

WP4 Task 4.3 Meeting - Dec. 2019

Status Report from ESO

Nima Sedaghat et al.

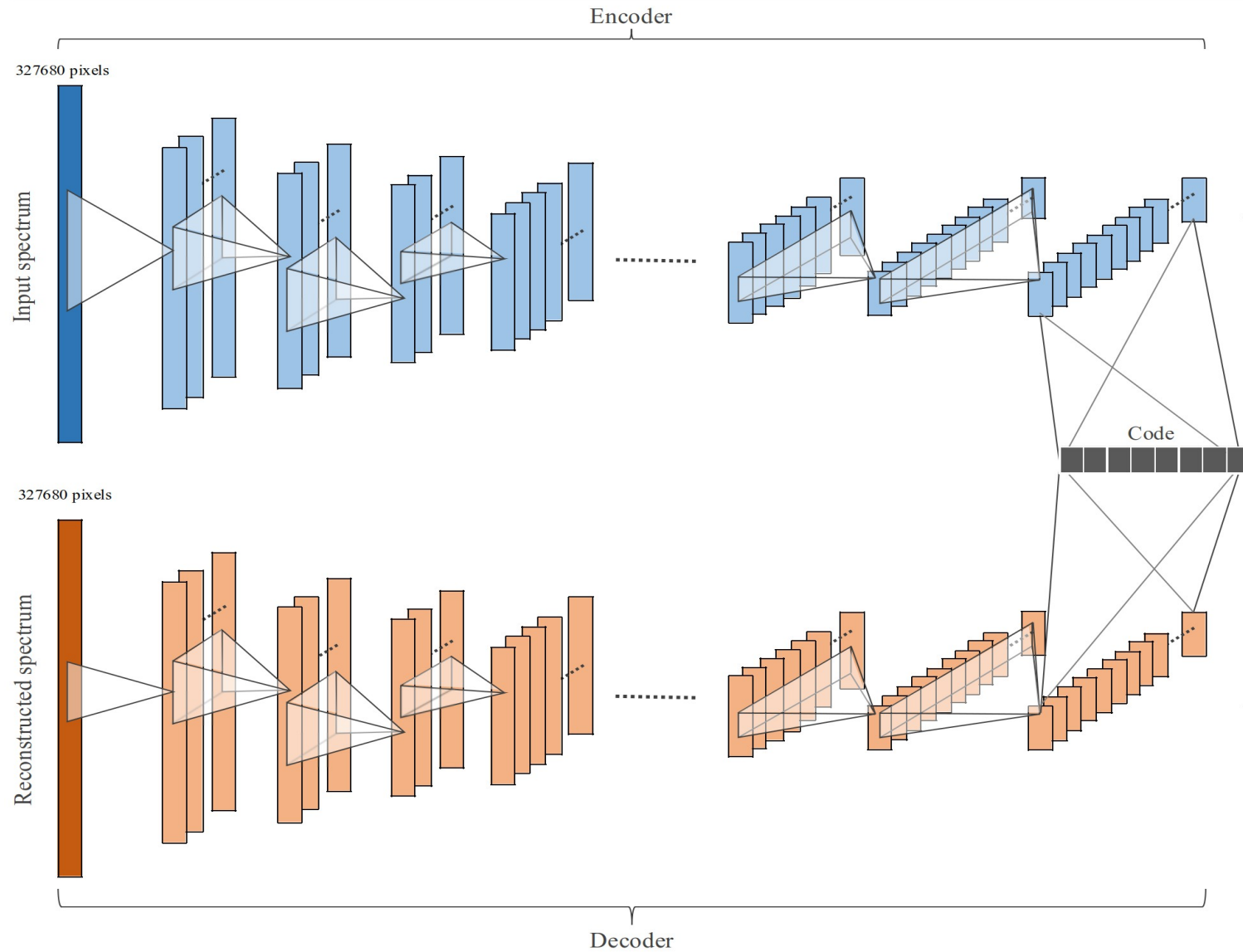
Overview

- **Main Focus:**
High-resolution search for similarities
- **Scientific Idea: Analysis of Information Content through Compression**
- **Telluric Lines**
- **HARPS Purification & Unique Objects**
- **(H)UVES**
- **DESPERT**

Main Focus

- **Self-supervised training of Auto-encoders to facilitate High-resolution search for similarities**
 - Testbed: HARPS
(experiments with UVES started too)
 - Full-resolution (~300K pixels)
 - Convolutional Auto-encoders

The beast



Analysis of Information Content through Compression

Latent Space Dimensionality (= Code Size)

