The planetary-mass domain of the σ Orionis star cluster

María Rosa Zapatero Osorio (CAB, CSIC-INTA)
Víctor J. S. Béjar (IAC)
Karla Peña Ramírez (IAC)

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Aims
Spectral data
Cluster mass function

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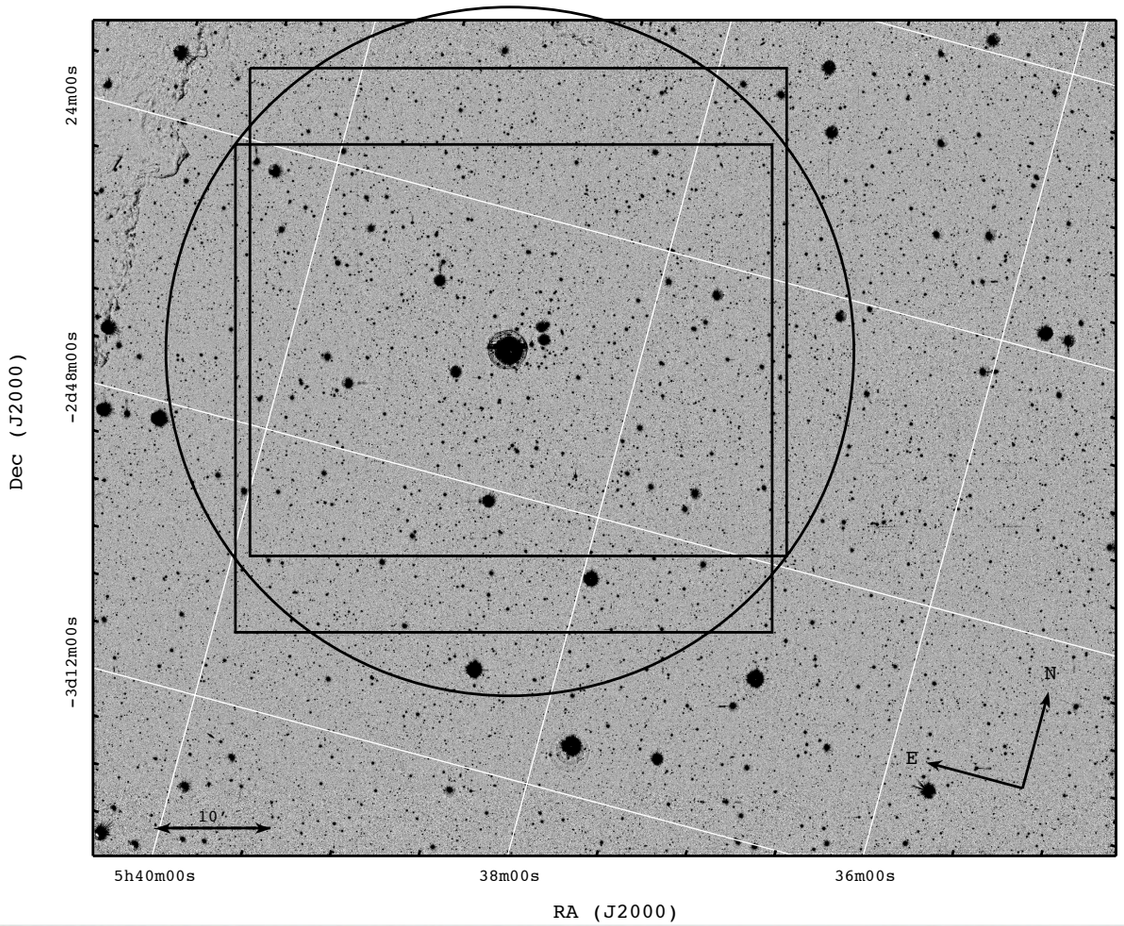

