E-ELT HIRES astrobiological science case for Solar System:

The case of C/2014 Q2 Lovejoy.

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Summary:

1- HIRES @EELT and GIANO @TNG

2- Water: the puzzling origin of oceans on Earth

3- Comet C/2014 Q2 Lovjoy observations

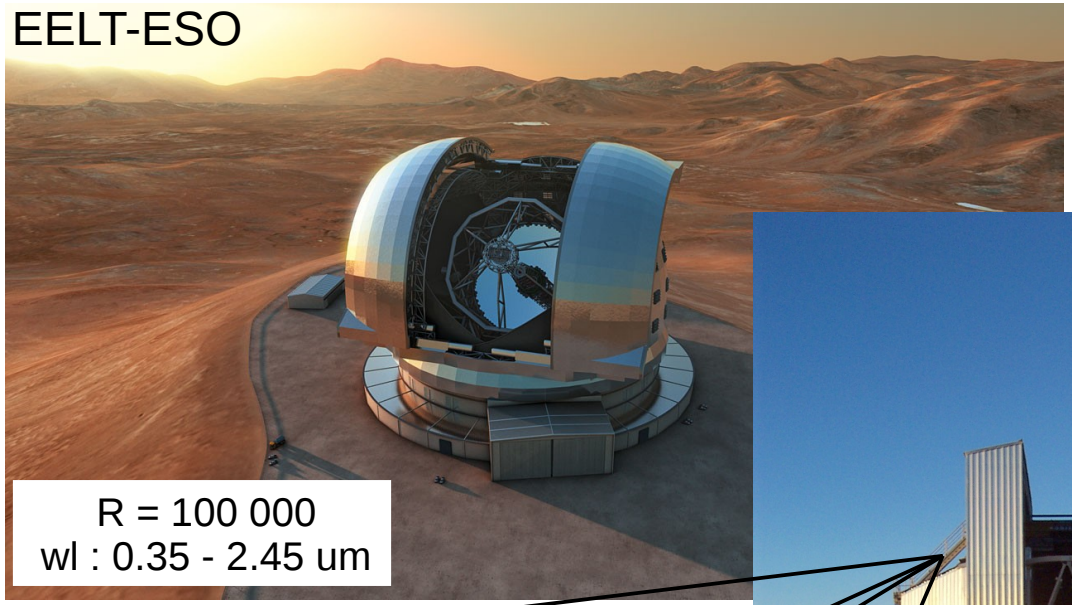
4- Data reduction

5- Analysis with Cometary Fluorescence Emission Model

6- Conclusions and future perspectives

1- HIRES @EELT and GIANO @TNG

EELT-ESO



R = 100 000
wl : 0.35 - 2.45 um

TNG-INAF

