High-z Ly$_\alpha$ candidates in the SHARDS survey

José M. Rodríguez Espinosa, Omaira González Martín,
Casiana Muñoz Tuñón & Noelia Herrera Ruiz
on behalf of the Estallidos group

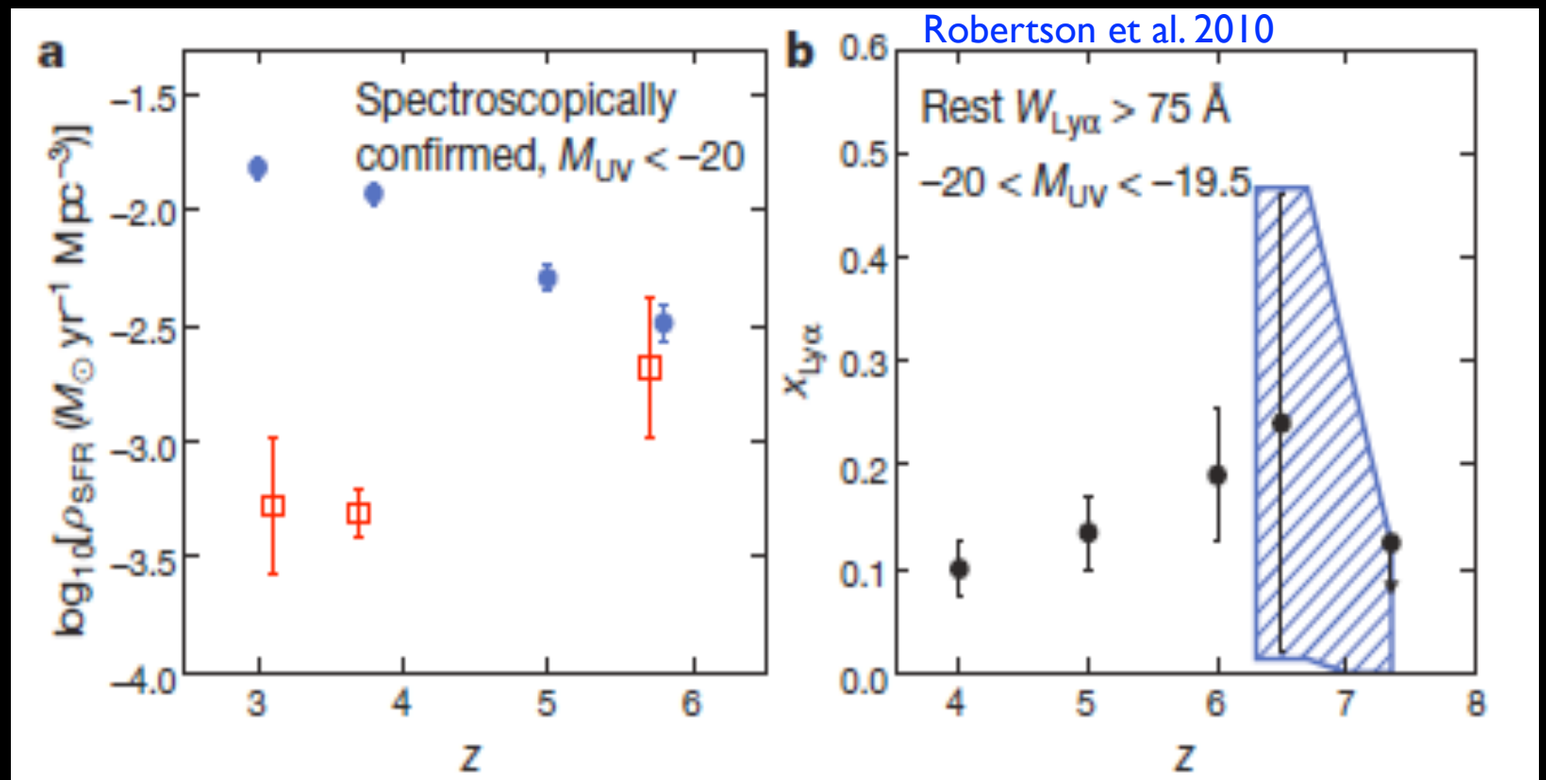
using SHARDS data courtesy from Pablo Pérez González (UCM)

The Lyα sources in the History of the Universe

- Lyα sources trace the high-z SFR history of the Universe
- Lyα sources can also be used to trace the re-ionization history of the Universe
- Two Flavours:
  - Lyα emitters (LAE)
    - Show prominent Lyα emission in the line
    - Very sensitive to extinction due to dust or neutral Hydrogen
  - Ly Break Galaxies (LBG)
    - Show very prominent Lyman continuum emission
    - Show sharp cont. break at λ below Lyα line
    - Less affected by neutral Hydrogen absorption

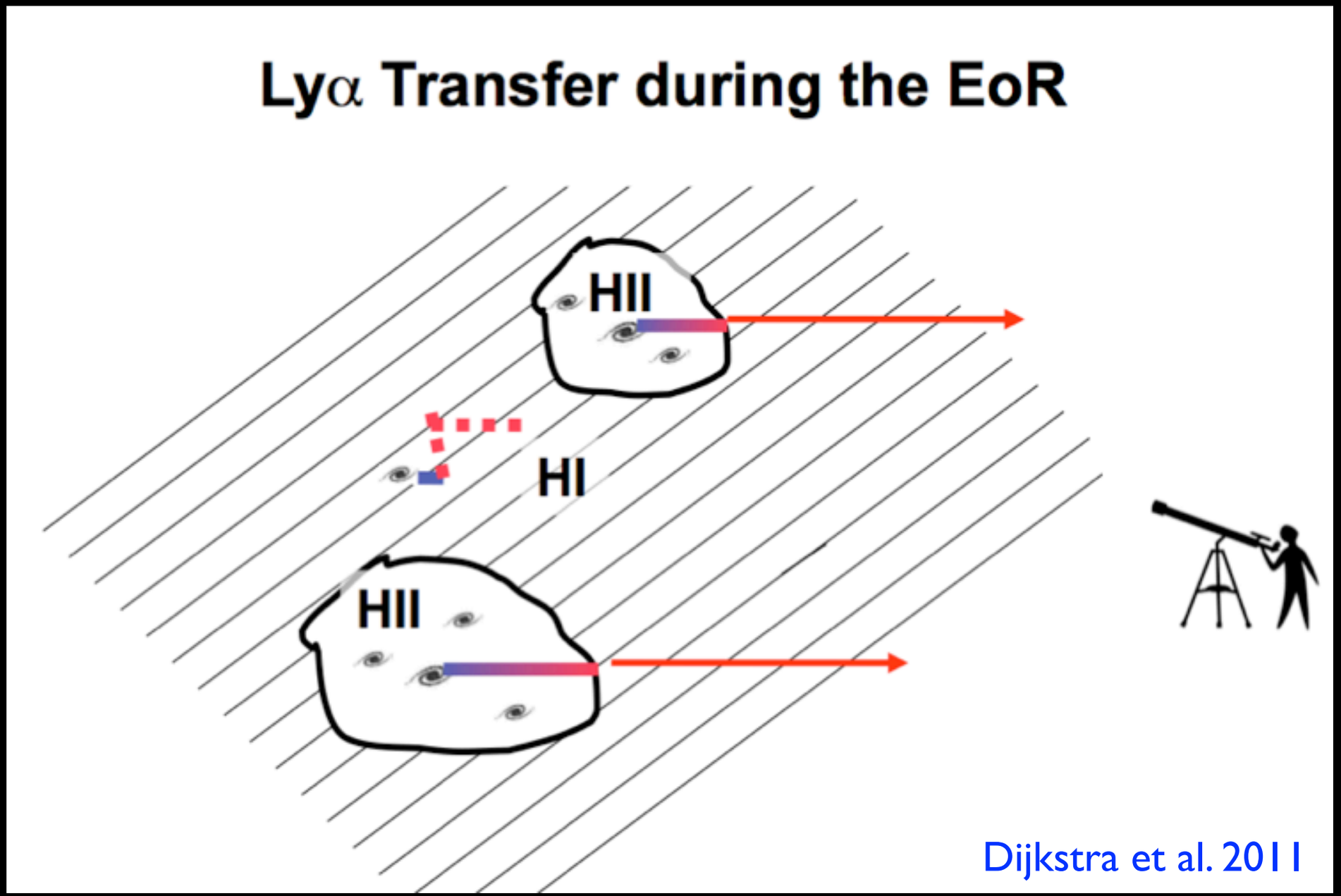
The relative abundances of LAEs and LBGs

- Note the different densities of LAEs & LBGs
- Interesting that the two populations equal their numbers at z~6
- It is also expected that the number density of LAEs should overcome that of the LBGs beyond z~6
- But note also the large uncertainties in the Lyα population beyond z~6

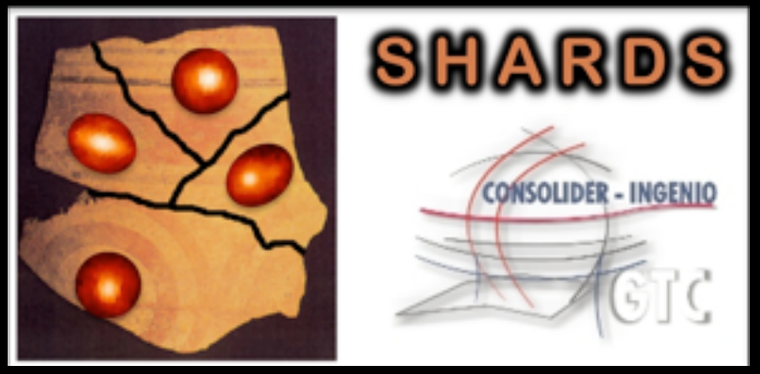


Clustering of Lyα sources?

Clustering accelerates the reionisation process & boosts the visibility of Lyα photons



Dijkstra et al. 2011



SHARDS

(Survey for High-z Absorption Red and Dead Sources)

The SHARDS survey is ideal to search for Lymanα sources

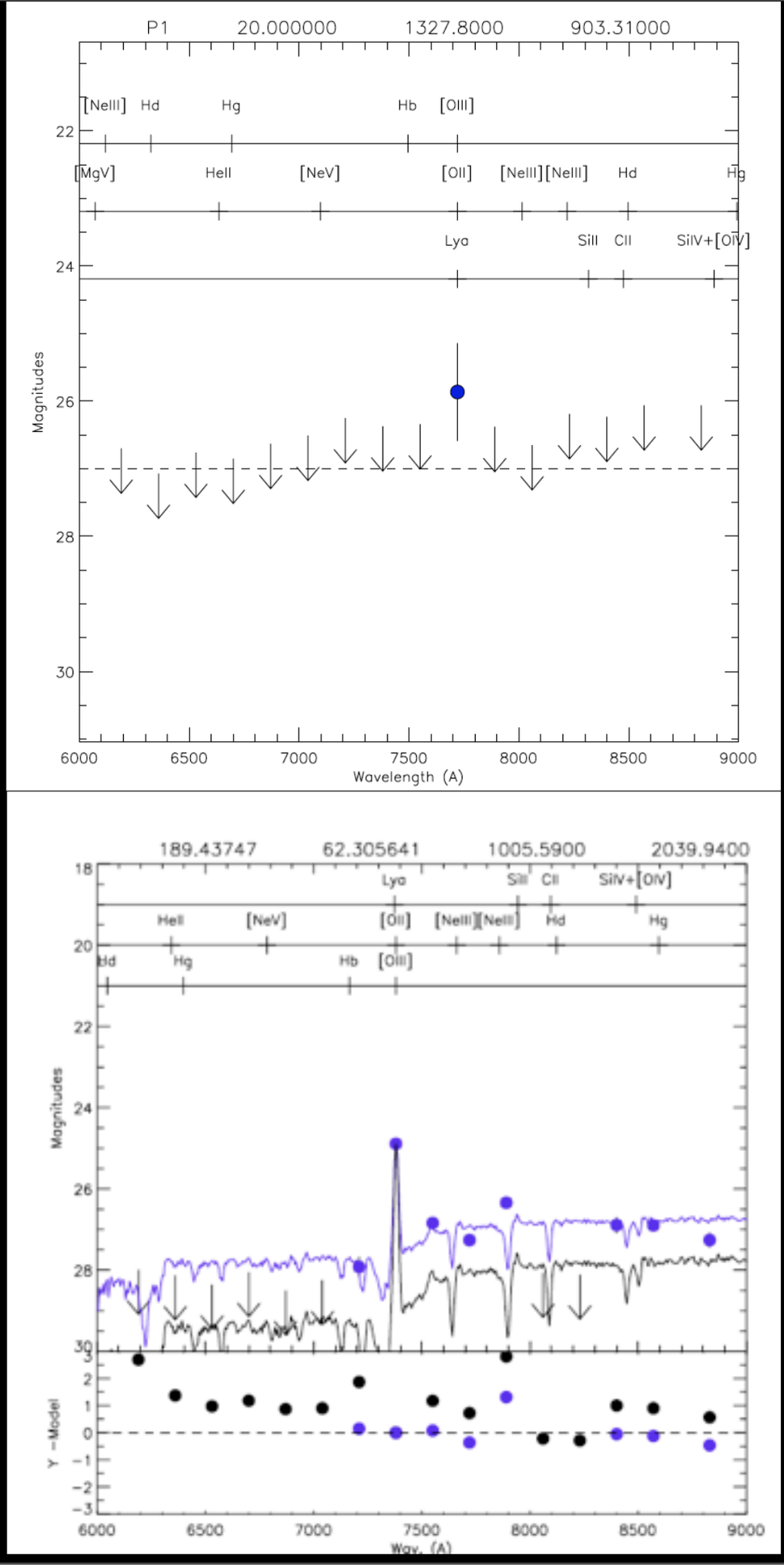
- Outstanding depth of the Survey (26.5 AB)
- Covering the range from 5000 to 9500 Å, i.e., z~3 to z~6.5