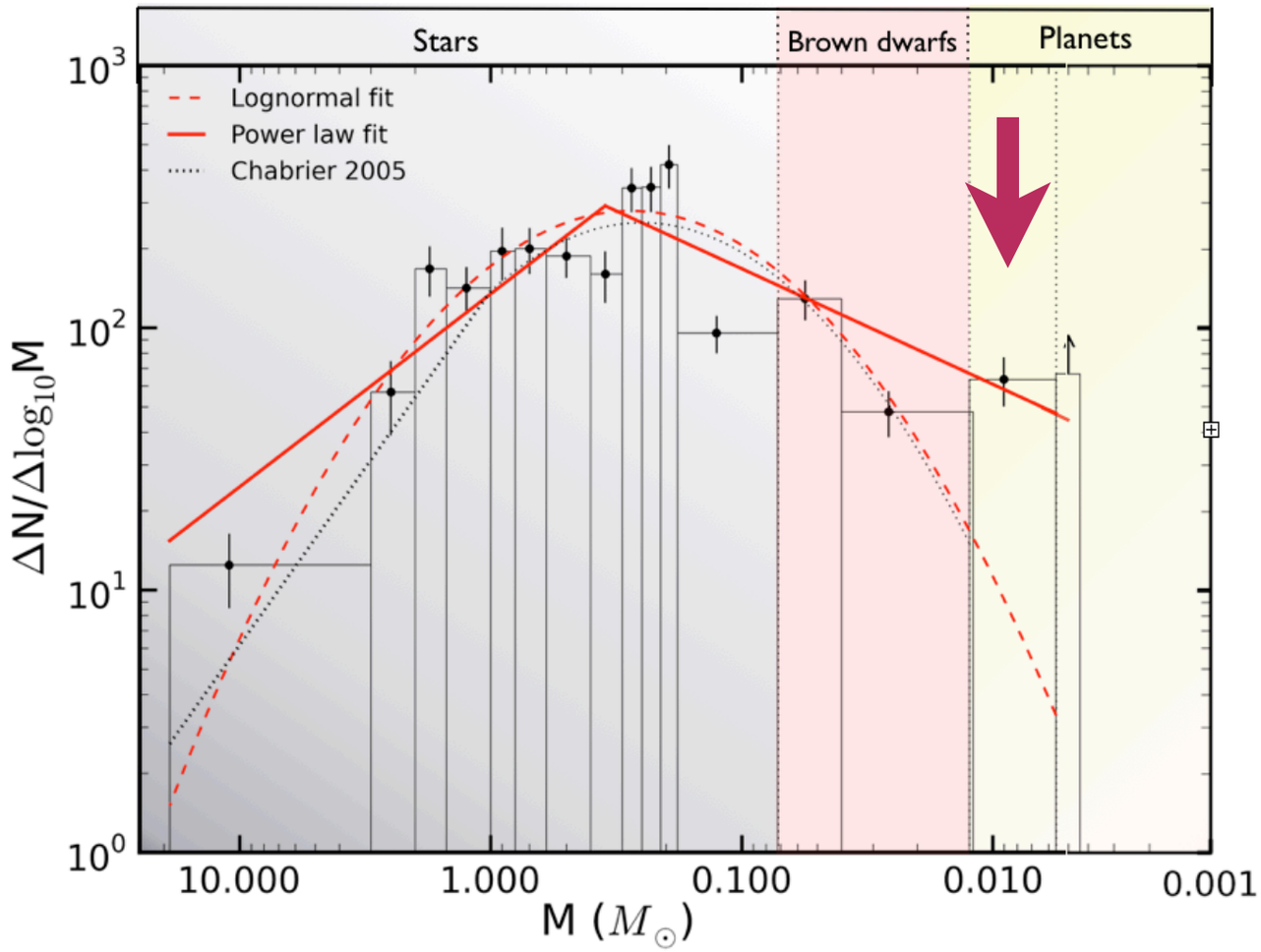

- In Peña Ramírez et al. (2012) we photometrically explored a circular area of radius 30' on the σ Ori cluster (3 Myr, 350 pc) using optical, NIR, and MIR data.
- We covered >80% of the cluster members with masses in the interval 6 M_{jup} through 0.25 M_{sol}. The survey is complete down to planets with a mass of 6 M_{jup}.
- Among the stars and brown dwarfs, >70% are confirmed cluster members, thus offering reliability to the derived mass function.

- Mass function based on 399 objects, 22 of which correspond to the planetary mass bin 6-12 M_{jup}.
- Chabrier's mass function nicely fits the σ Ori mass function, EXCEPT for the planetary domain.
- The membership of many free-floating planet candidates in the σ Ori cluster is pending ... until "today".