GIANO

Detector: HAWAII-2 2048x2048

Pixel size: 18 microns

Gain: 2.2 e-/ADU

Readout Noise: 5 e-

Dark Current:0.05 e-/s/pixel

Wavelength Coverage: 0.95 - 2.45 um

Spectral resolution: 50000

Fiber Size: 85 microns - 1.0 arsec

Slicer: 2x

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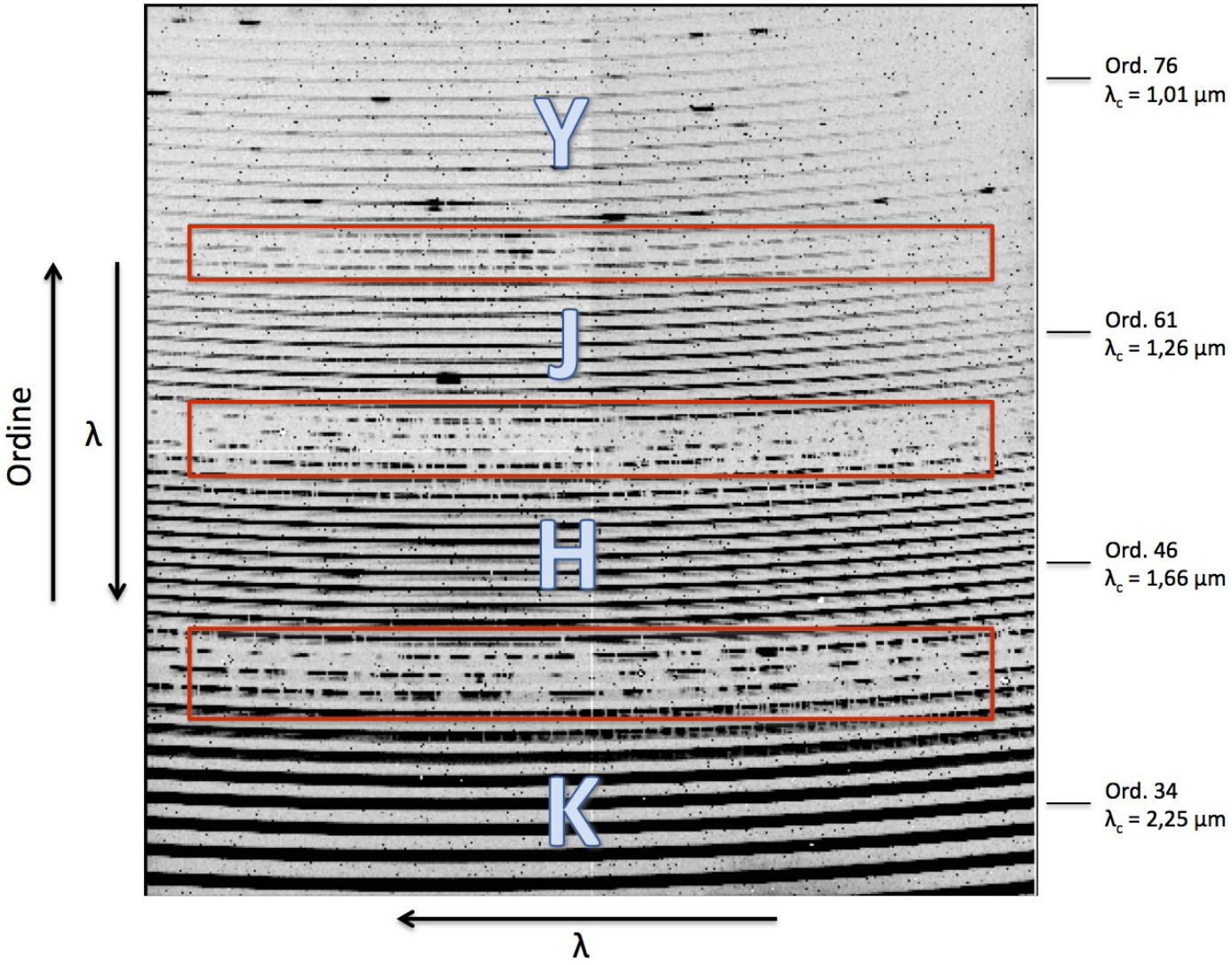
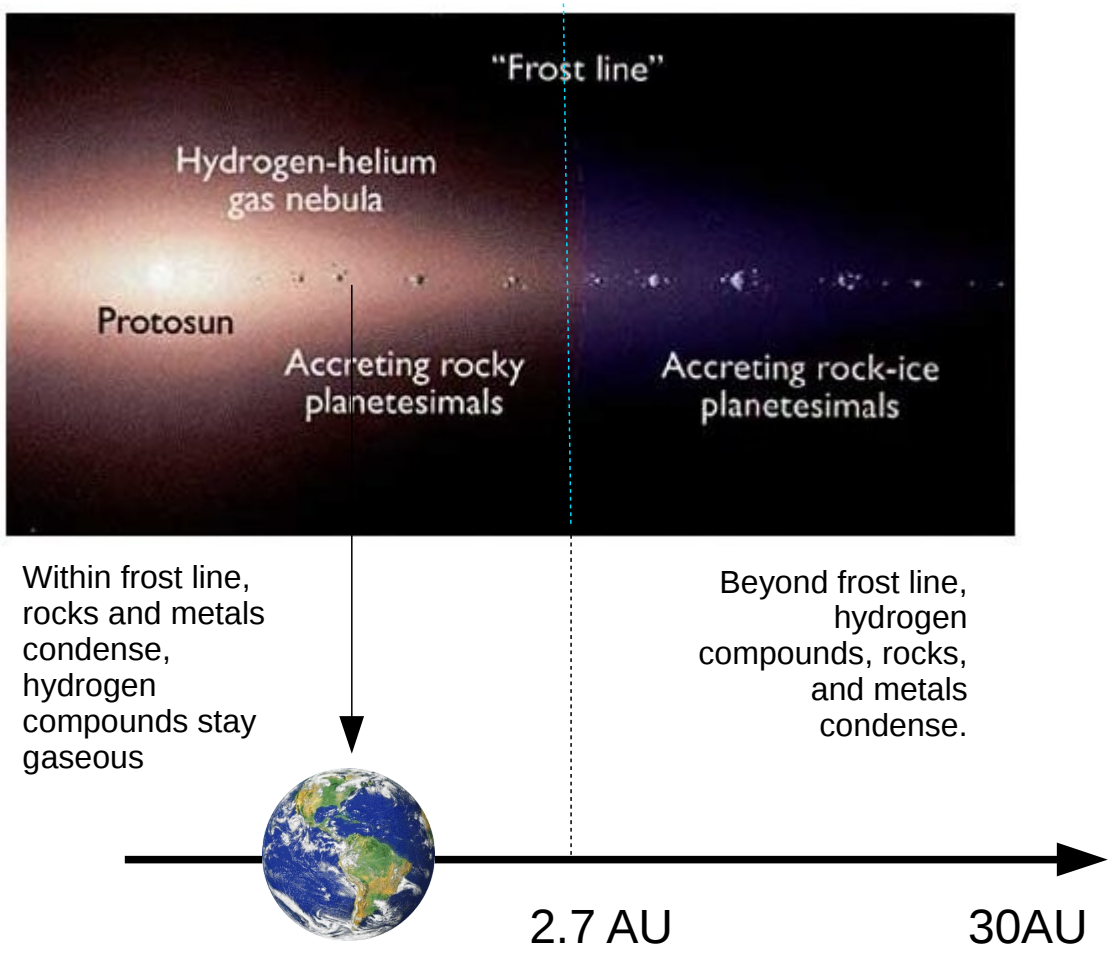
1- HIRES @EELT and GIANO @TNG

GIANO Echellogram



2- Water: the puzzling origin of ocean on Earth



Who delivered water on Earth?