Using SHARDS to detect Lyα sources

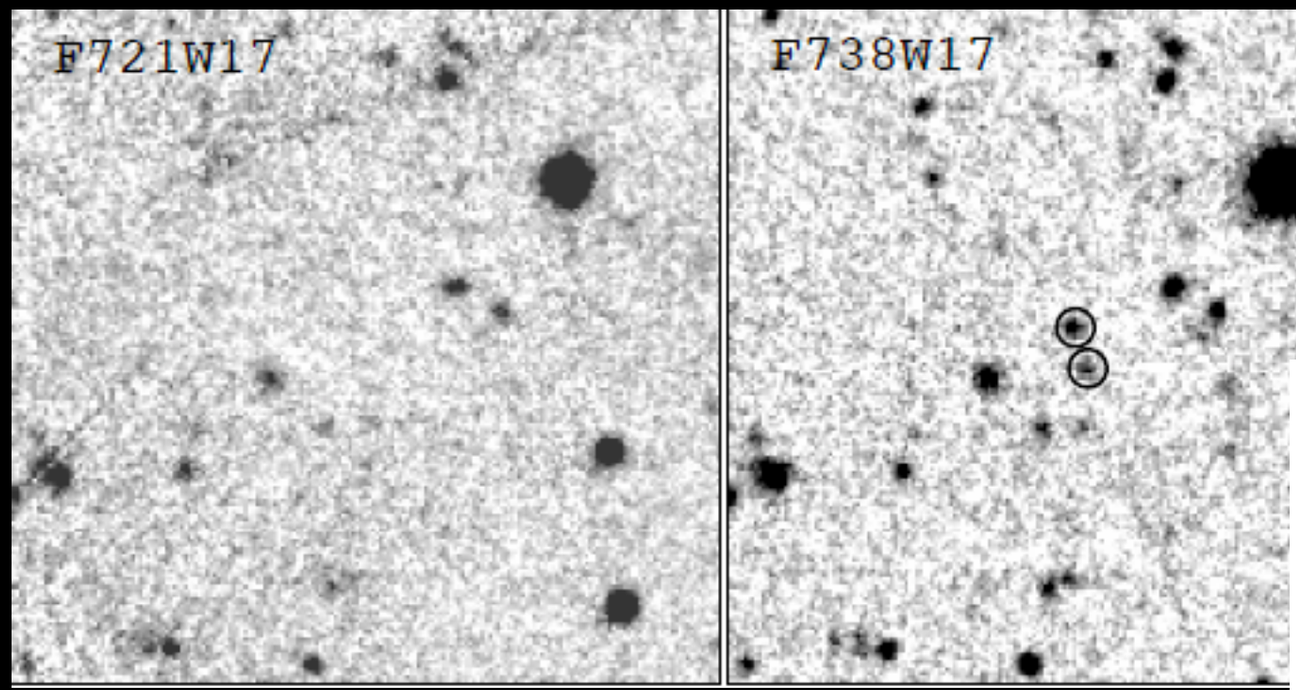
- Intend to produce accurate LFs for the Lyα source population from z ~3 to 6.5
  - Study the evolution of the LF for a large fraction of the history of the Universe
  - Study the steepness of the faint end of the LF per redshift bin
  - Compute ionizing photon densities at z~6 (the end of the EoR)
  - Check for clustering of Lyα sources throughout most of the history of the Universe

The Search

- Lyα emitters (LAES)
  - Look for sources showing up in just one filter
- LBGs
  - Look for sources dropping-out beyond a given filter



Examples of detections

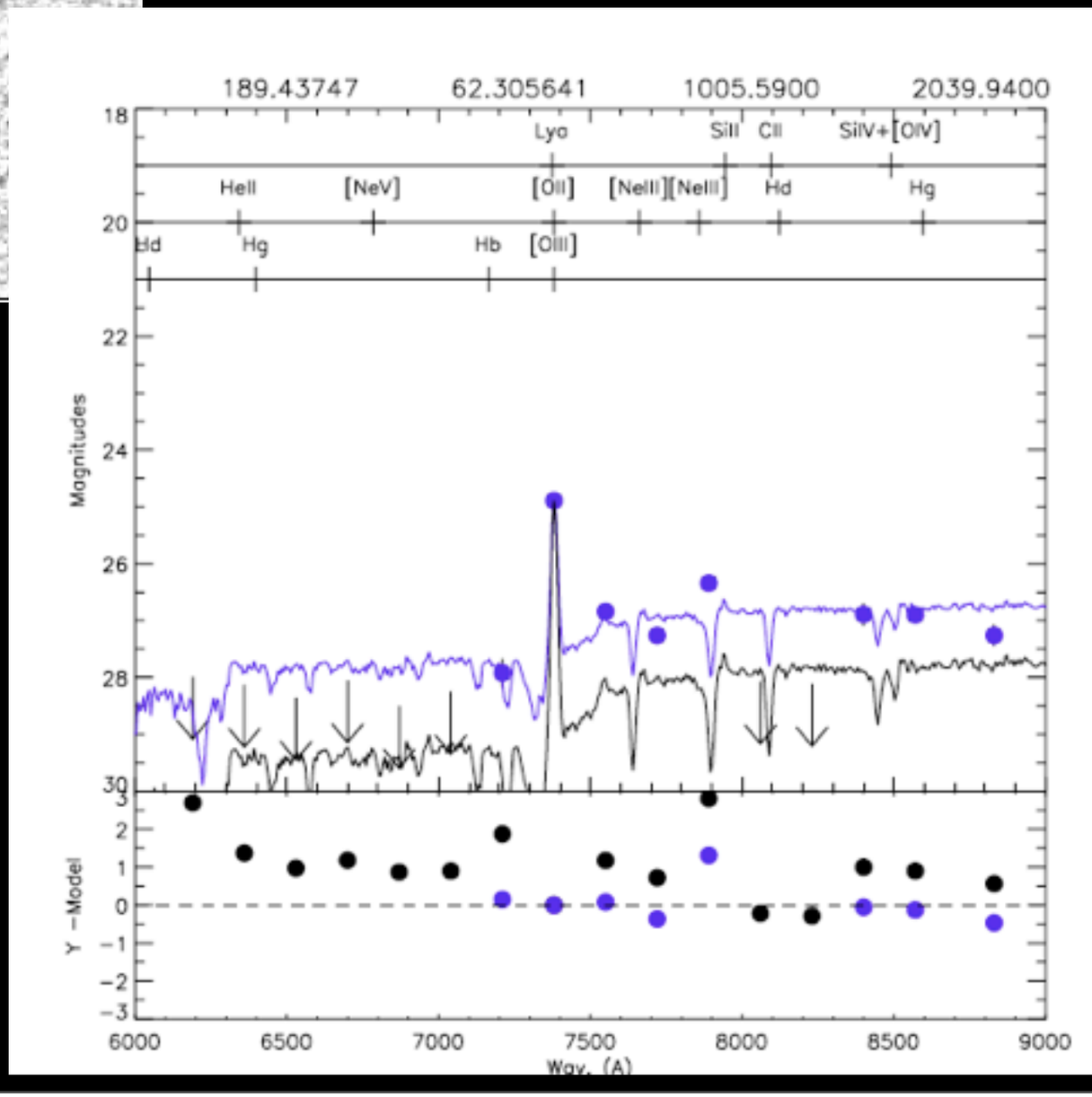


Two LBGs at z~5.2, separated 3.5" (~22Kpc)

Have been observed with OSIRIS/ GTC in long-slit mode.

Data reduction is ongoing

The spectra are difficult to disentangle (too many sky lines!!!)