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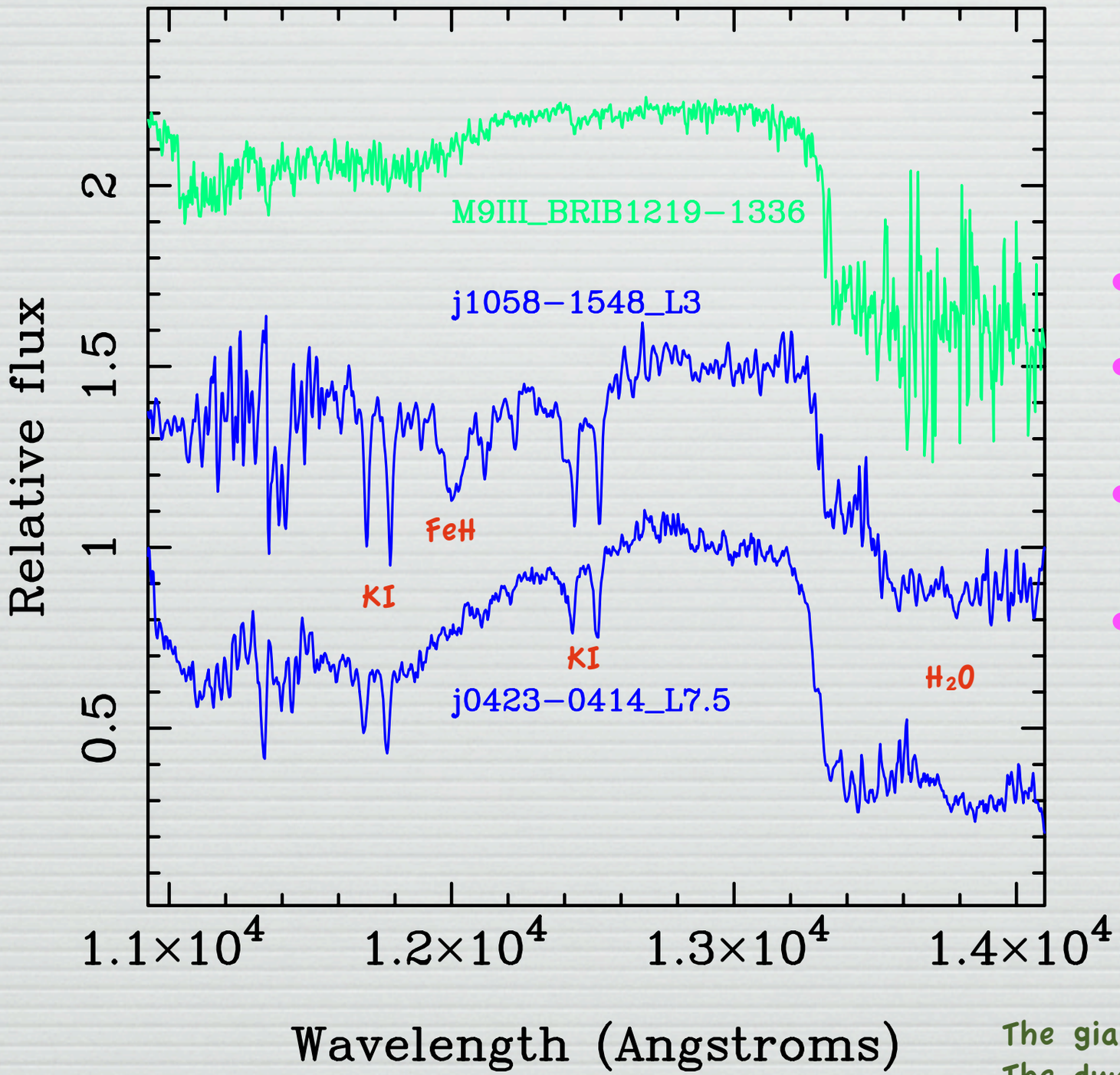

ISAAC spectra

- ISAAC/VLT spectra (J-band) were obtained for 7 planetary-mass candidates last Dec.
- High-gravity (log g ~4.5-5.0), cool atmospheres (1000-2800 K) show strong absorption features due to KI and FeH.
- Very low-gravity (log g ~1.5-2.5) atmospheres of giant stars are practically featureless.
- Water vapor absorption at 1.33 μm is present at both very low- and high-gravity objects.