4

8

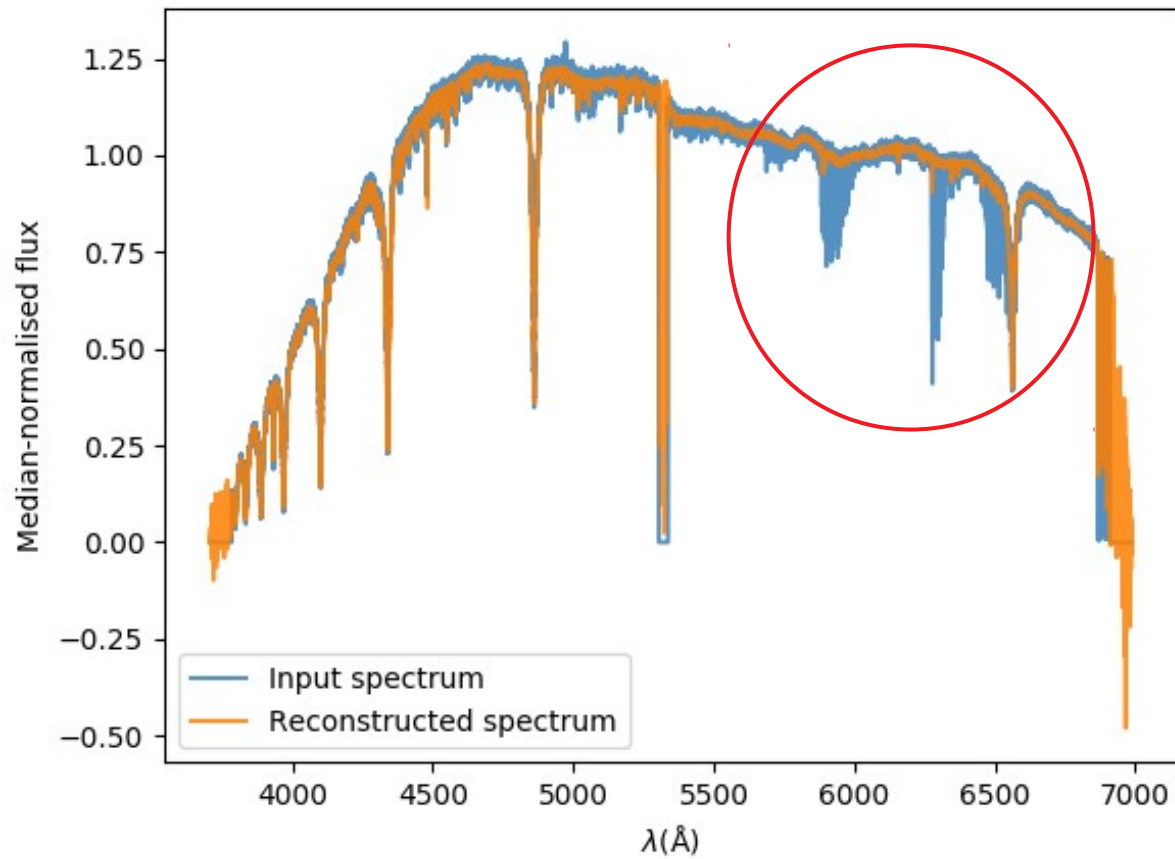
32

128

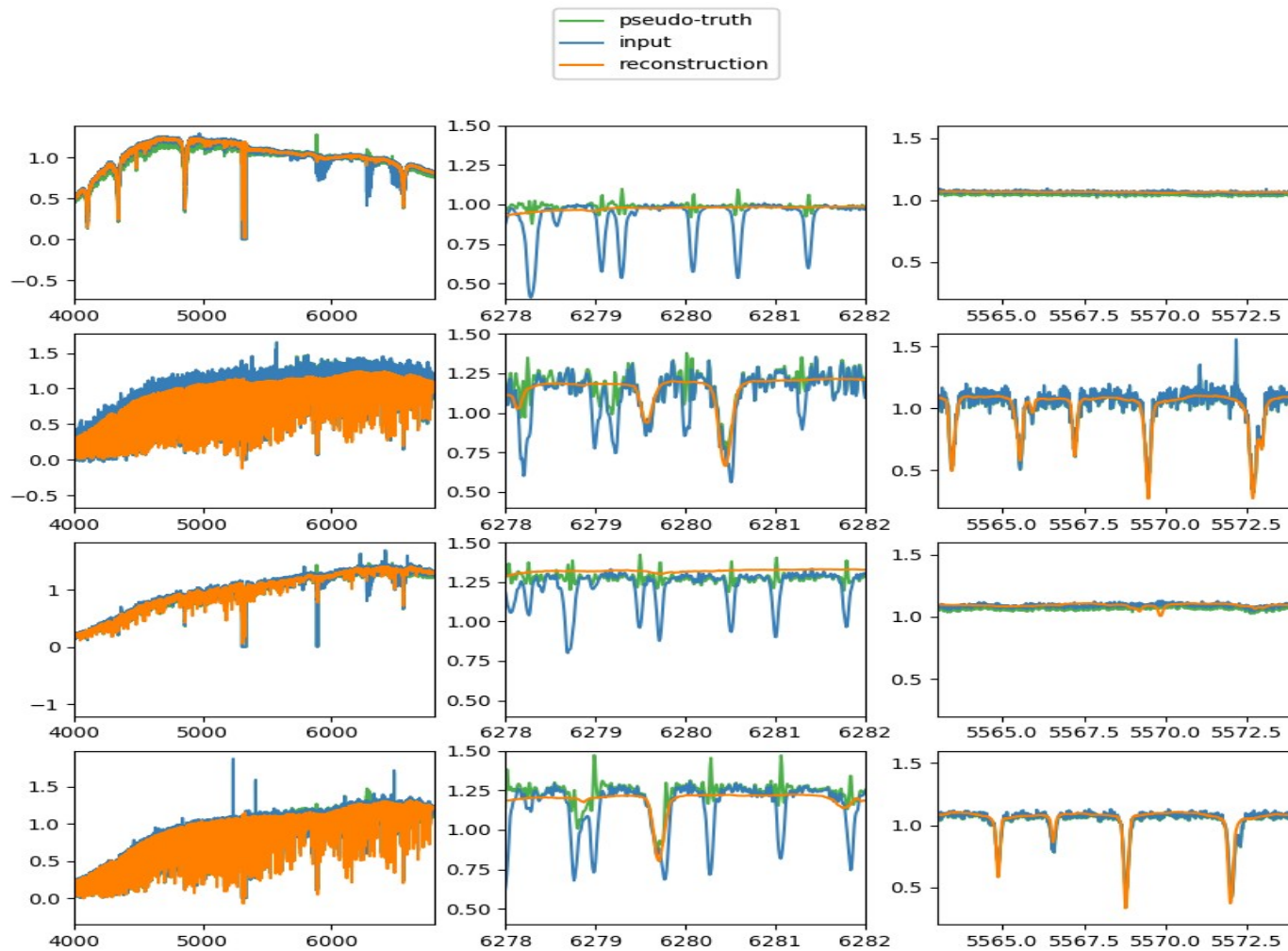
1024

8192

Telluric Lines



Telluric Lines



HARPS Purification

- ['MOON', 95.133603566160417, 14.224563331740205]
- ['MTTEL', 3.7522950040612471, 11.345030543435854]
- ['NONAME', 90.894394771783354, 32.102034304124679]
- ['NONE', 55.651649879249881, 25.586912829937106]
- ['PALLAS', 66.637048861614545, 15.052073090519571]
- ['PRESETNEARZENITH', 103.37994630007491, 1.9459621097996129]
- ['SAND657', 58.038263489917398, 28.204577713287382]
- ['SC1044', 124.99274957374966, 14.156647423990821]
- ['SC735', 124.45422892329151, 15.488396860122347]
- ['SKY', 58.528720422502332, 2.6089963035468013]
- ['SKYSPECTRA', 49.635987717240766, 1.4141472836485975]