2- Water: the puzzling origin of ocean on Earth

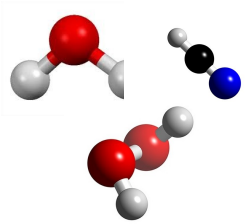
Earth Formation — 4.6

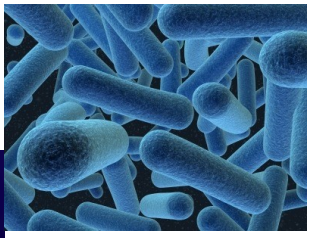
Prebiotic Chemistry — 4.0

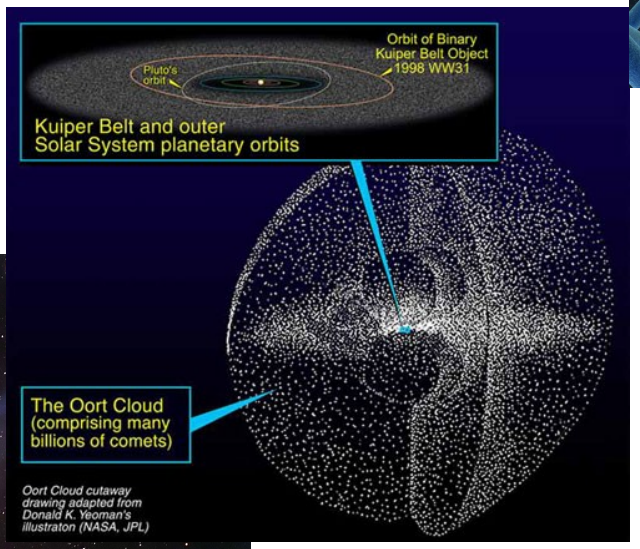
Cometary Late Bombardment — 3.9

Appereance of Life — 3.6

Gy

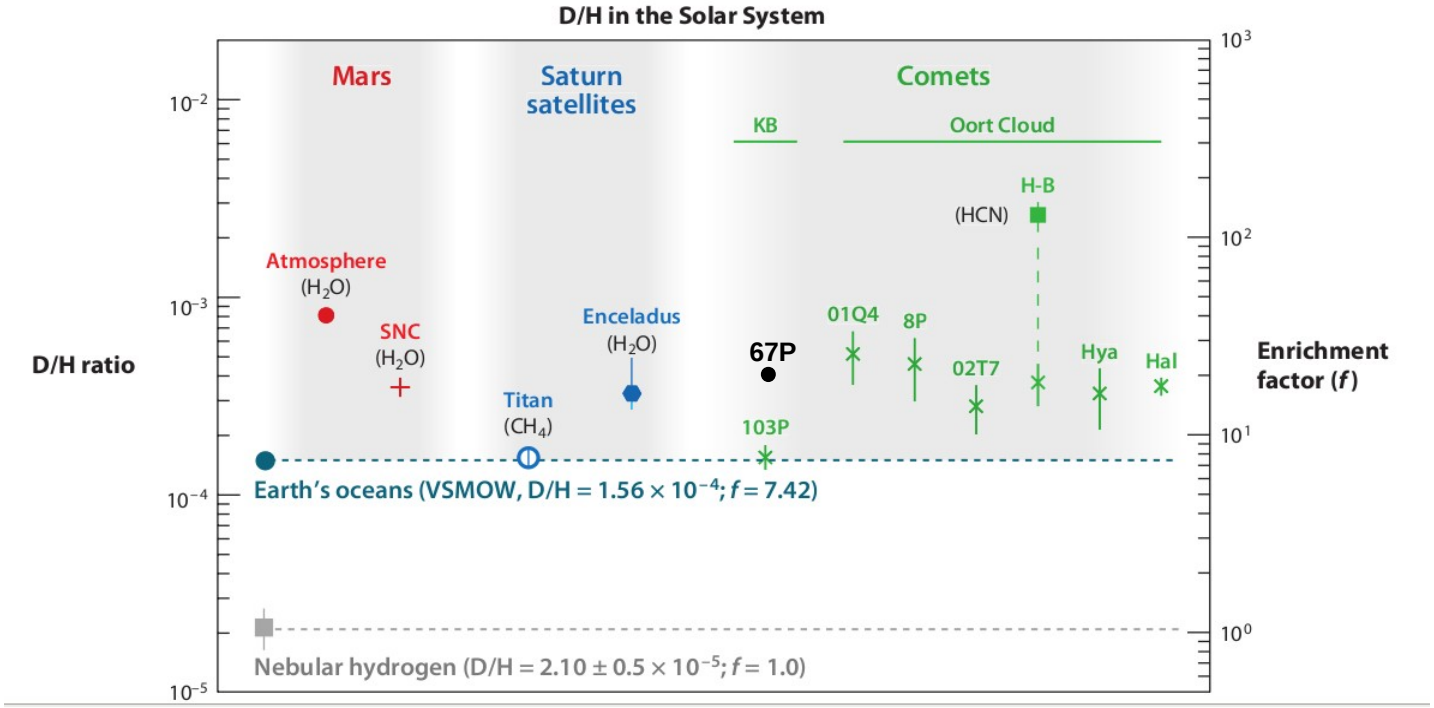






Are organics and water delivered on Earth by comets?