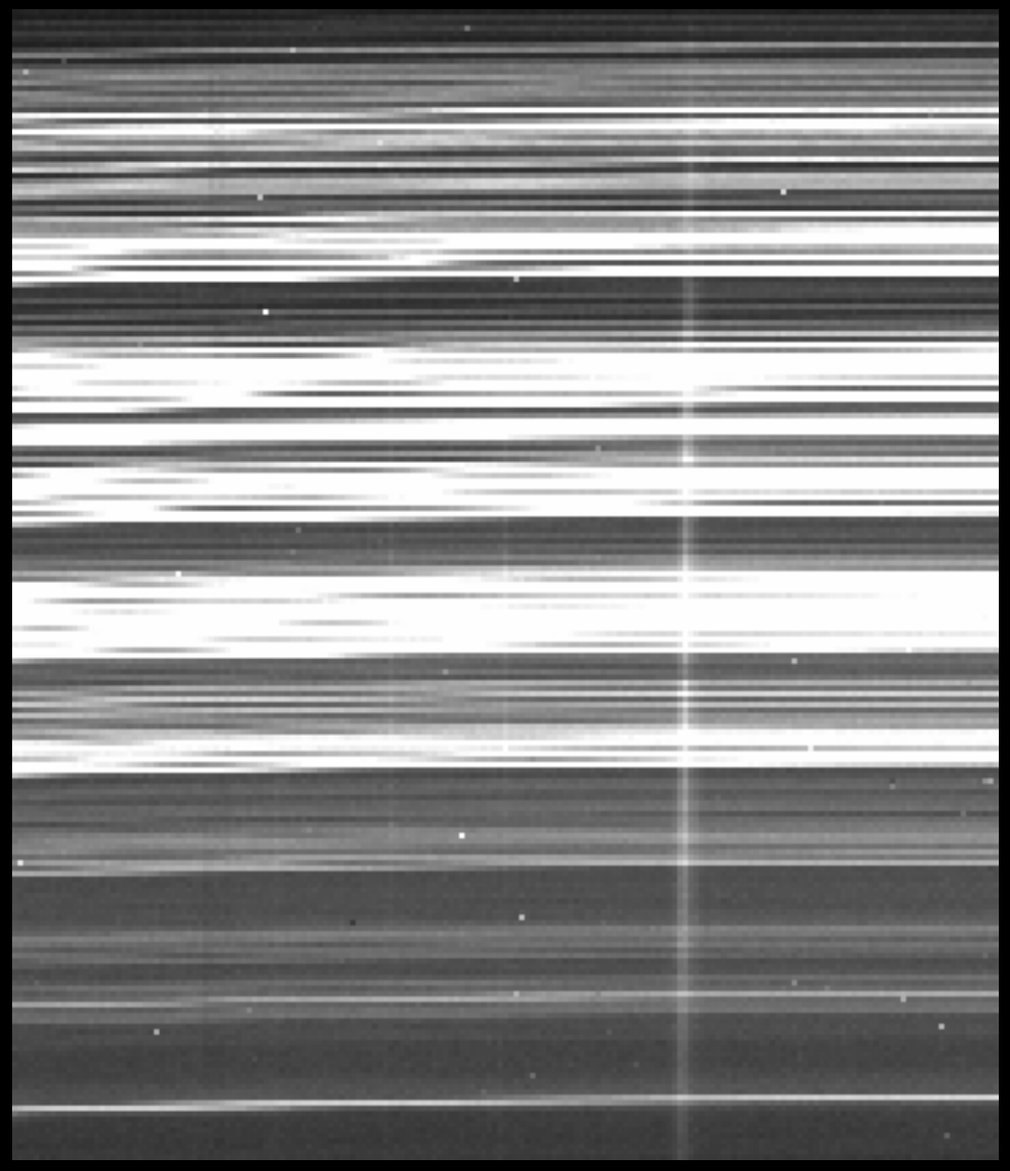
OSIRIS Spectroscopy

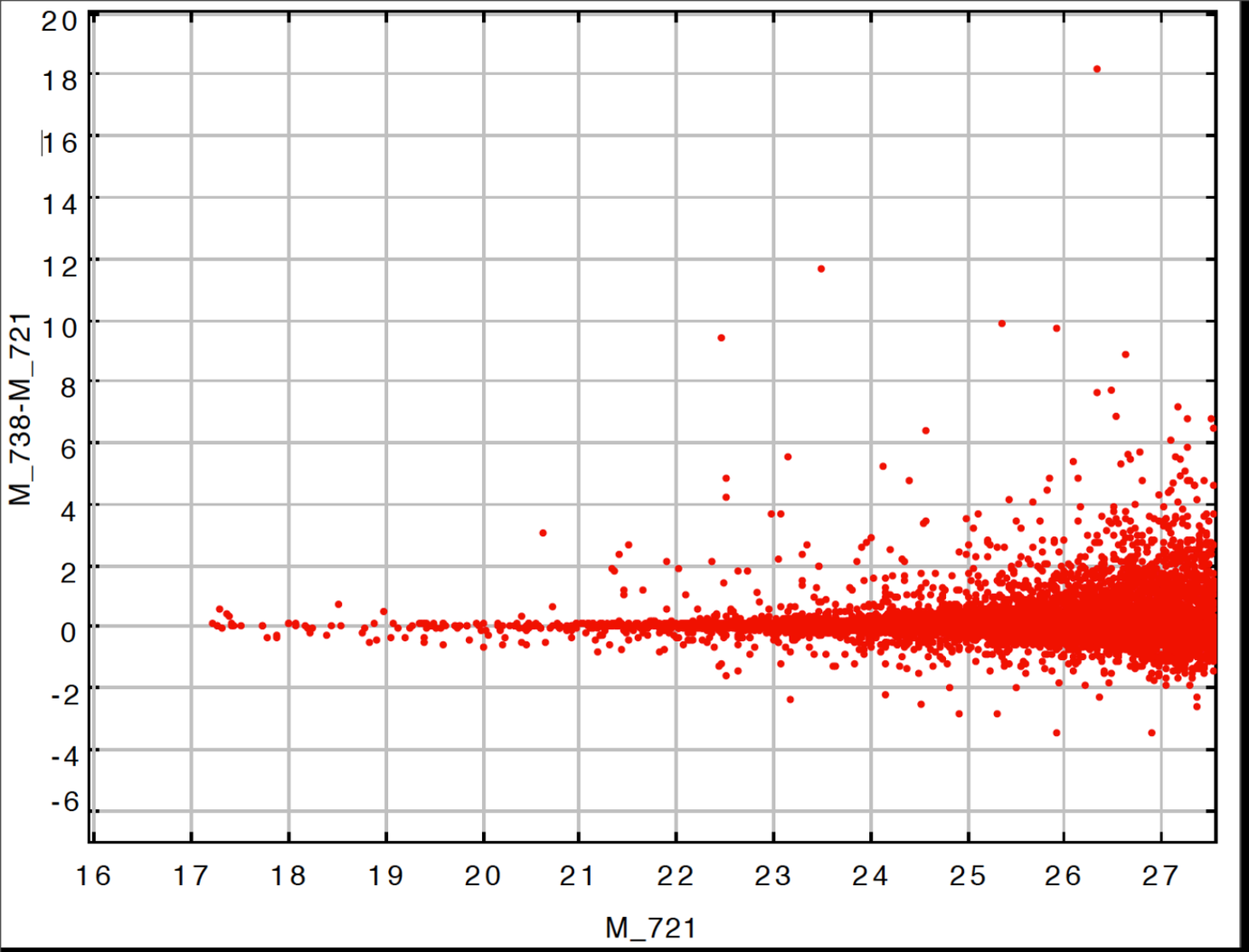
Have been observed with OSIRIS/GTC in long-slit mode.

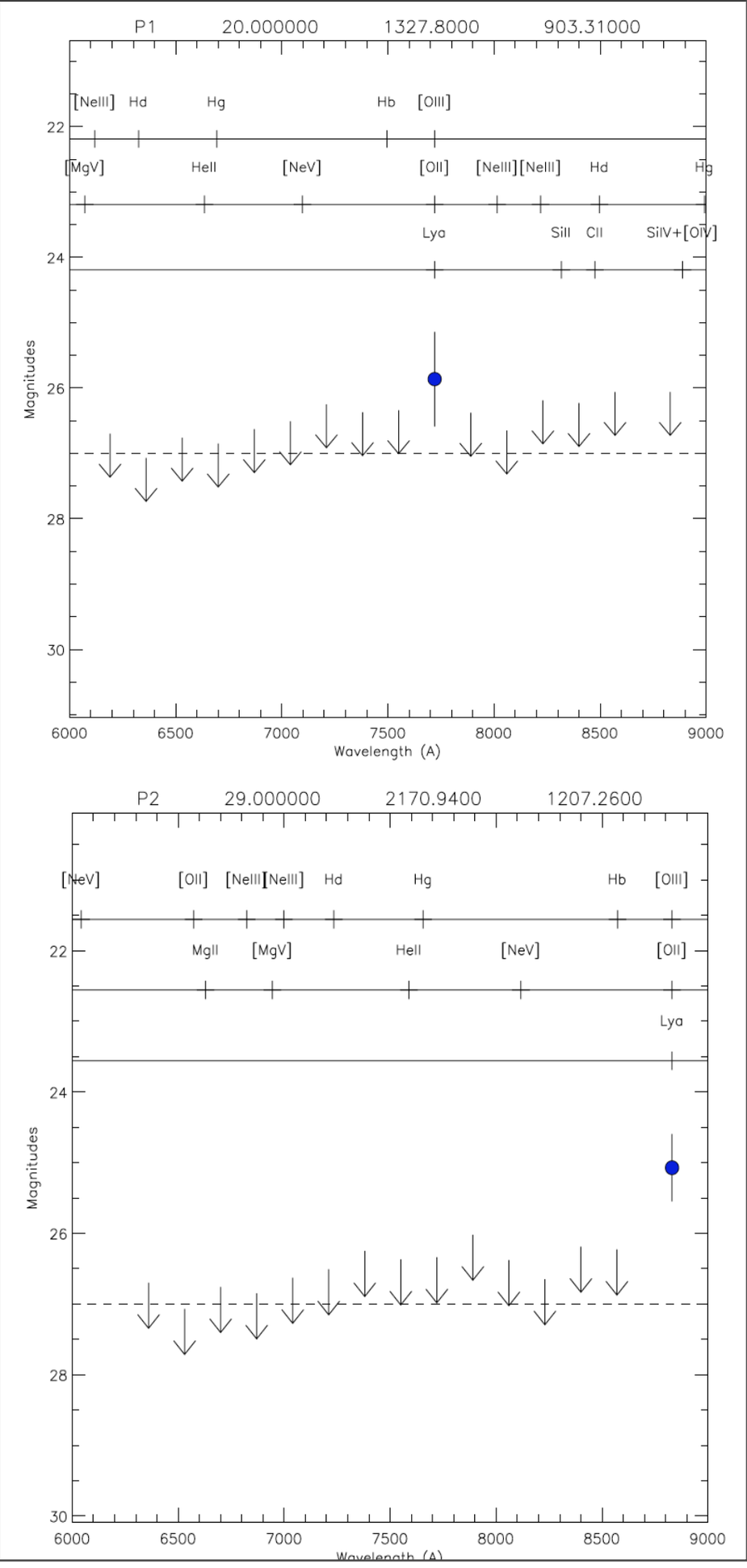
Data reduction is ongoing (grating 500R)

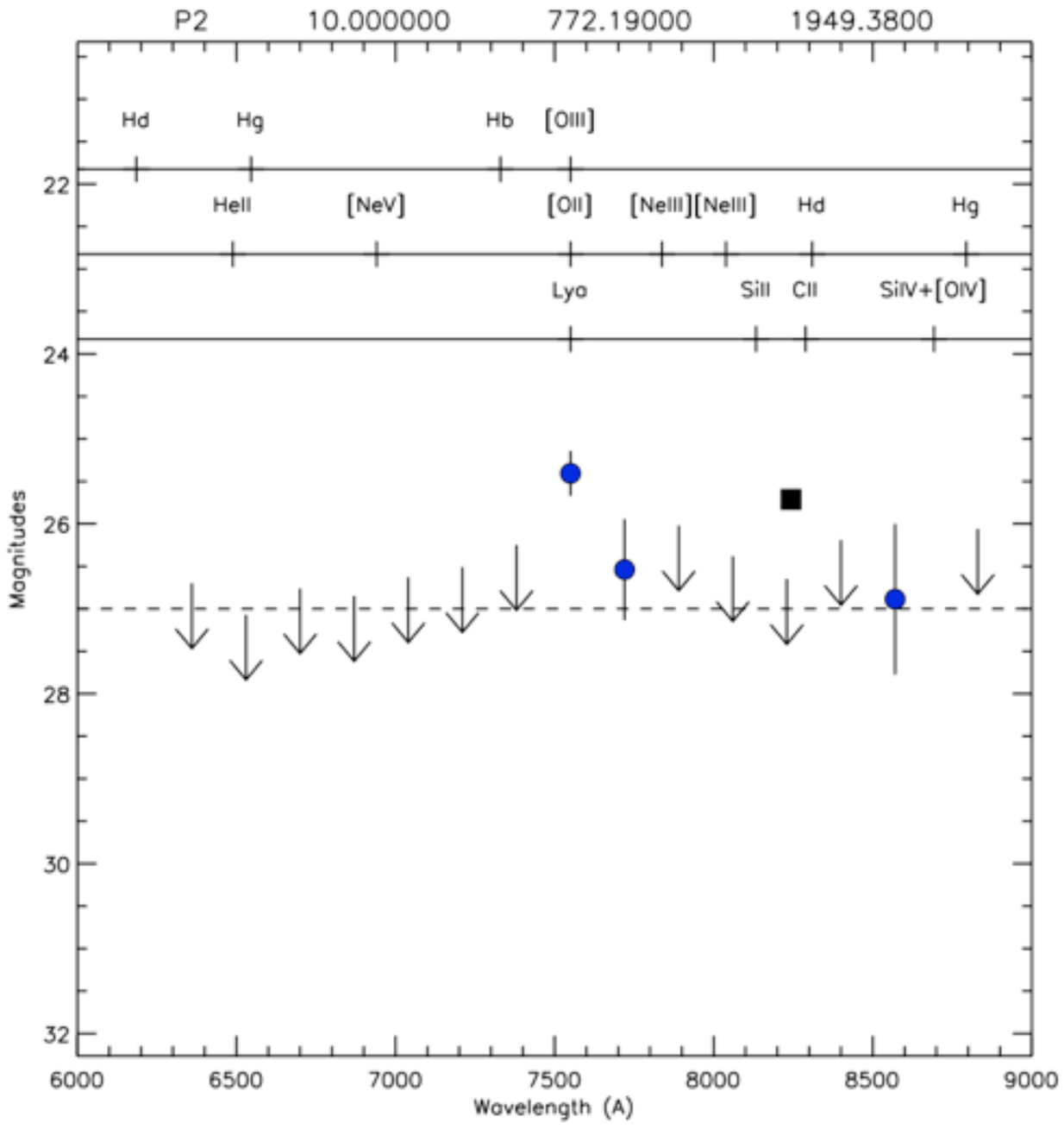
The spectra are difficult to disentangle (too many sky lines!!!)

Possibly higher resolution spectroscopy required, albeit at the expense of longer integration times!