The giant spectrum comes from Rayner et al. (2009). The dwarf spectra belong to our ISAAC data.

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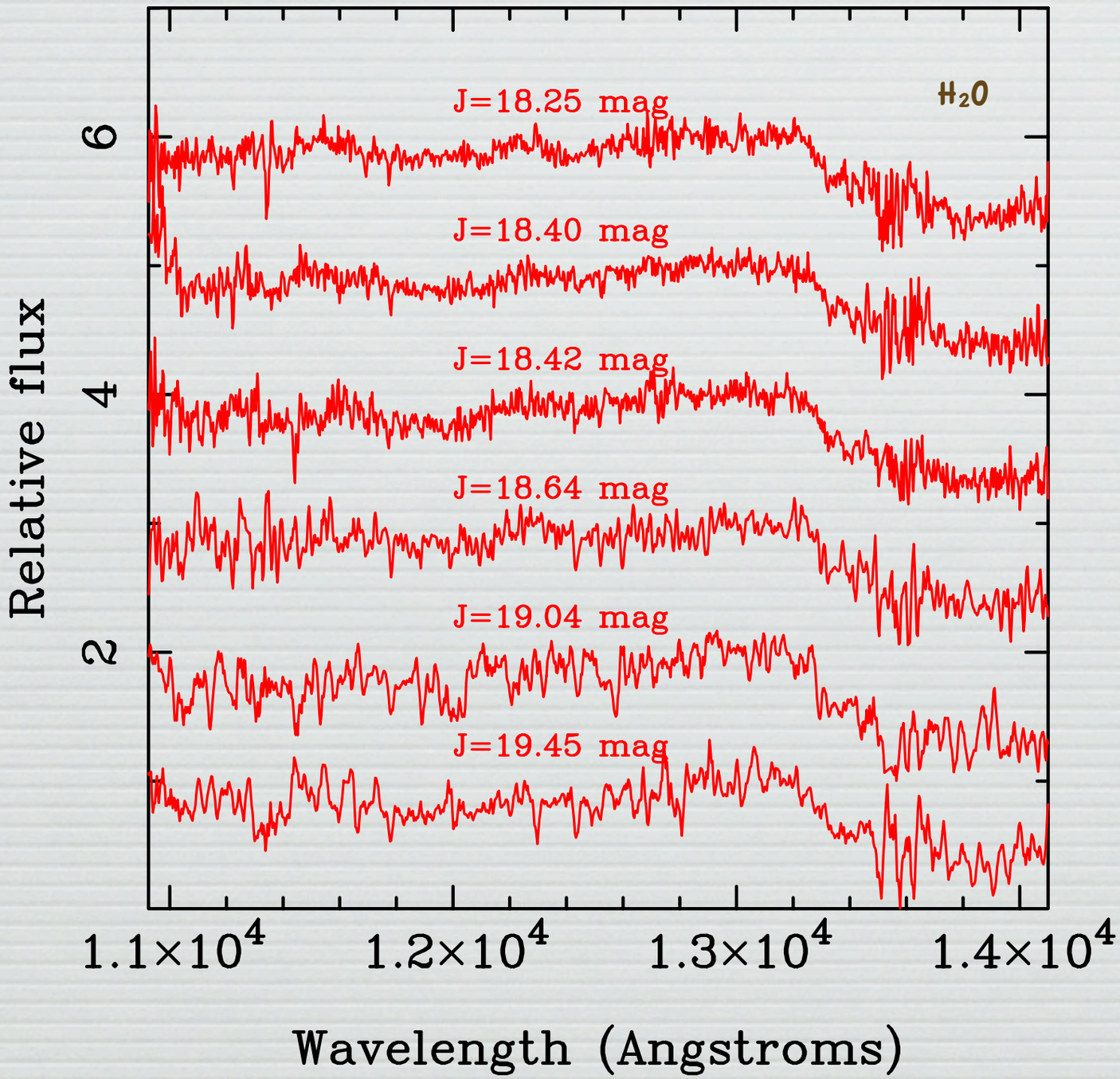

ISAAC spectra

- Our collection of σ Ori, L-type ISAAC/VLT spectra (J-band) obtained last Dec.
- The data of the faintest objects are smoothed by 3 and 5 pixels.
- The first spectral feature to look at is H_2O. Its presence is indicative of the cool nature of the sources. Its strength provides preliminary T_{eff}'s and/or spectral types.
- We confirmed that all these 6 sources have H_2O absorption at 1.33 μm, and that their surface temperatures are consistent with early- to mid-L types.

