spectrograph on ESO's Very Large Telescope (VLT) was used to show that the composite object was very cool by brown dwarf standards.

# Brown Dwarf - Definition

## Definition

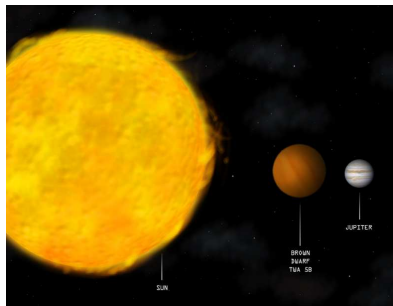
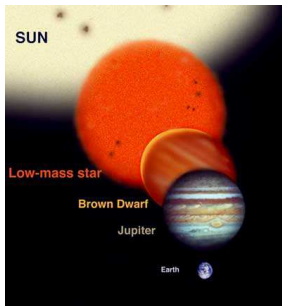
- Deuterium burning, but no hydrogen-burning
- $2\text{H} + {}^1\text{H} \rightarrow {}^3\text{He} + \gamma$



# Brown Dwarf - Mass

## Mass

- Mass between  $1.3\%M_{\odot}$  and  $7.5\%M_{\odot}$ .
- Below  $1.3\%M_{\odot}$  there is not enough pressure for Deuterium fusion



# Brown Dwarf - Classification

## Spectral Classes

class	temperature	properties
M	2000 – 3350 K	TiO features, red giant
L	1300 – 2000 K	maximum at $\approx 2 \mu\text{m}$
T	600 – 1300 K	infrared, methane is prominent
Y	200 – 600 K	suggested



Fig.: Brown Dwarfs: L - T - Y

## Brown Dwarf - Y spectral class

### Y spectral class

- It is suggested to define the Y spectral class with an ammonia feature at  $1.55\ \mu\text{m}$
- This is very difficult since feature could also be water or methane
- As of August, 26<sup>th</sup> 2011 only 6 candidates for spectral class Y.



Fig.: Y spectral class brown dwarf

# Brown Dwarf - The binary CFBDSIR J1458+1013AB

## CFBDSIR J1458+1013AB

- Orbit time: 30 years
- Separation: 2.6 AU
- Distance:  $23.1 \pm 2.4$  pc





# Brown Dwarf - The binary CFBDSIR J1458+1013AB

## CFBDSIR J1458+1013B

- the coolest brown dwarf in a binary so far
- estimated spectral class T9 - T10
- temperature  $370 \pm 40$  K
- candidate for the suggested spectral class Y0



# VLT/XSHOOTER Overview

## VLT XSHOOTER Key Data

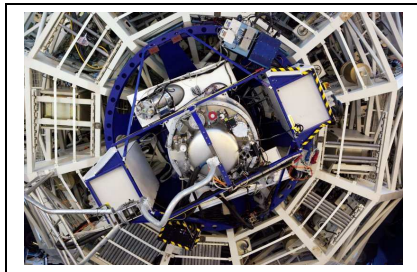
- XSHOOTER is the first of the second generation instruments at VLT. The instrument received first light in November 2008.
- XSHOOTER is a multi wavelength (range 300-2500nm) medium resolution spectrograph mounted at the UT2 Cassegrain focus, and covers in a single exposure the spectral range from the UV to the K' band .
- The incoming light is split into three independent cross dispersed echelle spectrographs/arms completed with its own shutter and/or slit mask.

(source: ESO, Paranal Instrumentation )

# VLT/XSHOOTER Overview

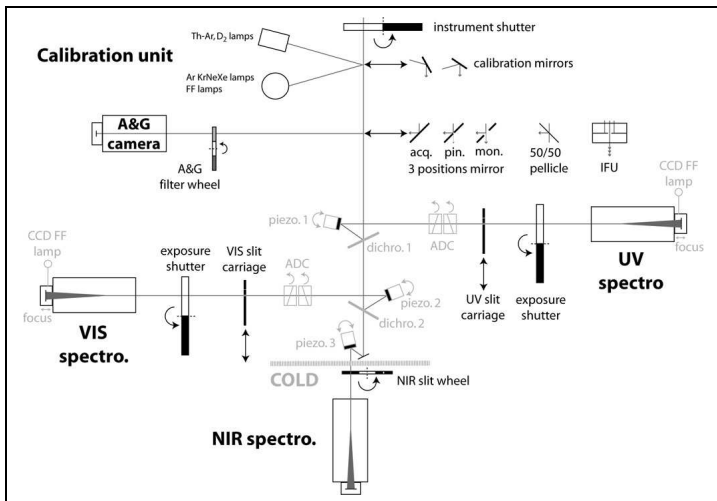
## VLT/XSHOOTER mounted at VLT UT2

A view of X-shooter at the Cassegrain focus below the primary mirror cell of the VLT UT2. In this view from below the instrument one sees the UVB and VIS spectrographs at the top and bottom, respectively. The NIR cryostat is visible in the center.



(source: ESO, Paranal Instrumentation )

# VLT/XSHOOTER Instrument Concept



(source: ESO, Paranal Instrumentation )

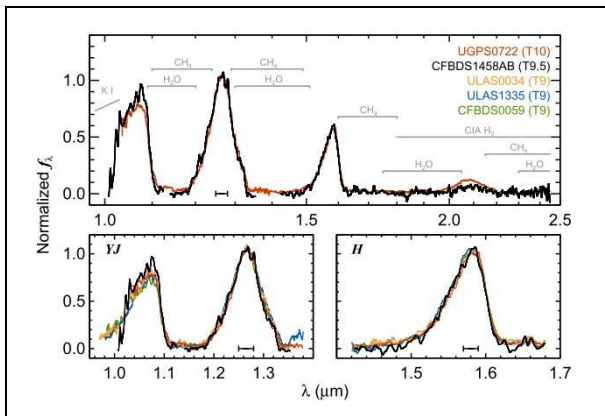
# VLT/XSHOOTER: NIR Spectrograph

## NIR Spectrograph Key Data

- The NIR spectrograph is fully cryogenic. It is cooled with a liquid nitrogen bath cryostat and operates at 105 K.
- Main dispersion is provided by a 55 grooves/mm échelle grating.
- After dispersion, the collimator creates an intermediate spectrum near the entrance slit. The fixed focus camera re-images the échellogramme onto the detector.
- The NIR detector is a  $2k * 2k$ ,  $18\mu\text{m}$  pixel Hawaii 2RG of which only  $1k * 2k$  is used. It is operated at 81K.

# VLT/XSHOOTER: one Result of the Observations

According to (Liu M.C. et al, 2011) the integrated-light NIR spectrum of CFBDSIR *J1458 + 1013AB* is very similar to other recent very late-T dwarf discoveries.



## References

ESO VLT: X-shooter User Manual

ESO Press release 10/11: CFBDSIR J1458+1013B: A Very Cold (>T10) Brown Dwarf in a Binary System

Liu M.C. and Delorme, P. and Dupuy, T.J. and Bowler, B.P. and Albert, L. and Artigau, E. and Reyle, C. and Forveille, T. and Delfosse, X., CFBDSIR J1458+1013B: A Very Cold (T10) Brown Dwarf in a Binary System, ApJ, in press (accepted March 4, 2011)