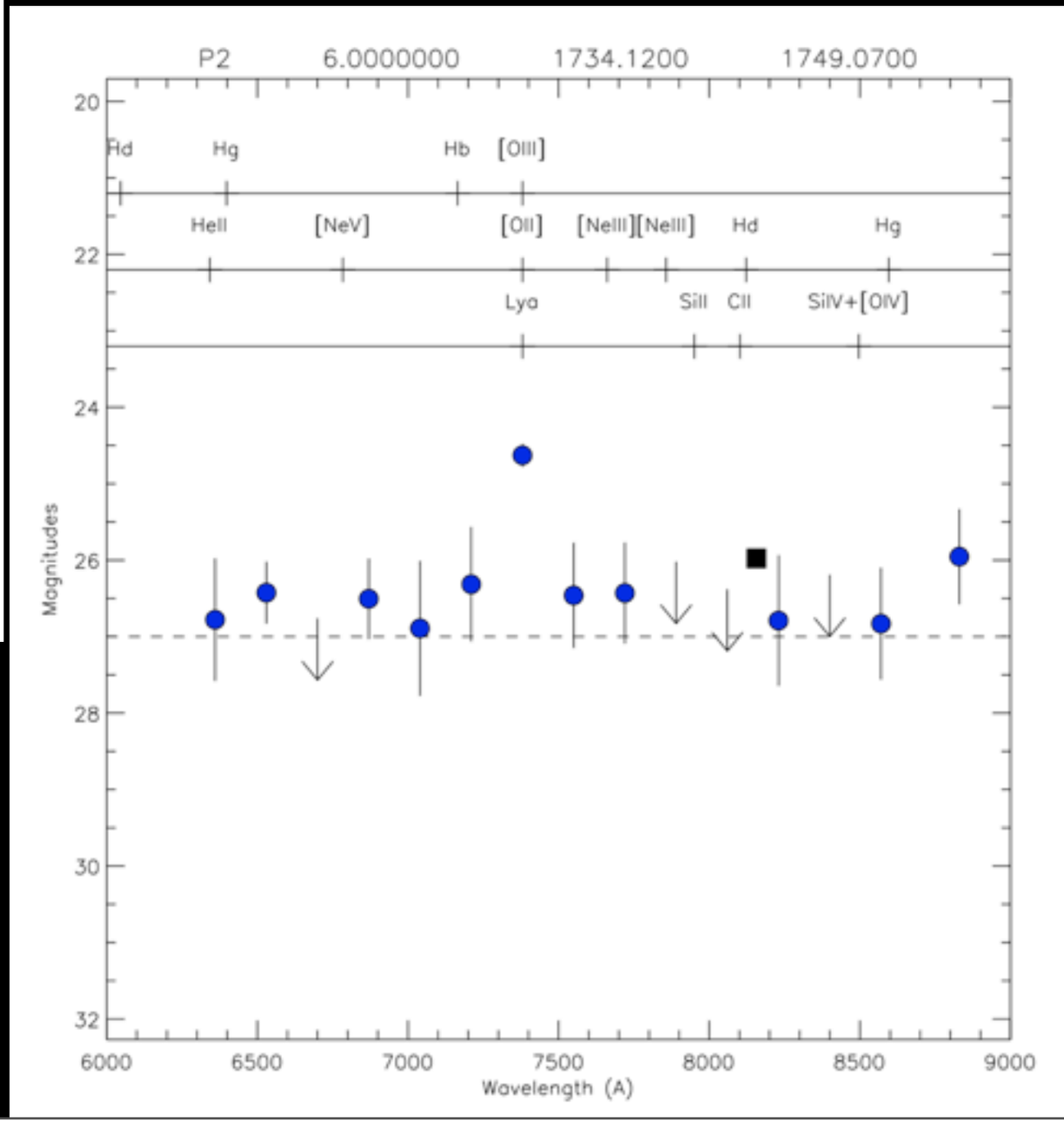

M_738-M_721
M_721
20
18
16
14
12
10
8
6
4
2
0
-2
-4
-6
16
17
18
19
20
21
22
23
24
25
26
27

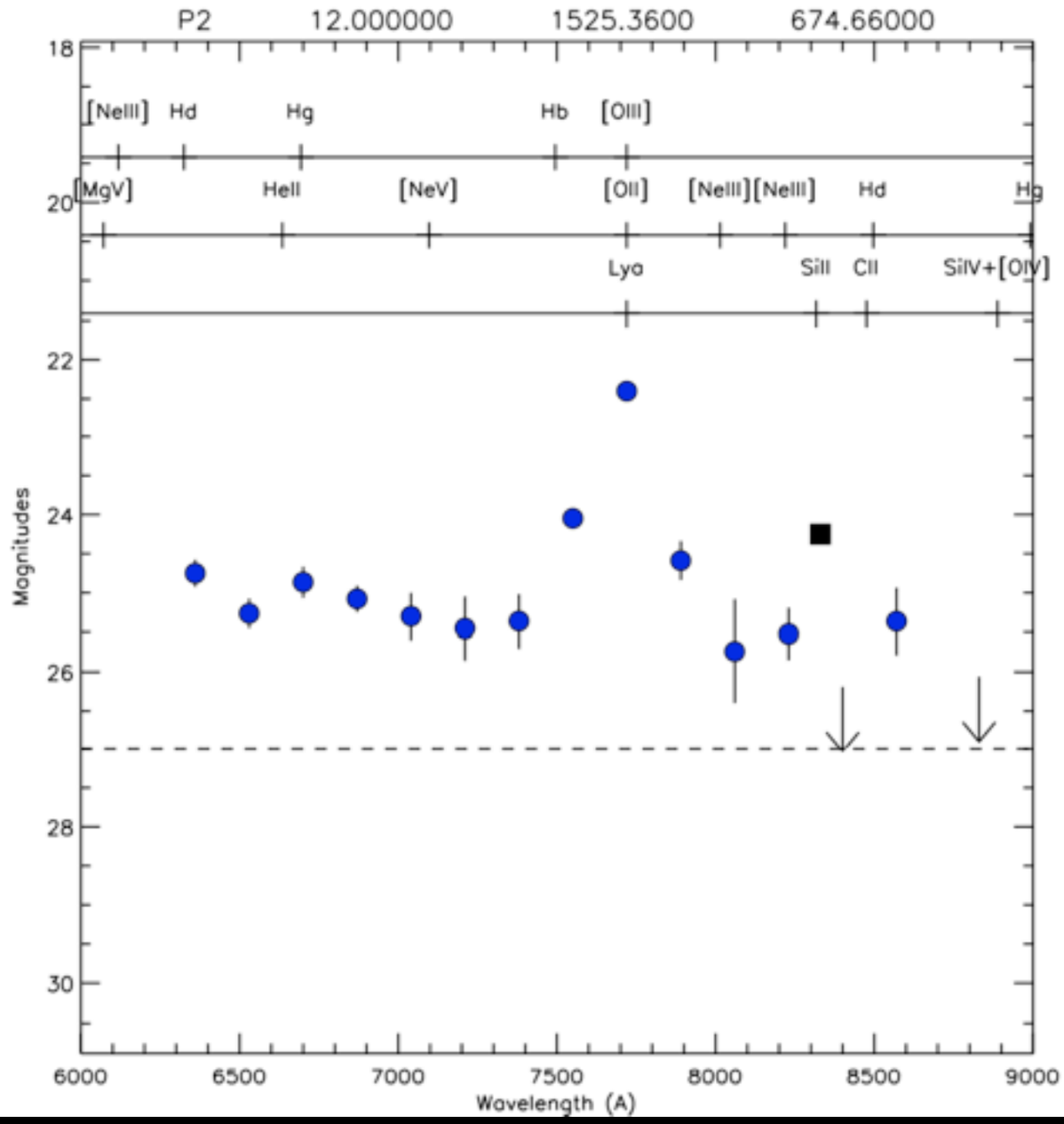

P1 20.000000 1327.8000 903.31000
[NeIII] Hd Hg Hb [OIII]
[MgV] HeII [NeV] [OII] [NeIII] [NeIII] Hd Hg
Lya SiII CII SiIV+[OIV]
Magnitudes
22
24
26
28
30
6000
6500
7000
7500
8000
8500
9000
Wavelength (A)
P2 29.000000 2170.9400 1207.2600
[NeV] [OII] [NeIII] [NeIII] Hd Hg Hb [OIII]
MgII [MgV] HeII [NeV] [OII]
Lya
Magnitudes
22
24
26
28
30
6000
6500
7000
7500
8000
8500
9000