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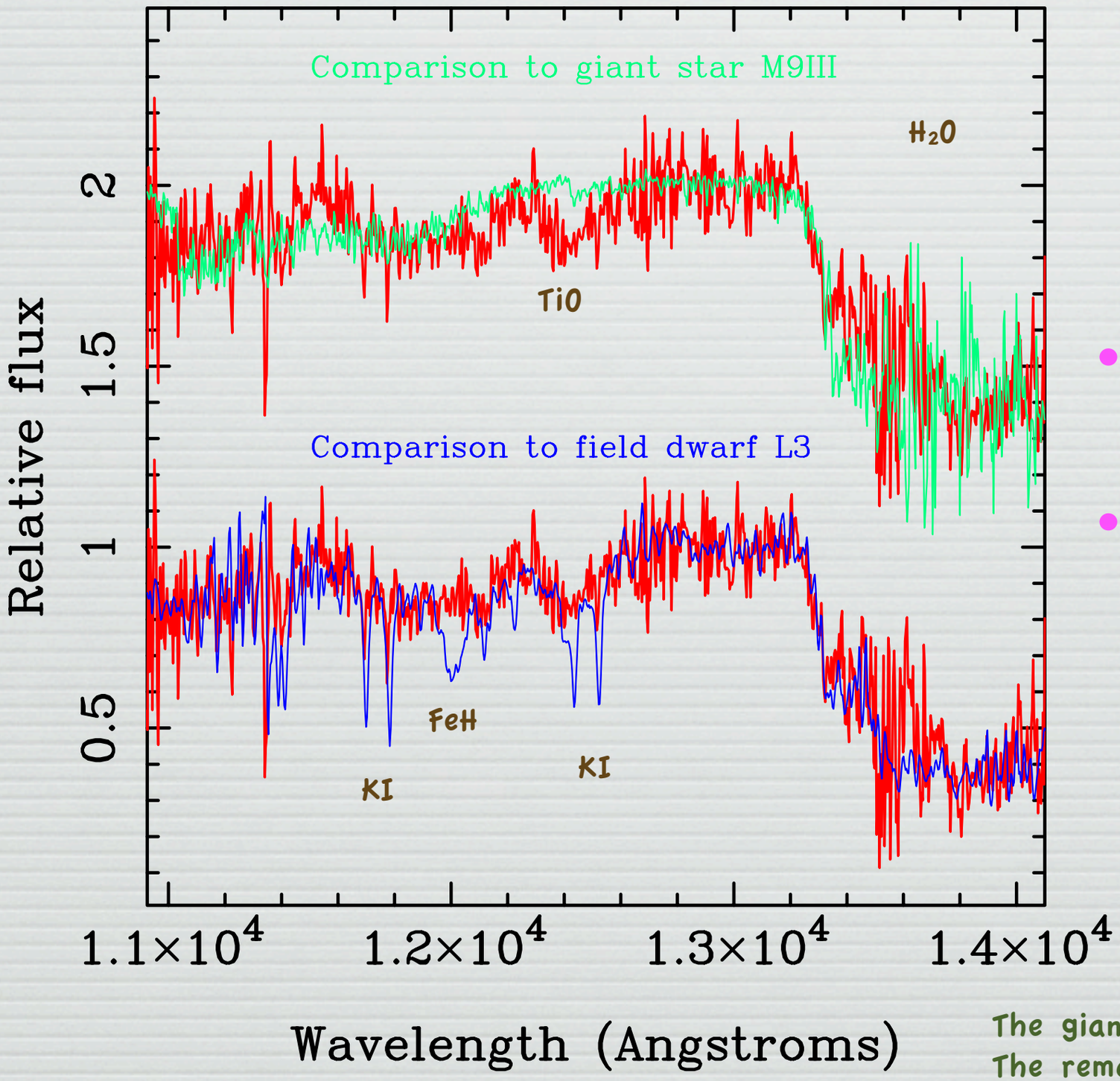

ISAAC spectra

- The ISAAC/VLT spectra of the planet candidates lack many of the atomic and molecular absorption features present in the high-gravity dwarfs.
- The data confirm the low-gravity nature of the targets and their young age, thus providing support to their membership in the cluster.