2- Water: the puzzling origin of ocean on Earth



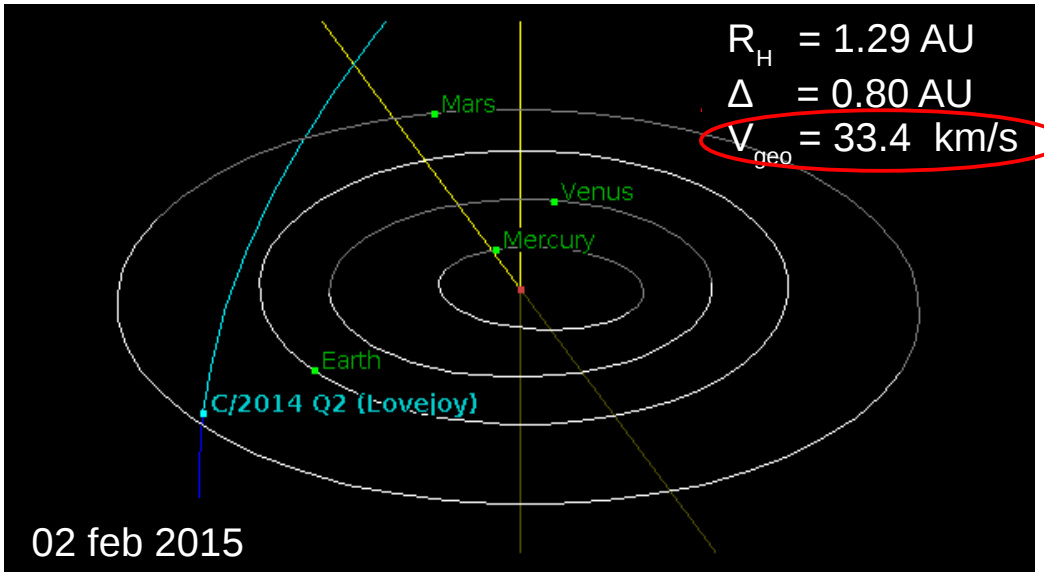
[Mumma & Charnley, 2011]

Is the present D/H on Earth the primordial one?

Does different class of comets have the same D/H ?

Could other mechanisms be possible ?

3- C/2014 Q2 comet Lovejoy observations



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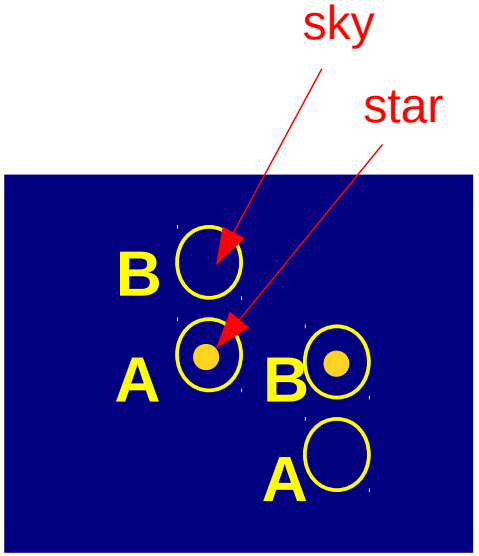
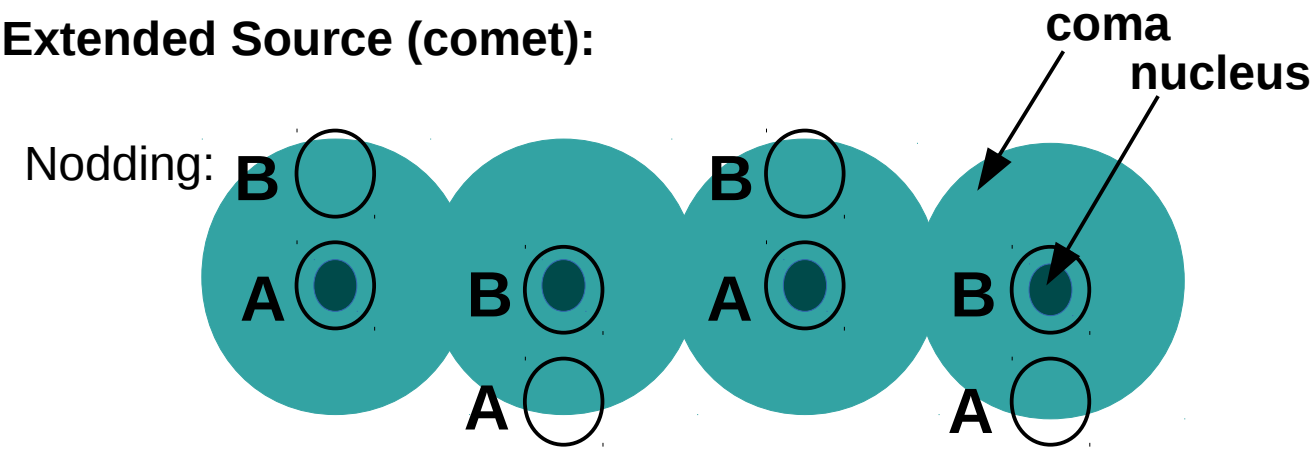
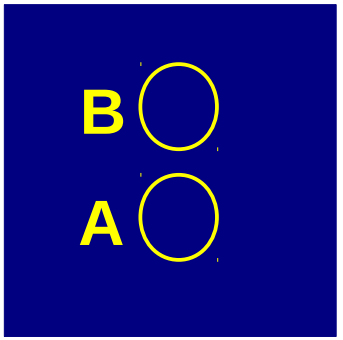


Extended Source (comet):