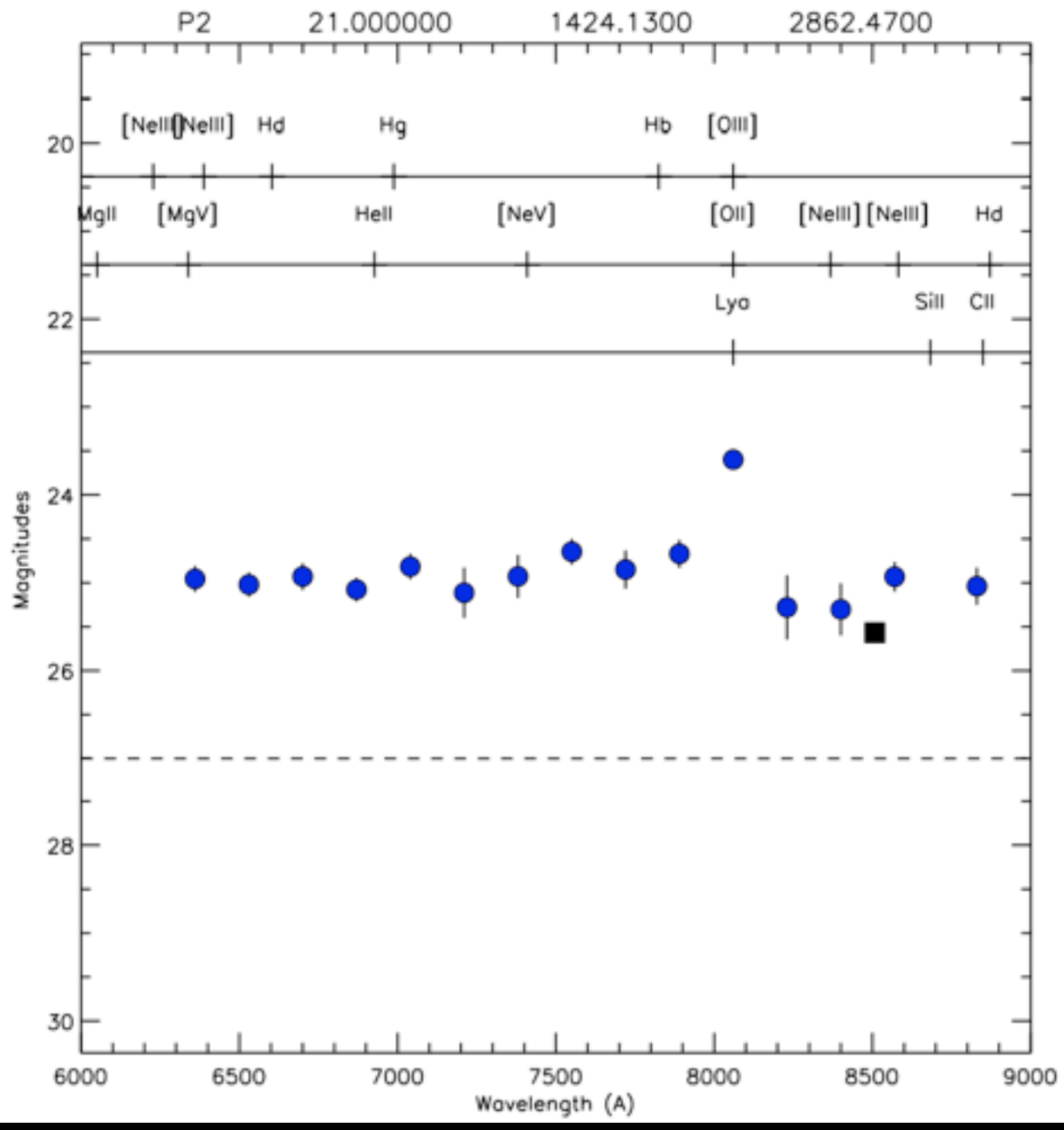


A candidate LBG

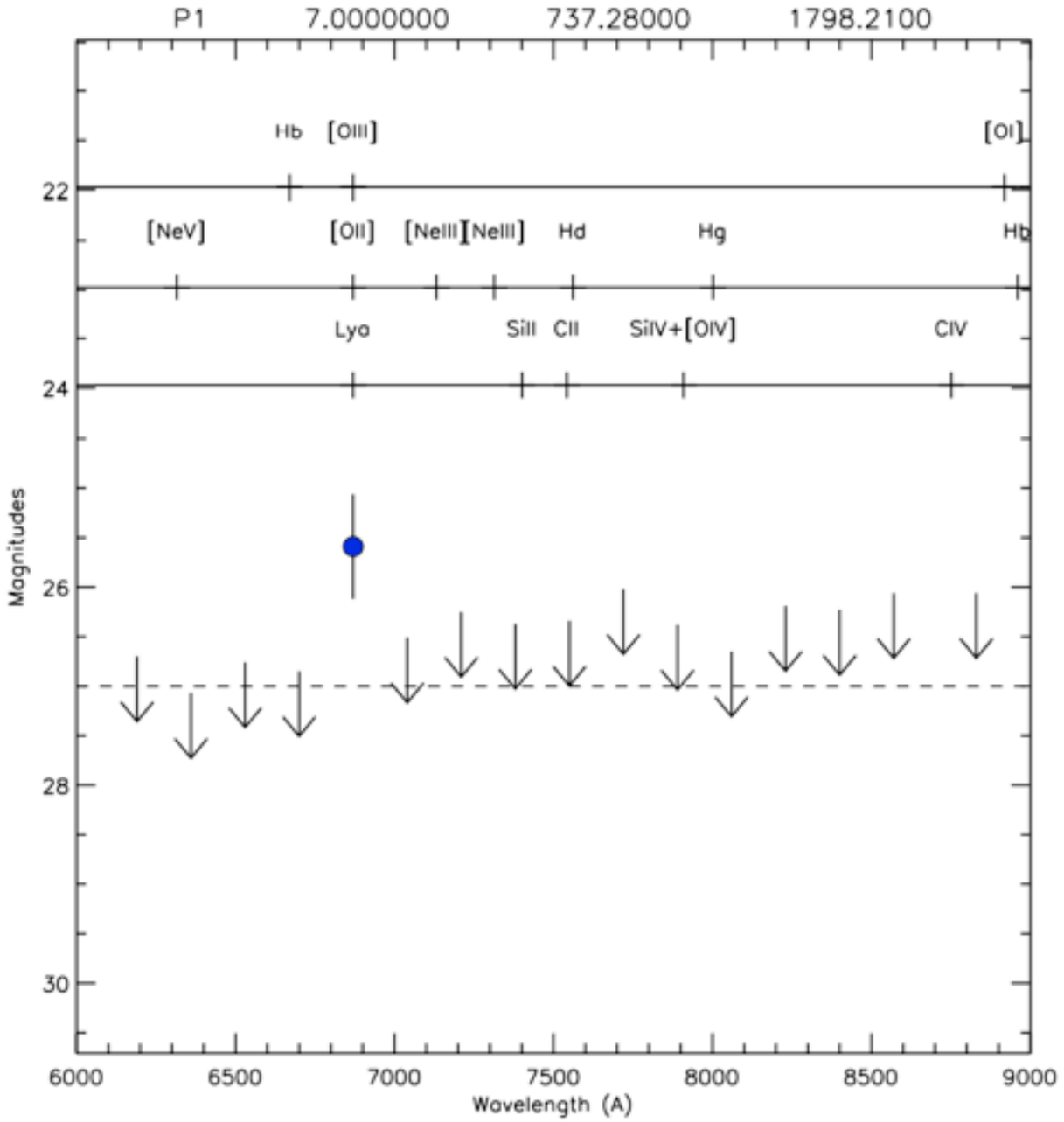
An emission line galaxy

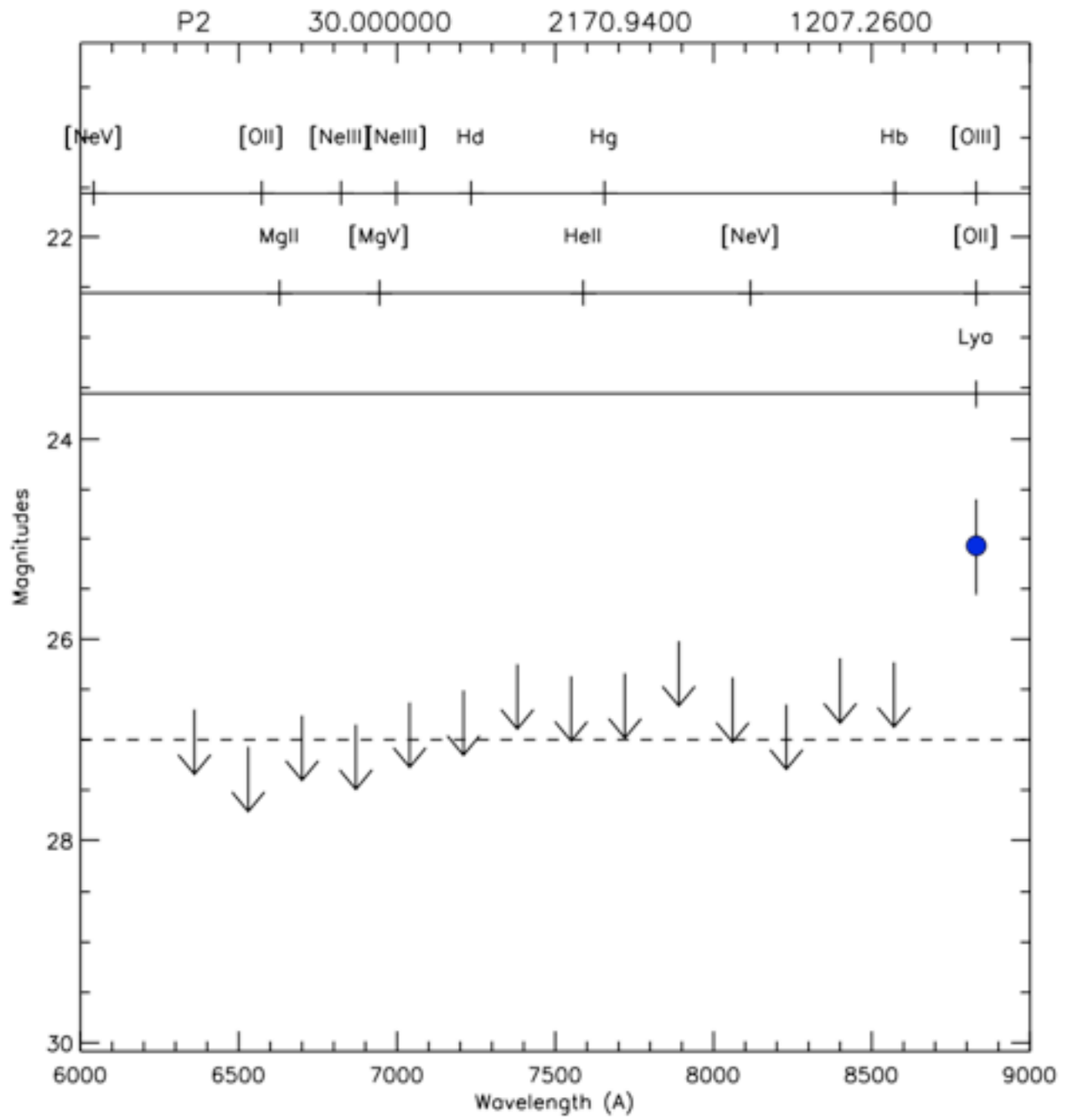




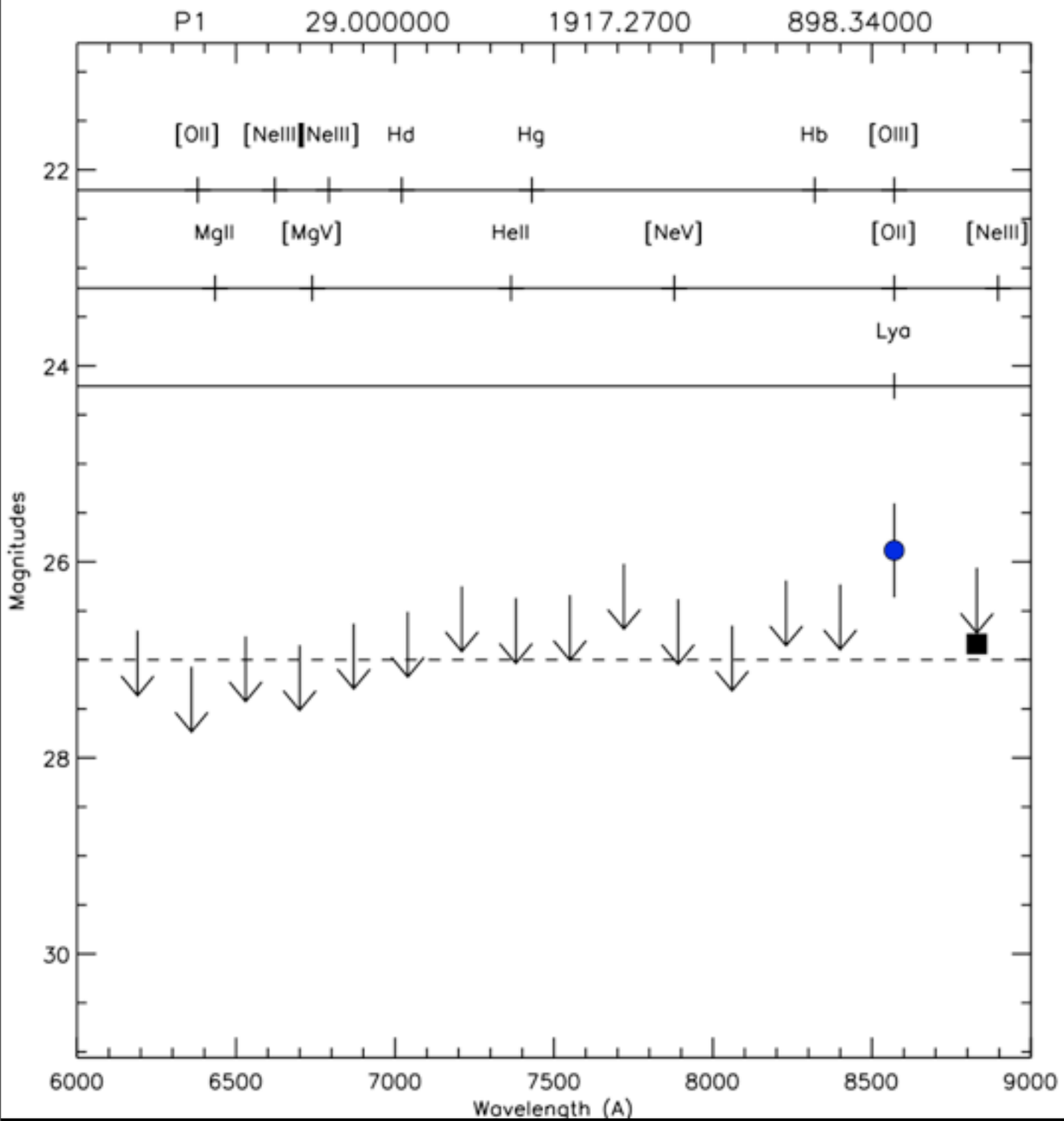


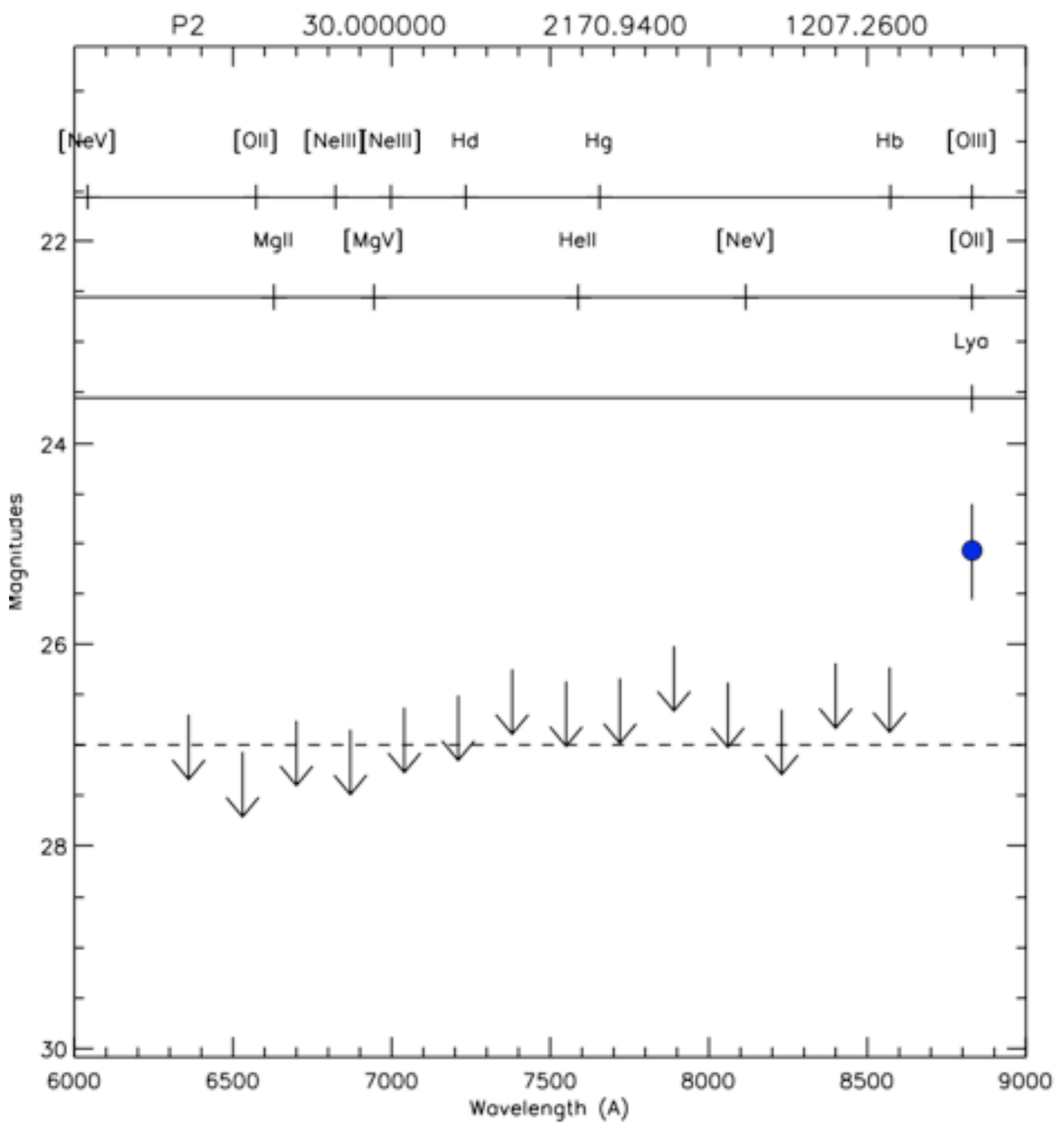
Two impressive broad line AGNs





Three LAEs candidates

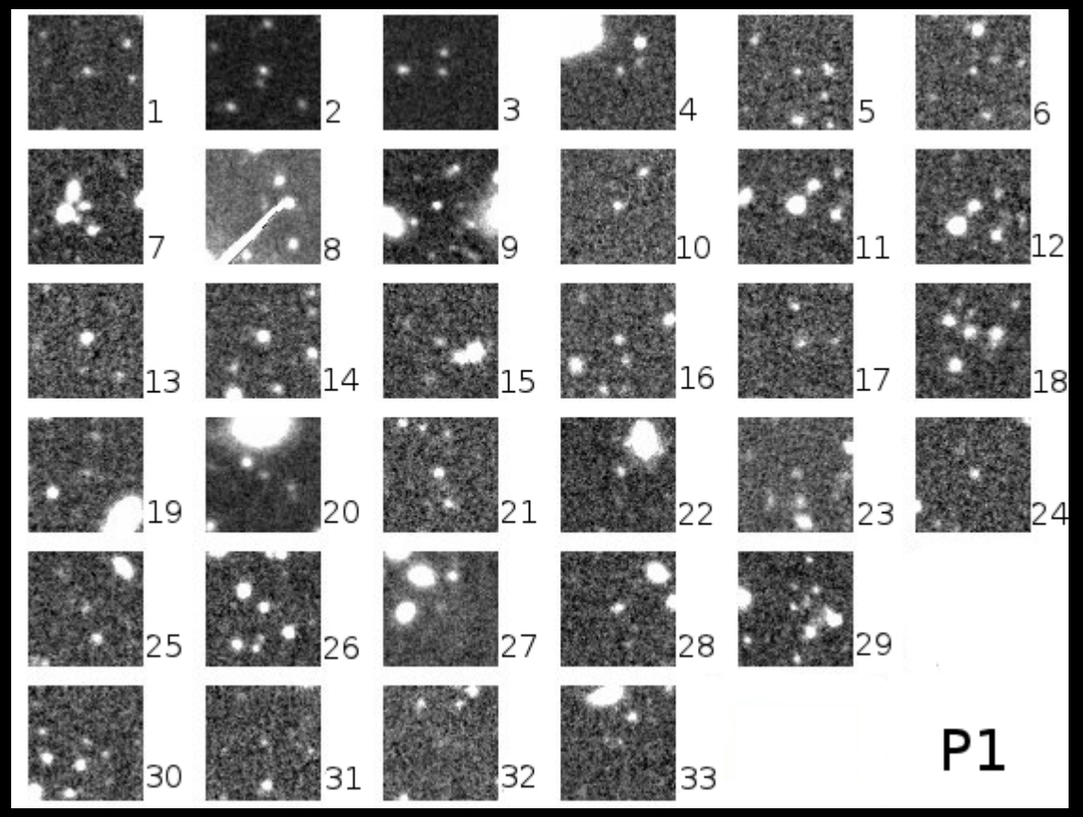