The giant spectrum comes from Rayner et al. (2009). The remaining spectra belong to our ISAAC data.

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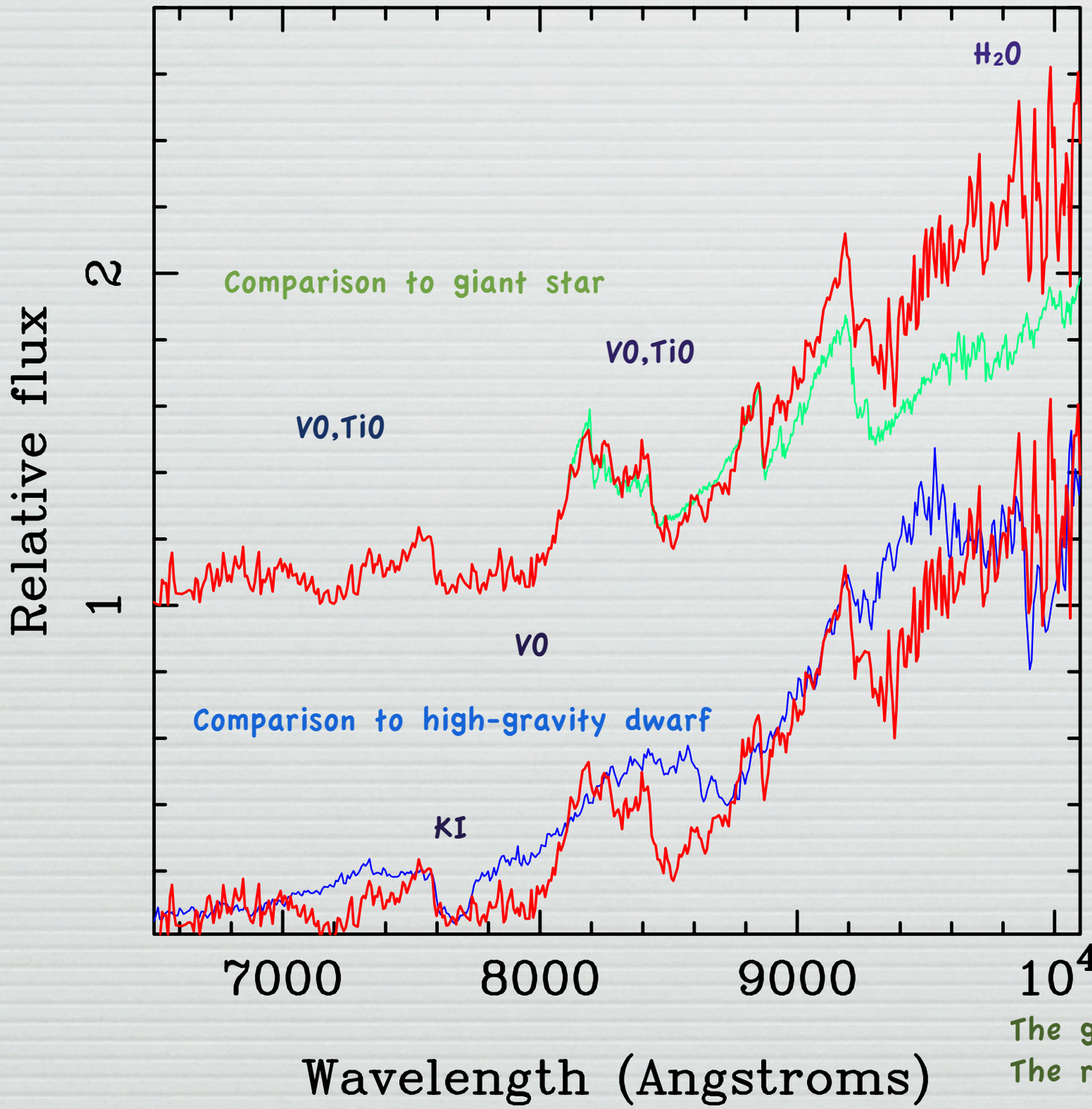

GTC/OSIRIS spectra

- GTC/OSIRIS spectra (obtained a few weeks ago) also confirm the cool and low-gravity nature of our candidates at optical wavelengths.