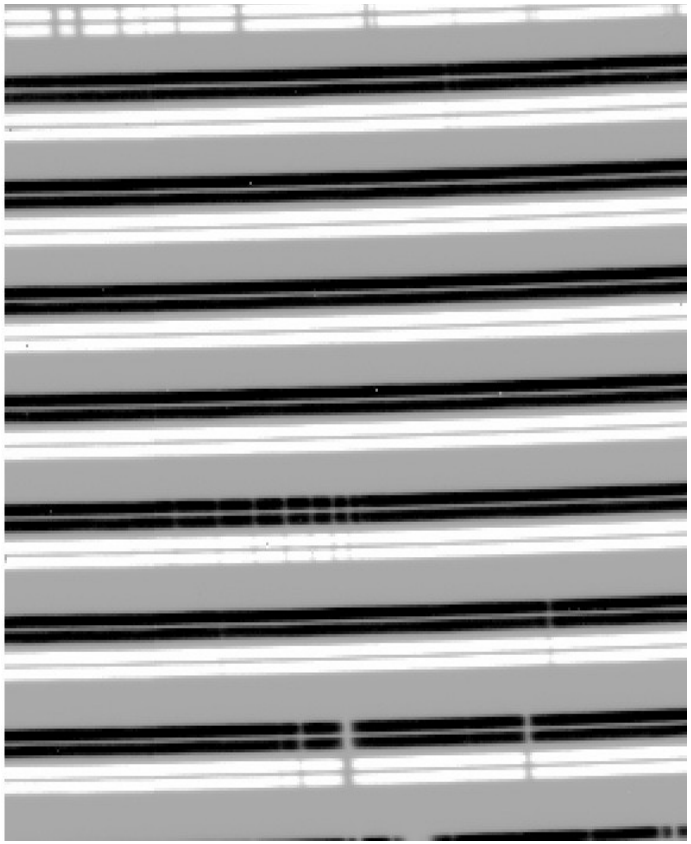
\+

Sky:

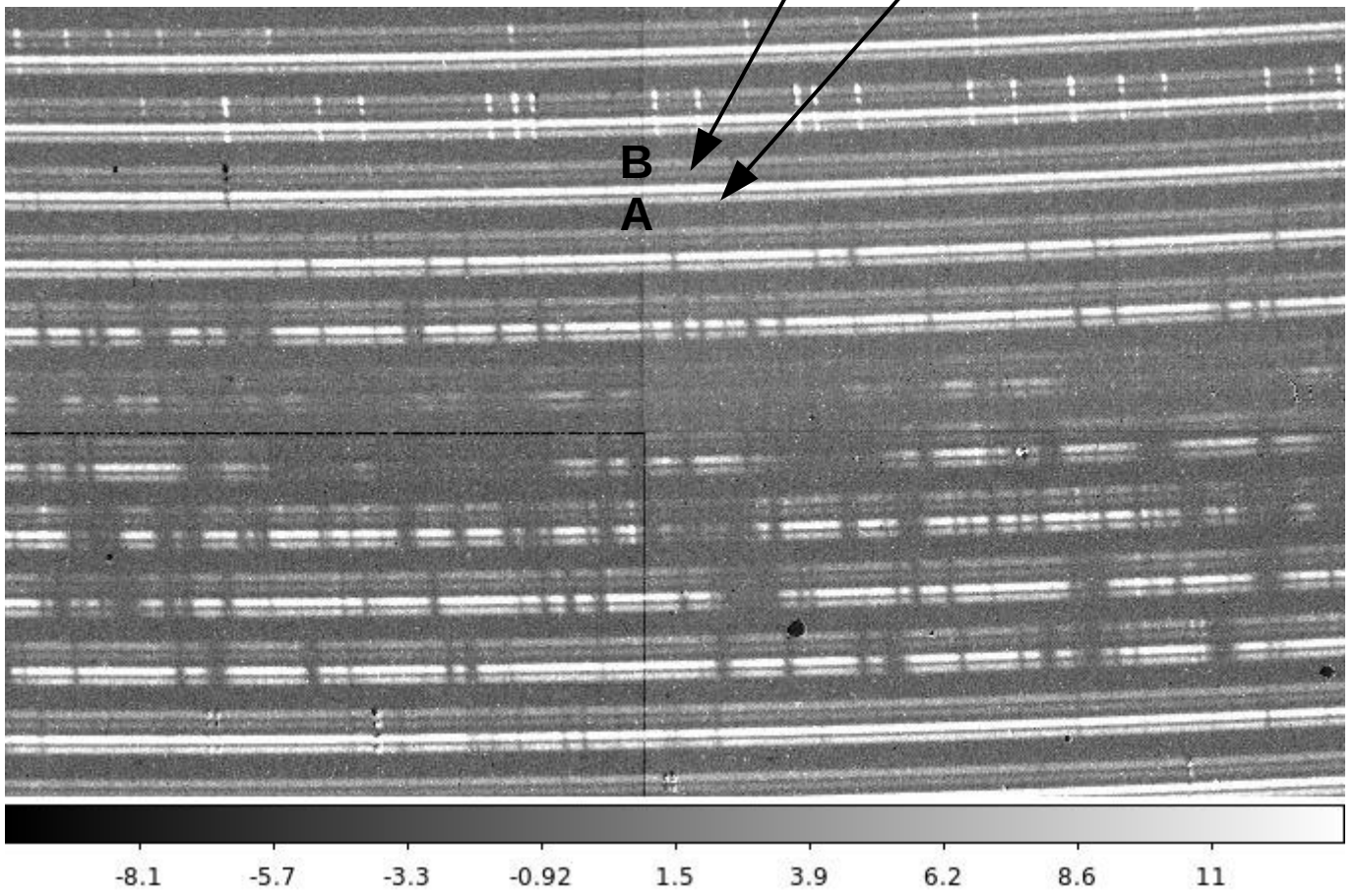


3- C/2014 Q2 comet Lovejoy observations

Star:

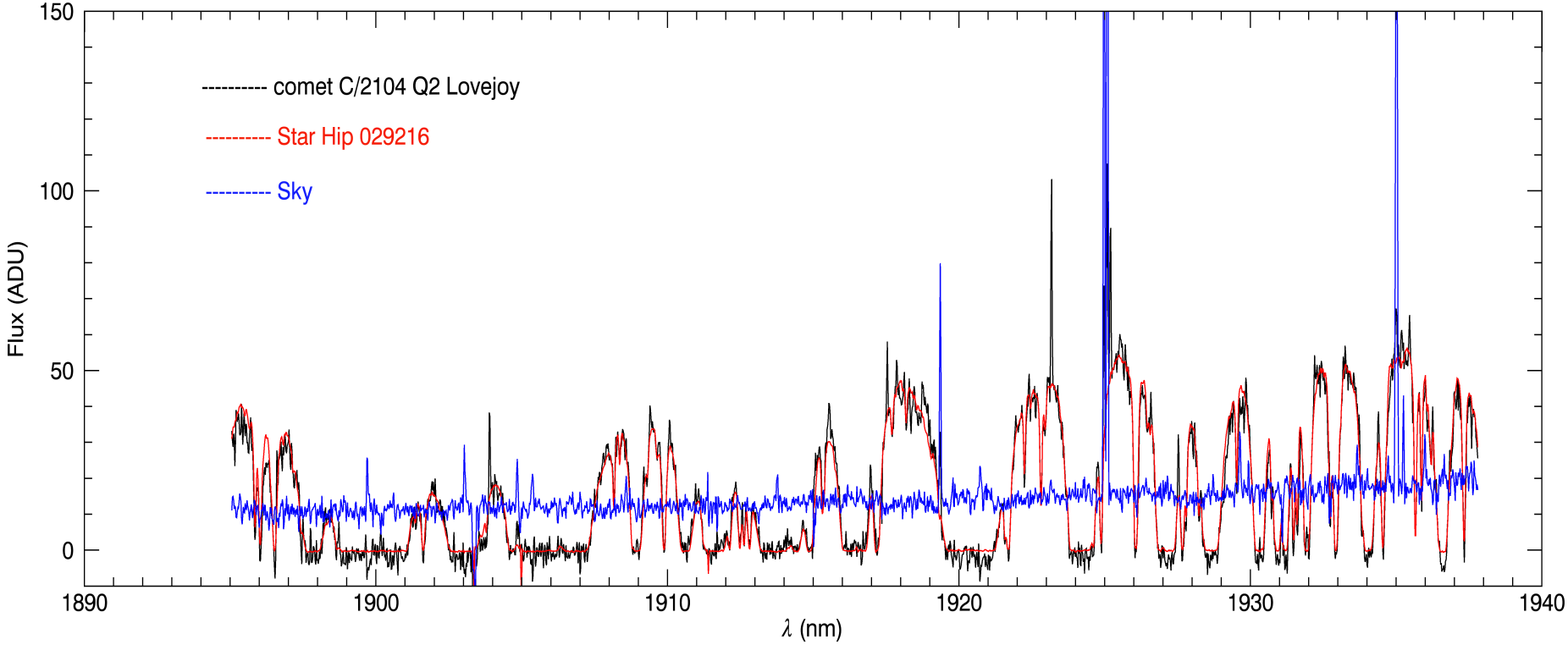


Comet with nucleus on A fiber:



3- C/2014 Q2 comet Lovejoy observations

Order # 40



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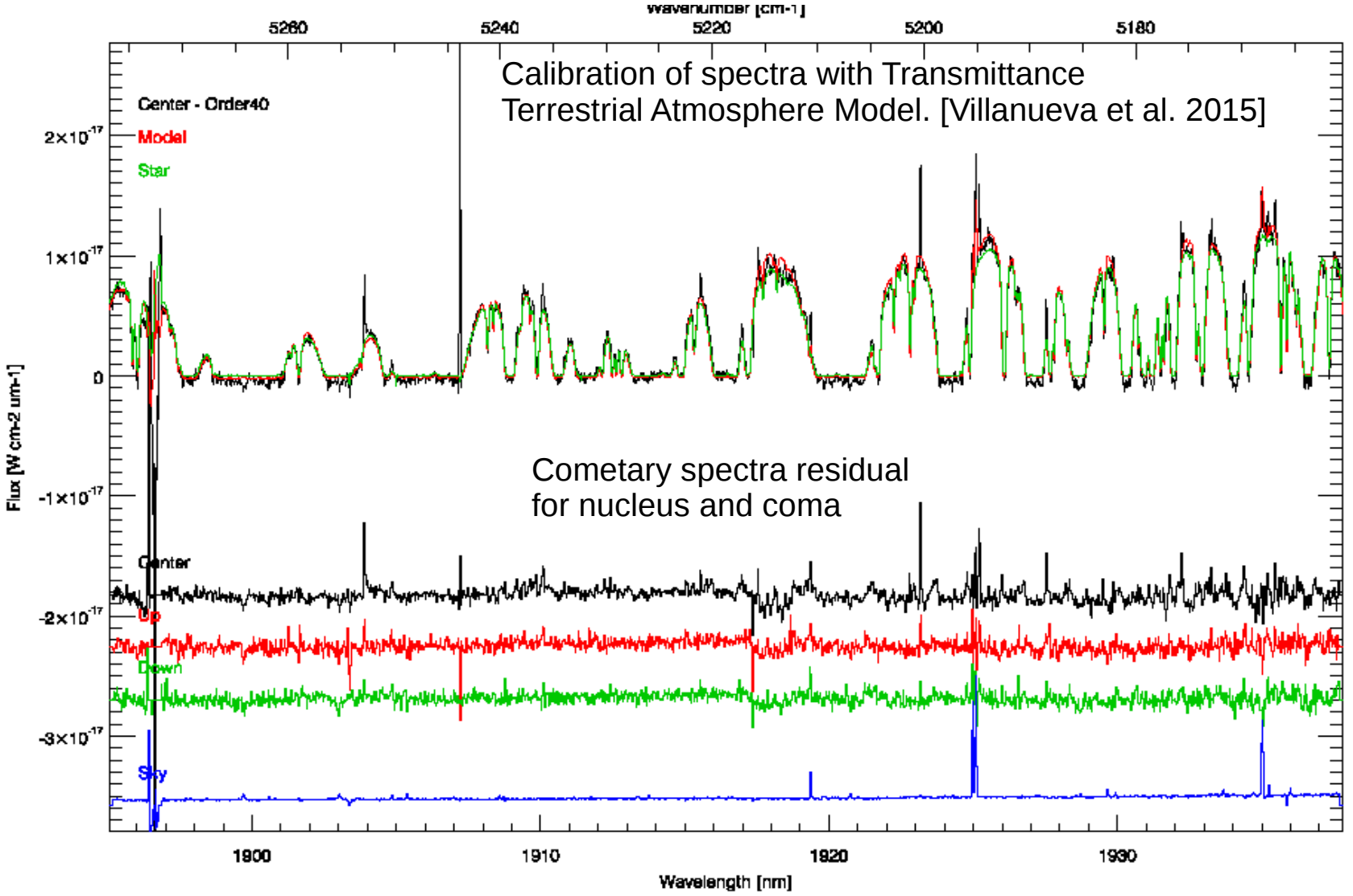
4- Data reduction