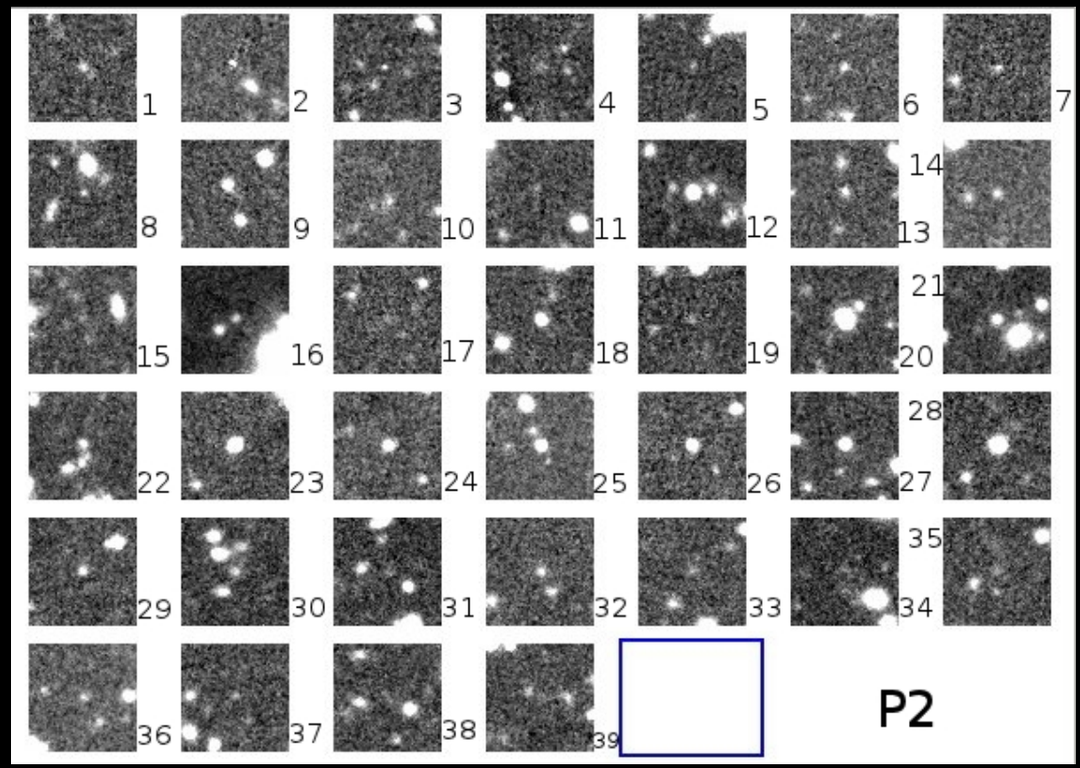


Three LAEs candidates

Postal stamps of the candidates

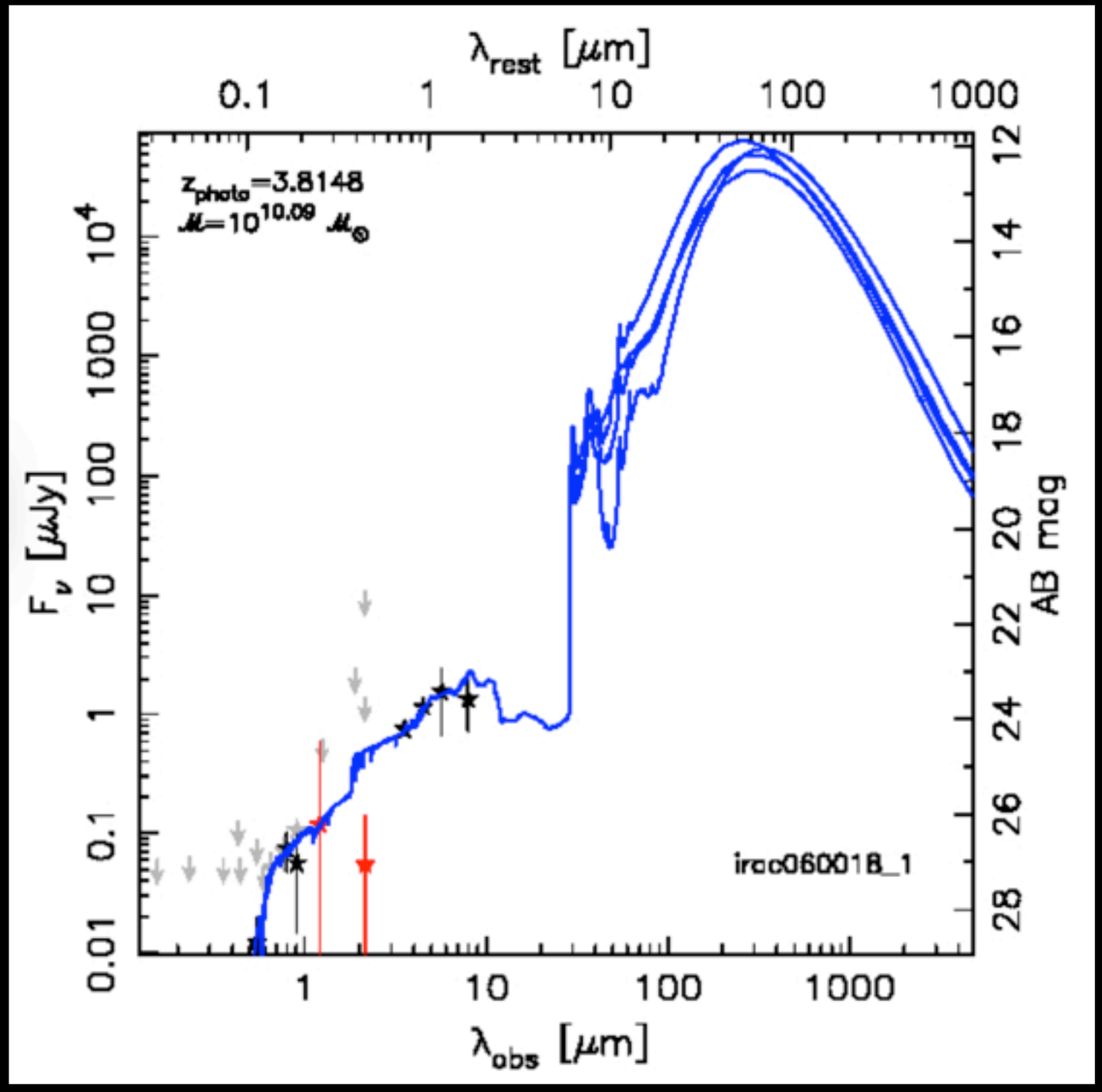
- After looking at 16 filters we find:
  - Over 70 candidates with
  - The study is fairly preliminary
  - Most importantly is the spectroscopic confirmation
  - And the separation per redshift bins

