



# Machine Learning in the future ultracool dwarfs classification with Euclid

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## WORK DONE

### Brown dwarfs

Spec. Type: **L, T, Y**

Low temp.  $\Rightarrow$  Atmospheric molecules

**Lab NIR Spec.**  
more complete than simulations

**Object NIR Spec.**  
extremely faint and peaks at NIR



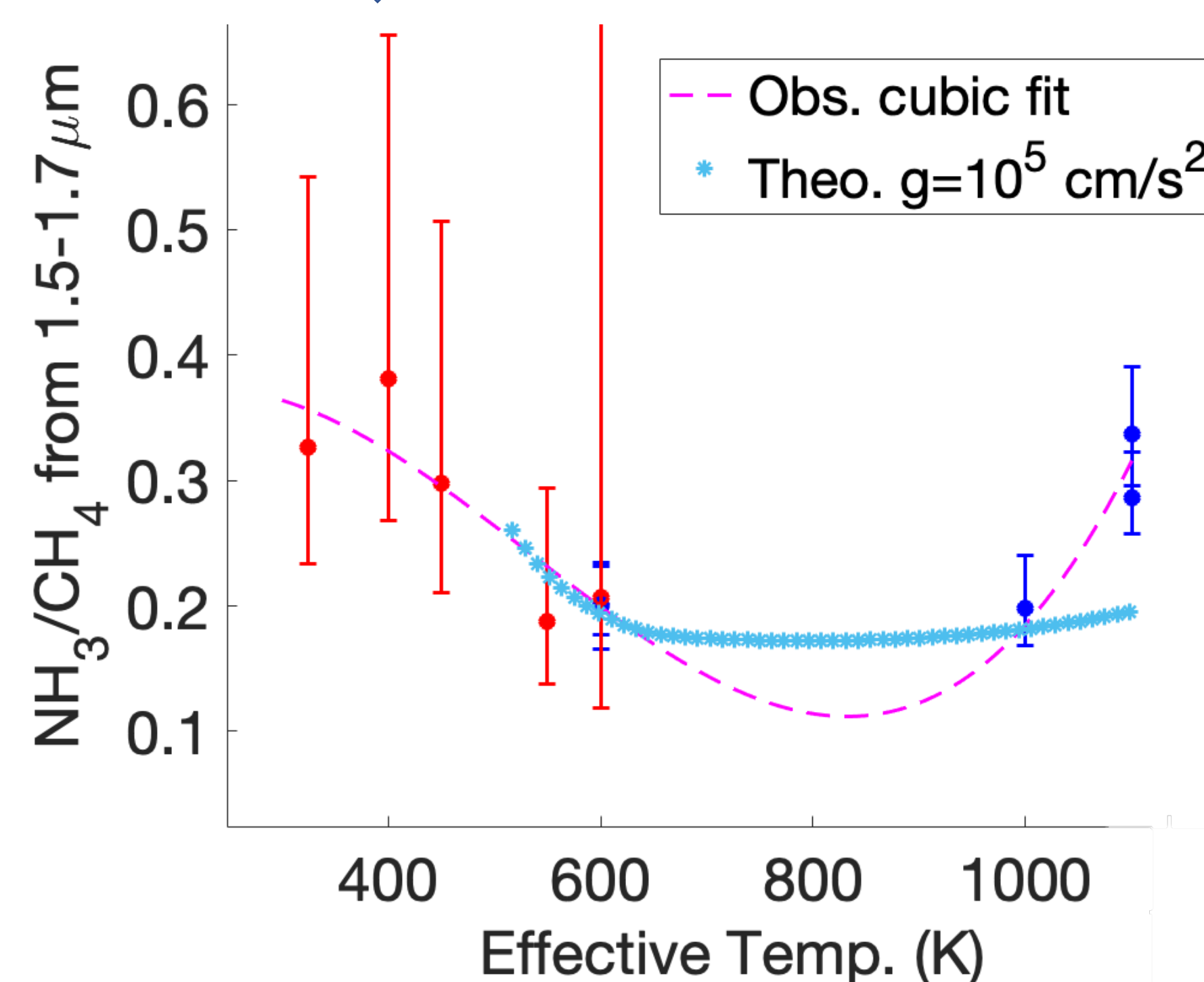
Find wavelength windows

Spec. Type classification

Regression to find abundances

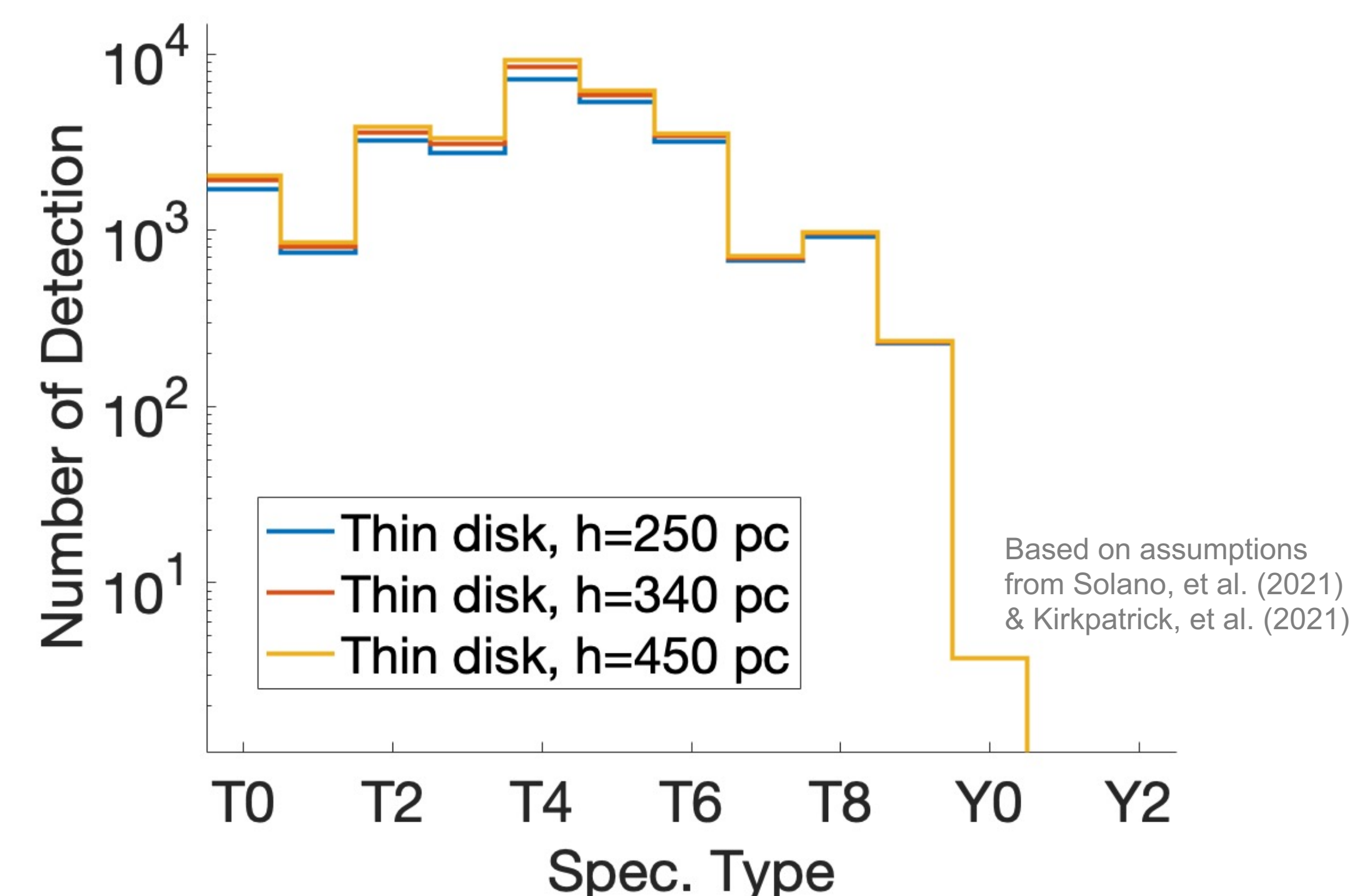
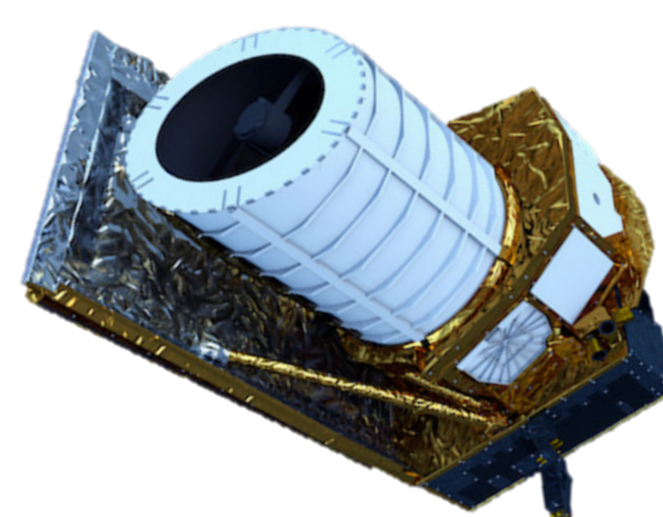
Effective temp.

We found a **new spectral index** abundance ratio between  $\text{CH}_4$  and  $\text{NH}_3$  indicating the temperatures, and it matches well with the theory.



## FUTURE

**Euclid** (will be launched in 2022) can provide sky survey in NIR range, is a good brown dwarf searcher



### Current

N# of objects with NIR spec.  $< 20$   
N# of lab molecule spec.  $< 5$

### Future

N# of objects with NIR spec.  $> 10^4$   
N# of lab molecule spec.  $> 50$

- Clearer brown dwarf spec. index-temperature relation
- More definitive brown dwarf spec. type classification
- Very-low-mass tail of the Galactic populations

Very-low-mass IMF (Initial mass function)

## We need Machine Learning to

- Find **new wavelength windows**
- Find and fix **new spectral indices**
- Recognize **spectral patterns**
- Automatize index measurements
- Determine the **spectral types**
- Combine different datasets
- Assign **membership probability**
- Estimate Initial Mass Functions for different galactic populations
- ...



Enjoy our Video !



## Reference

Solano, E., et al. "Ultracool dwarfs in deep extragalactic surveys using the virtual observatory: ALHAMBRA and COSMOS." *Monthly Notices of the Royal Astronomical Society* 501.1 (2021)

Kirkpatrick, J. Davy, et al. "The Field Substellar Mass Function Based on the Full-sky 20 pc Census of 525 L, T, and Y Dwarfs." *The Astrophysical Journal Supplement Series* 253.1 (2021)

Brown dwarf illustrations credit: NASA/JPL-Caltech  
Euclid spacecraft illustration credit: ESA/ATG medialab