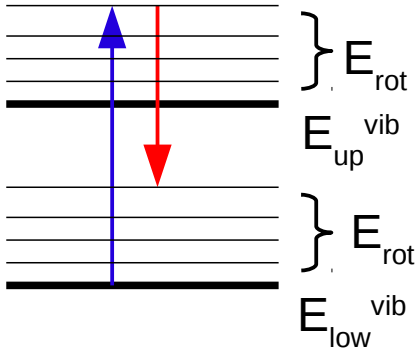
GIANO Order # 40



[Faggi et al. 2015 (in prep)]

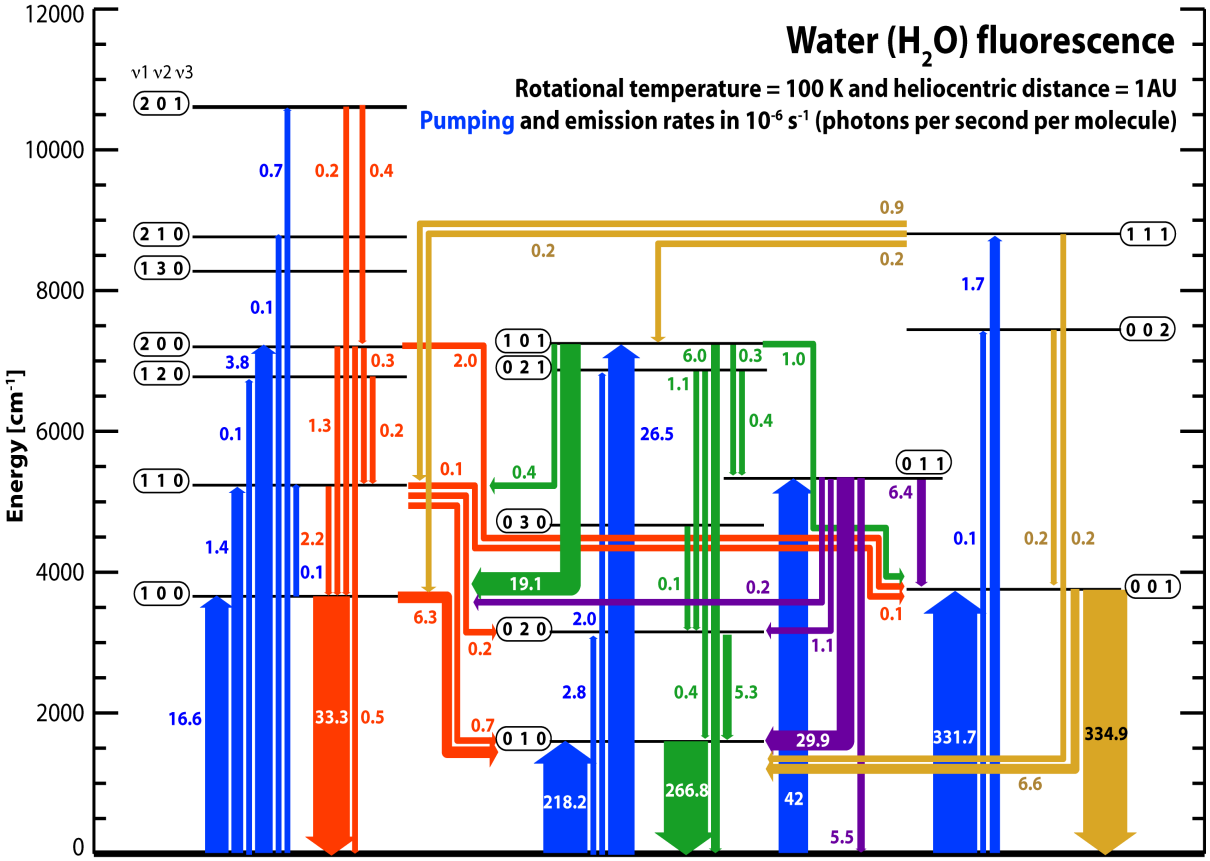
5- Analysis with Cometary Fluorescence Emission Model