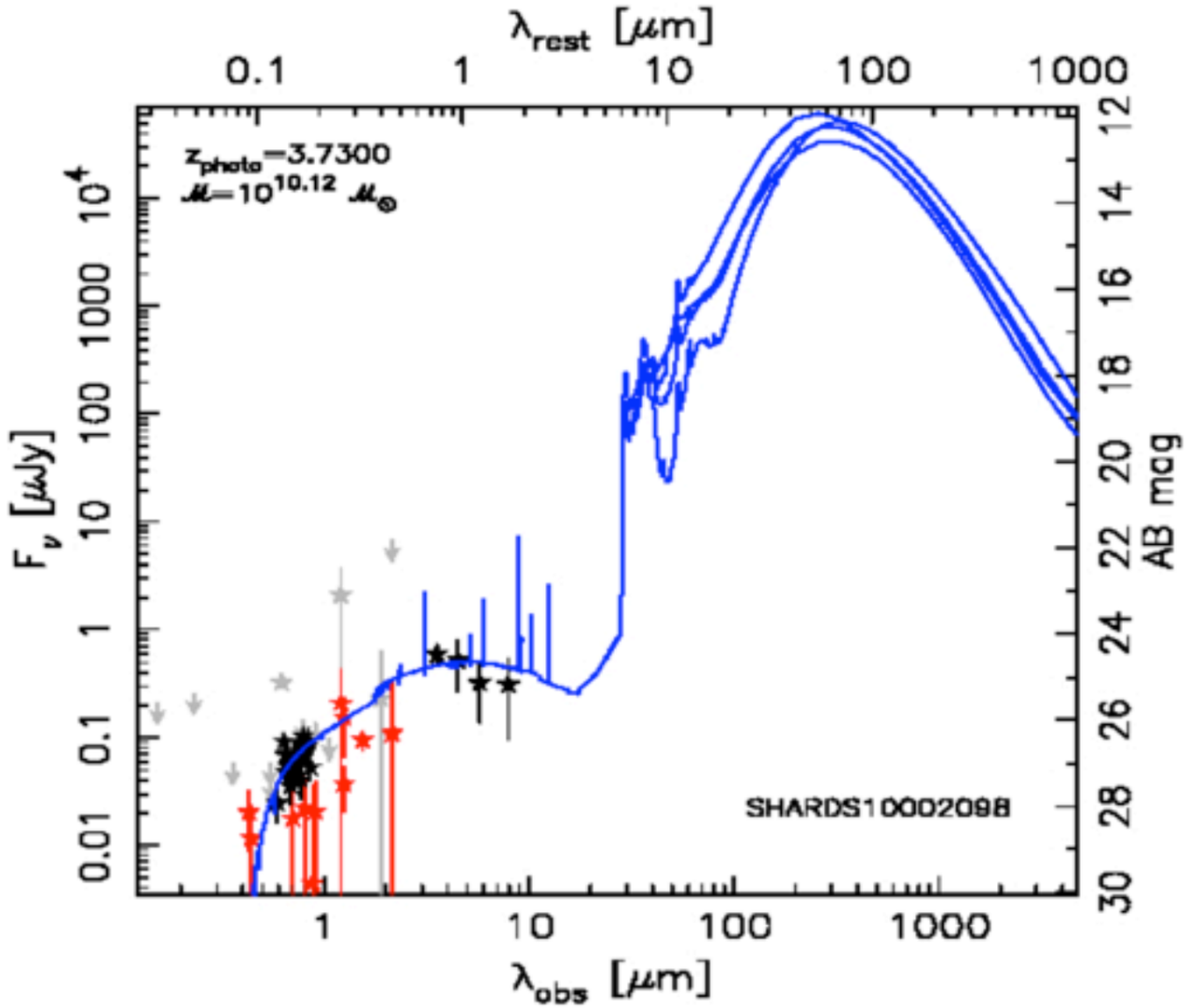


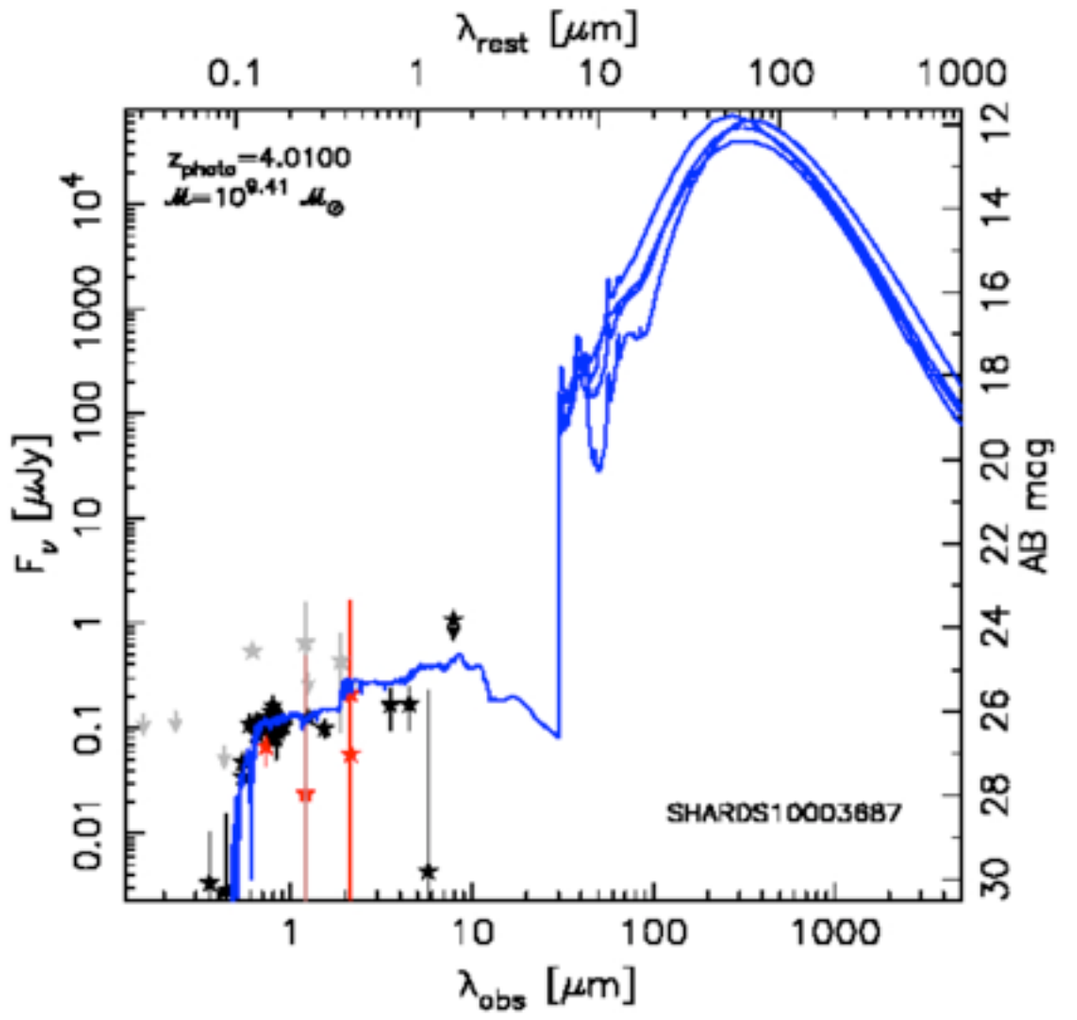


Using Rainbow

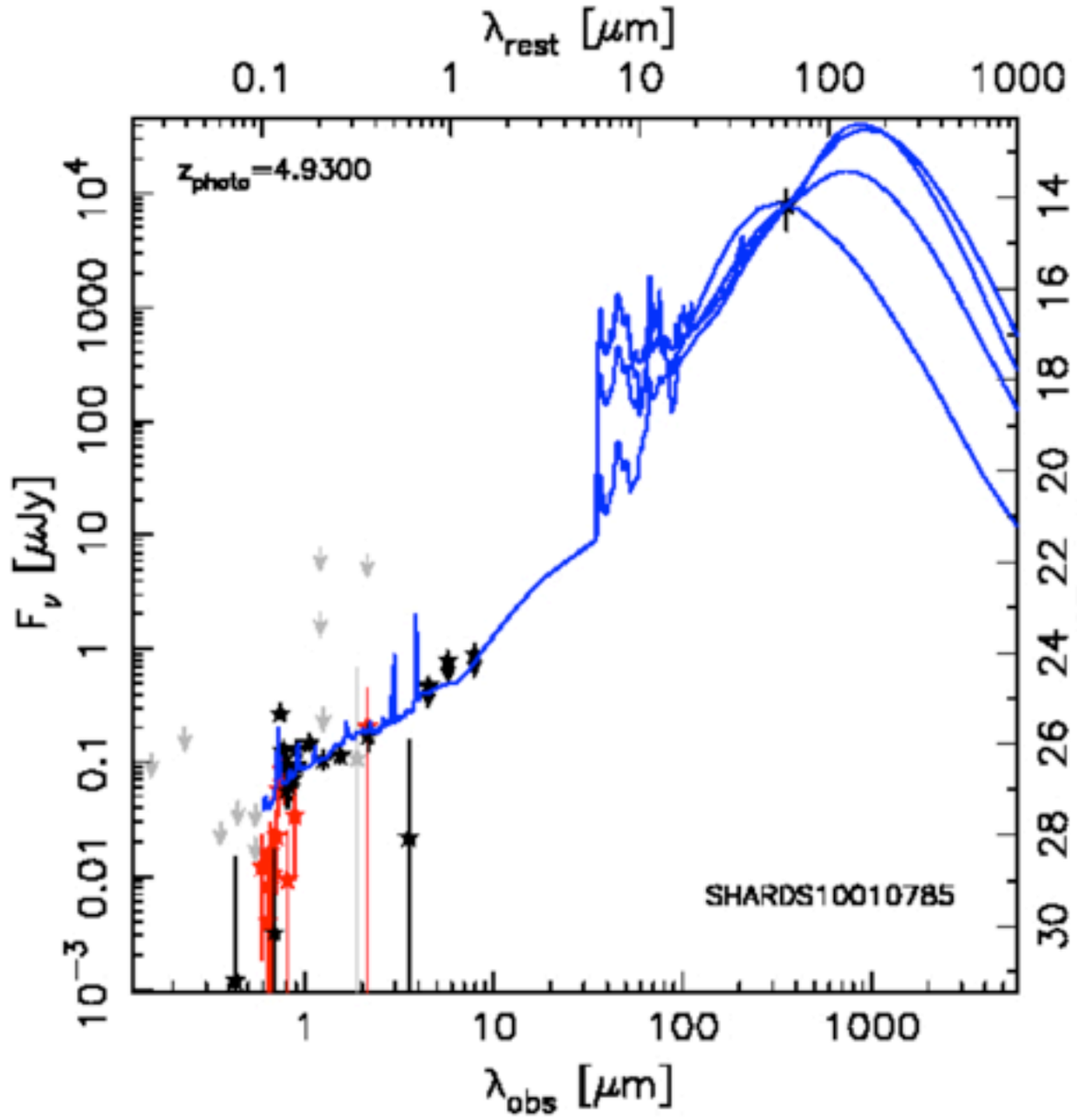
- Noelia has been using rainbow for the past week or so
- The data is preliminary
- However very juicy!

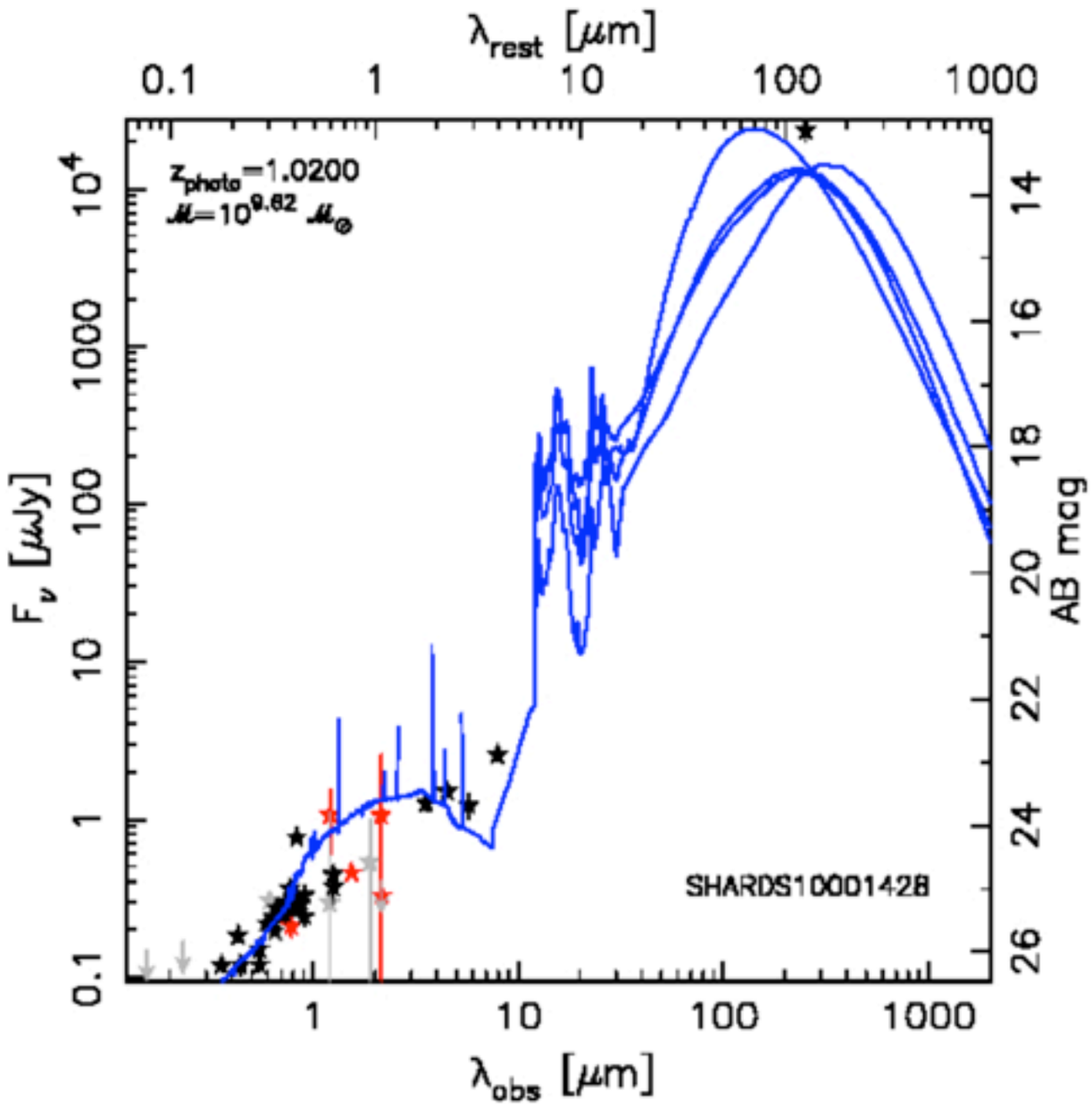






Two conspicuous LBGs?