The giant spectrum comes from Rayner et al. (2009). The remaining spectra belong to our GTC data.

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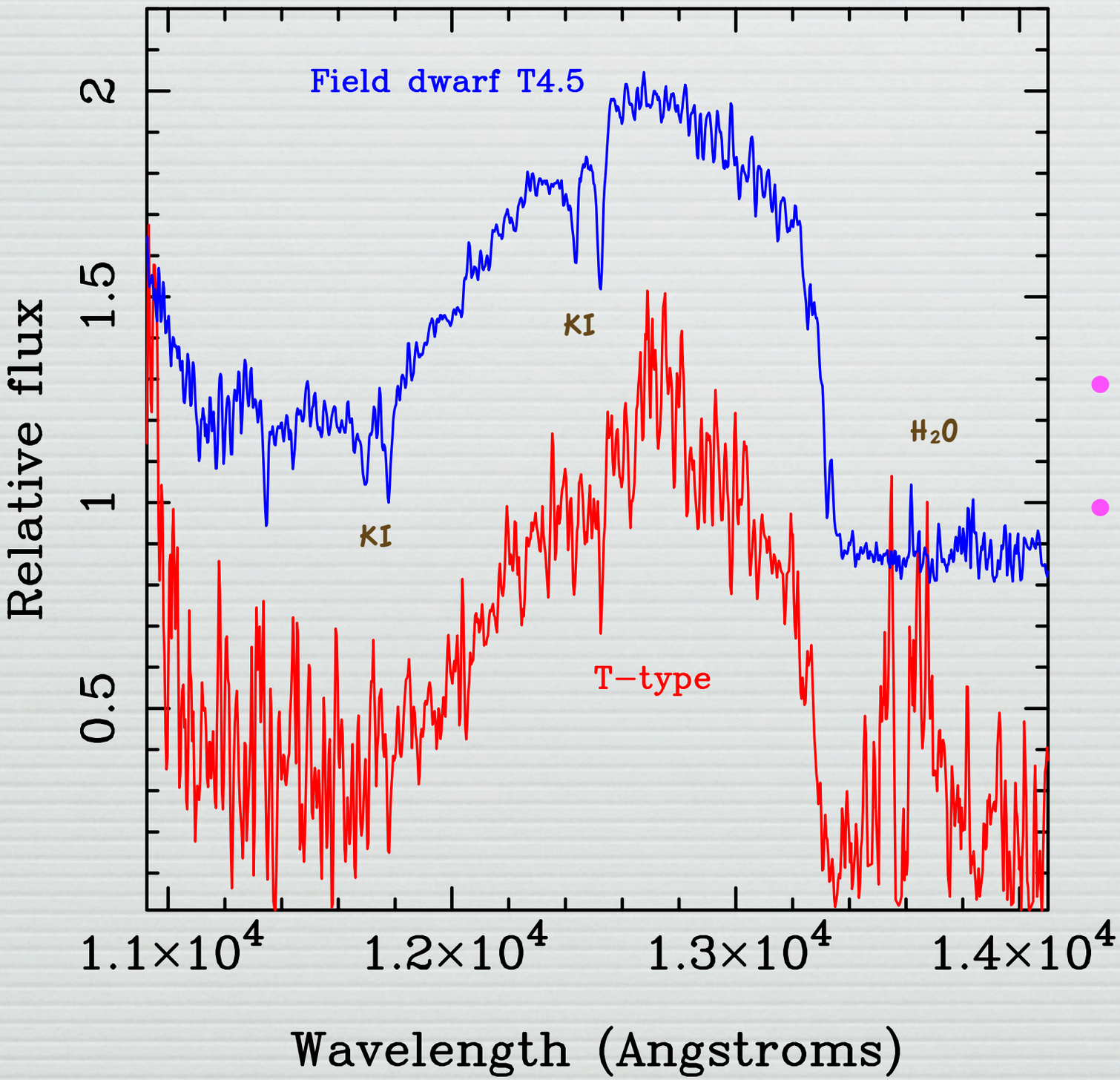

ISAAC spectra

- We also have a few contaminants in the sample. One is this ultracool dwarf which we classify as a mid-T interloper.
- A few contaminants does not have a great impact in the determination of the height of the corresponding mass bin in the mass function.