Fluorescence = Pumping + Emission



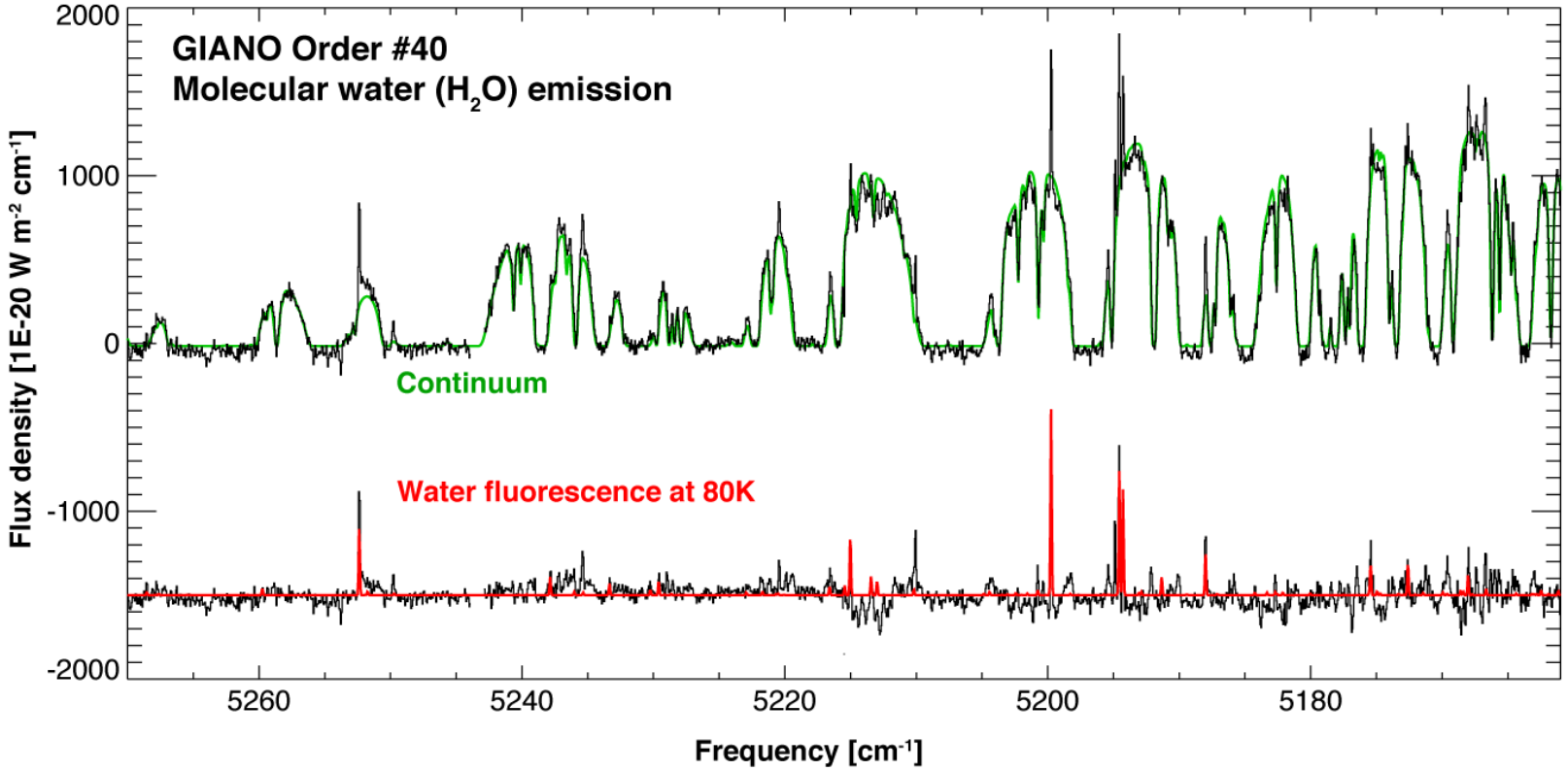
Pumping ≈ F_{sun} * B_{12}

Emission ≈ Pumping * BR



[Villanueva et. al 2012]

5- Analysis with Cometary Fluorescence Emission Model



[Faggi et al. 2015 (in prep)]

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6-Conclusions and future perspectives

- We obtain promising results on **H_2O** in comet Lovejoy for **order #40** of GIANO echellogramm: **$Q(H_2O) = 3.3 \times 10^{29}$ mol s^{-1}**.
  [Faggi et al. 2015, in prep.]

- We are going to measure **HDO** and **OH** ⟶ **D/H and OPR**

- We observed **CN**, **C_2** ⟶ **new model development**

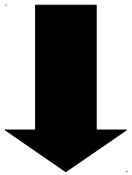
-Search for other emissions across GIANO echellogram (NH_3, CH_4, CO..)

- Submitted proposal for **C/2014 US10 (Catalina)** with GIANO @TNG.

6-Conclusions and future perspectives

With HIRES @EELT we would get a “quantum leap” in the results!!

- EELT collective area 100 times greater than TNG
- HIRES resolving power twice than GIANO
- Extension in the visible region (NH_2,CN, C_2, C_3, O[I]...)



- measure D/H for JFC
- enhancement of statistic of D/H in comets
- isotopic ratio other species (C, N..)
- OPR ratio