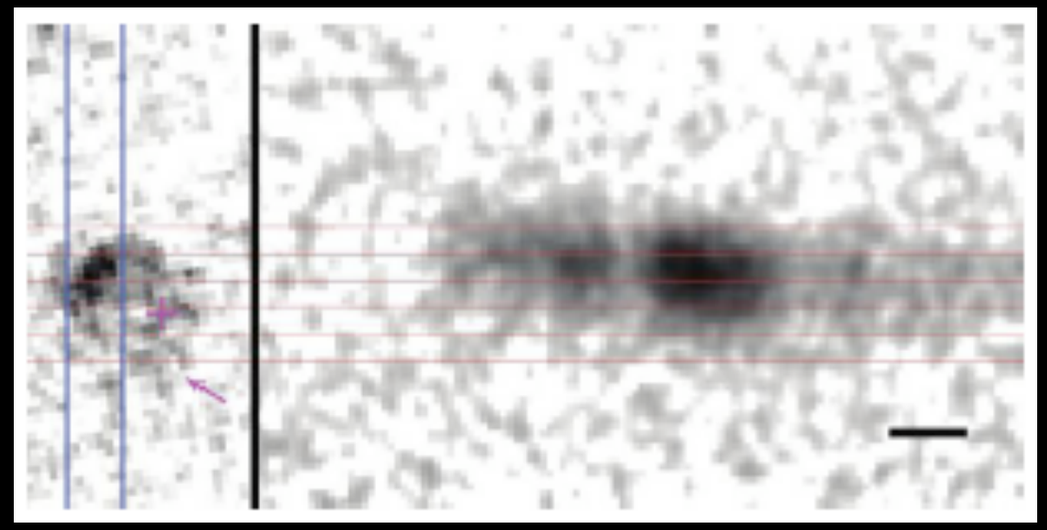


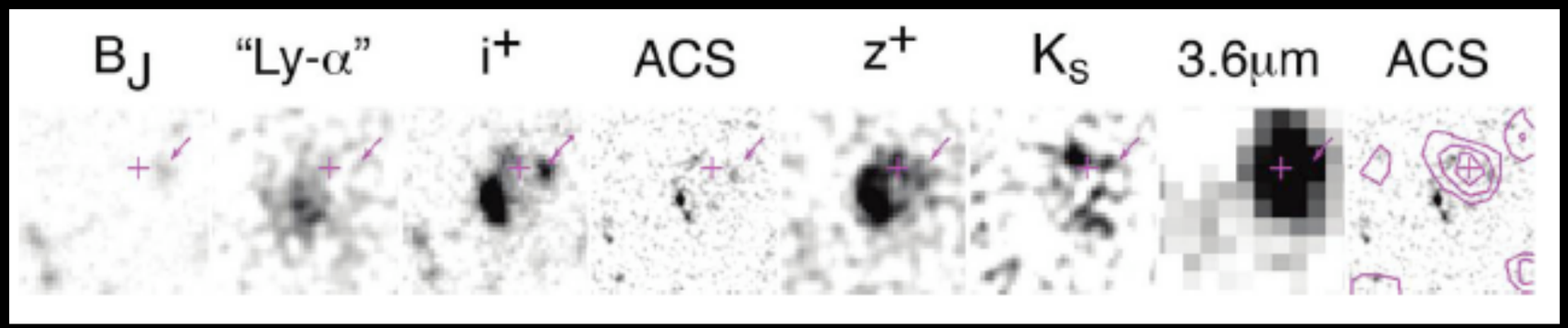
Two conspicuous SMGs???

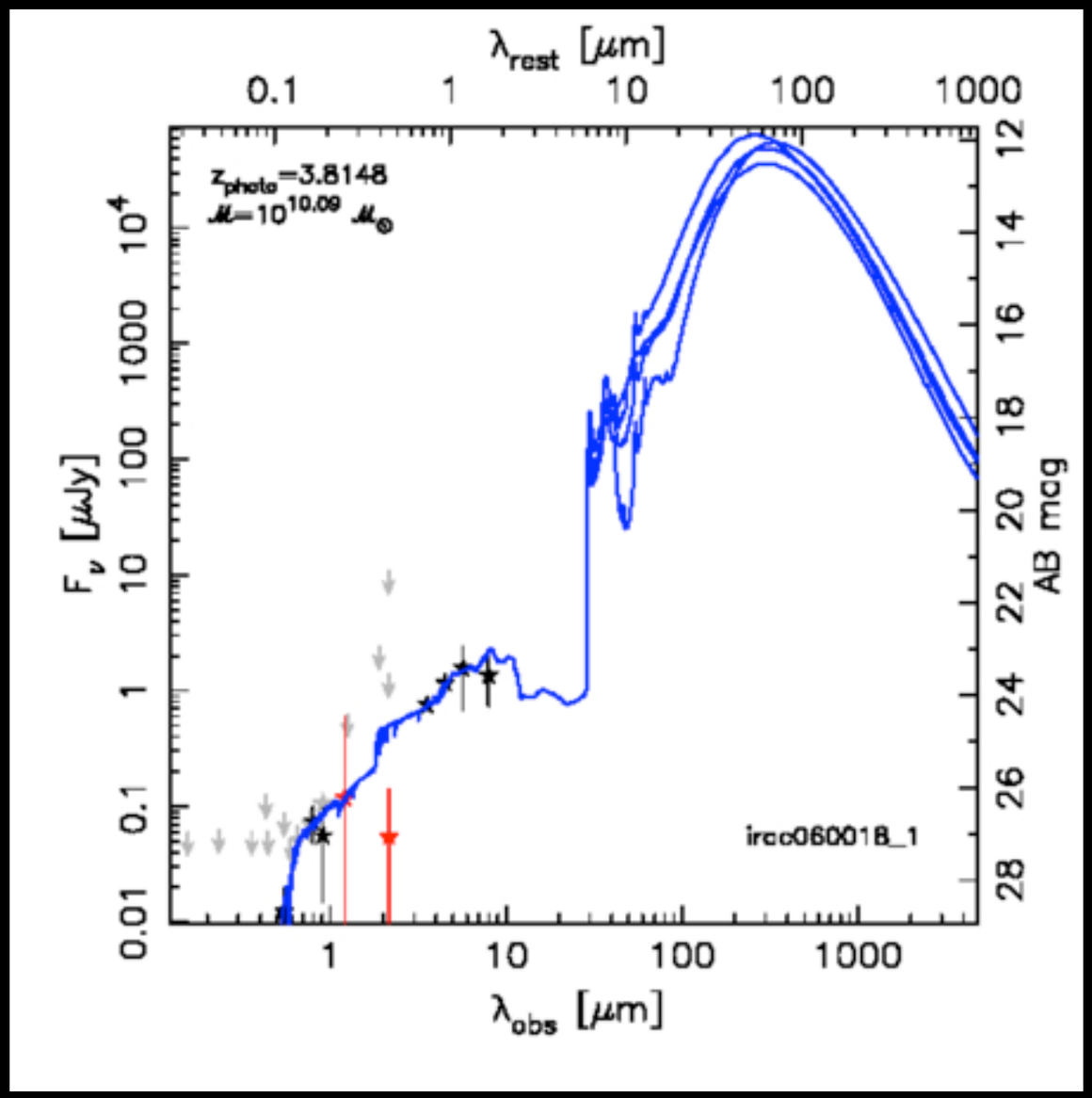
J1000+0234

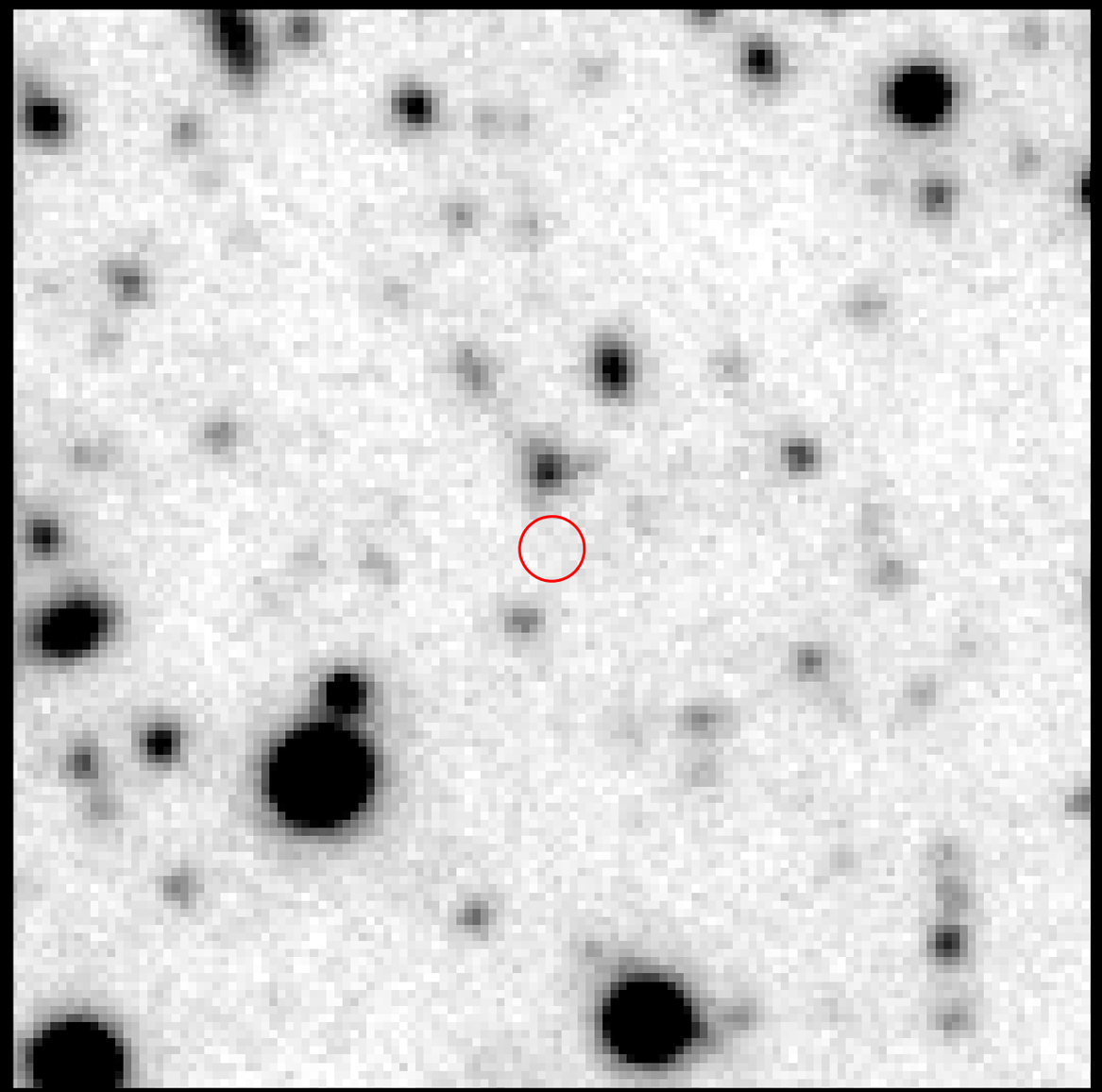
A SMG at z = 4.547

- Independently selected as
  - a V drop-out & Lyman Break Galaxy (Lee et al. ‘08), &
  - a submillimetre & radio source (Carilli et al. ‘08)









A further LBG not seen in a deep Subaru R Image

Some numbers & summary

- This work refers to 16 filters only
- Detecting typically 5 to 10 candidates per filter (as would be expected; however in some filters no sources are found)
- Currently weeding out the catalogue to discard interlopers and other spurious sources
- A pair of possibly interacting LBGs at z~5 waiting for a proper sky substraction to be confirmed spectroscopically
- Confirmation of most sources will come with GTC/ OSIRIS and its MOS capability hopefully next semester