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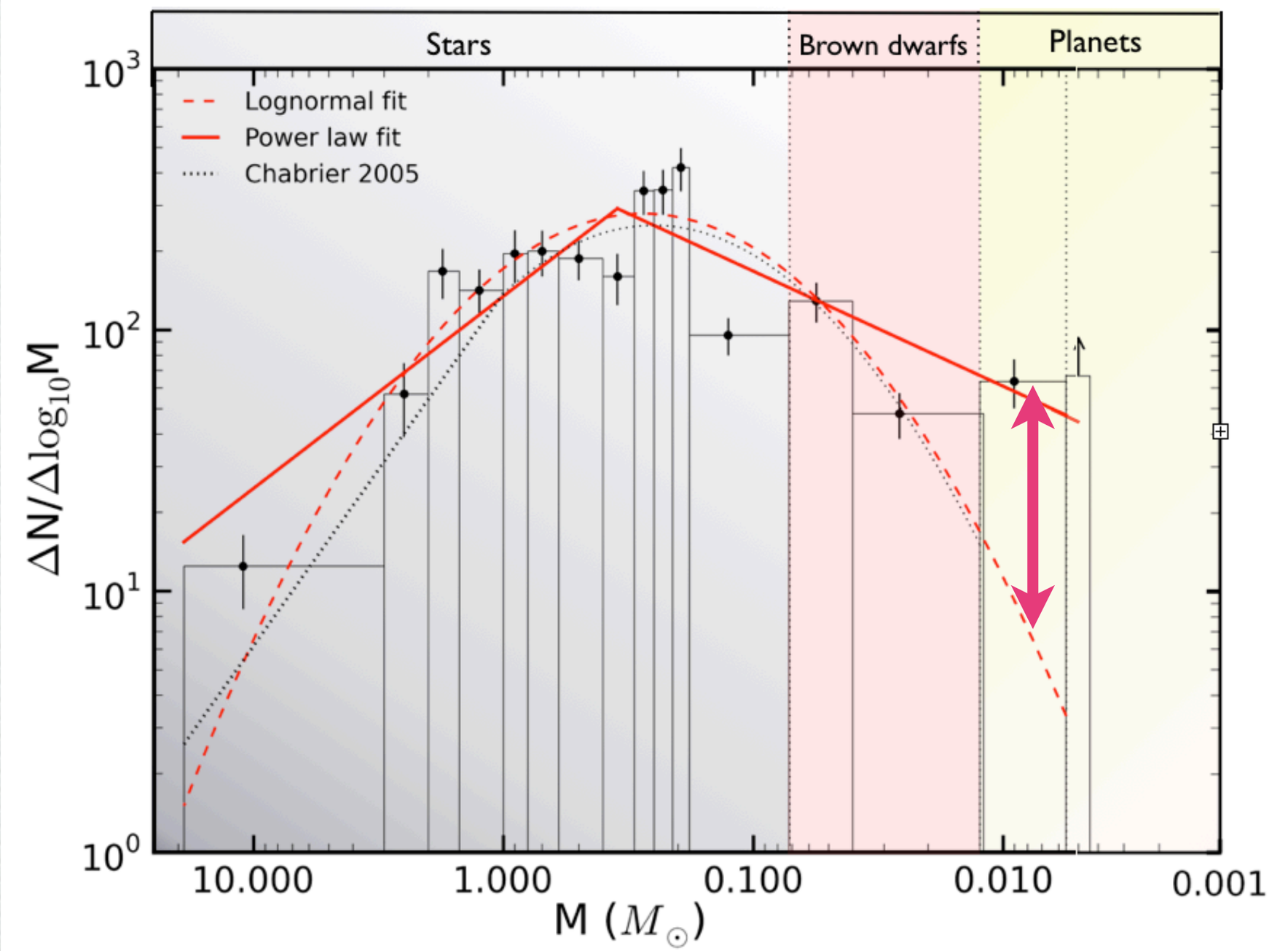

- **Final remark.** We confirm the reliability of the planetary-mass bin (6-12 M_{Jup}) of the cluster mass function, and the observed discrepancy (larger than a factor of 5) with Chabrier's log-normal function.