- ['SOLARSPECTRUM', 87.122858204548734, 8.6546578894099593]
- ['STAB', 112.29638120692337, 22.515482575538861]
- ['SUN', 85.620100205375138, 6.2881780733511325]
- ['SUNSKY', 149.42683736901765, 11.912790434108821]
- ['TEST', 68.417328068646469, 19.022972951117374]
- ['TEST300SEC', 9.0453433524773175, 4.6709936607966524e-06]
- ['TEST600SEC', 27.136024027118811, 5.0452497891685982e-06]
- ['TEST900SEC', 22.677850742214993, 3.7796447289420838e-06]
- ['TOI540', 2.9889663169188792, 23.796870013795932]
- ['TWA7', 2.2560005035758226, 0.17057470011867168]
- ['TYCHO', 1.6472168977332975, 0.57364140562147337]
- ['VESTA', 76.921566512201537, 13.422894161596719]
-

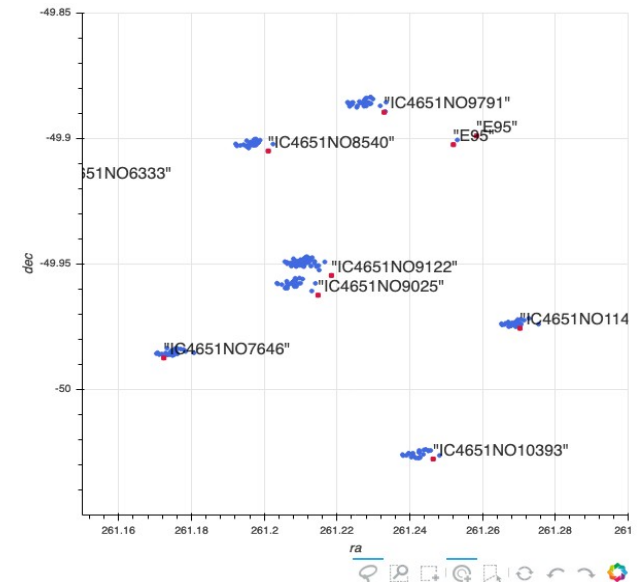
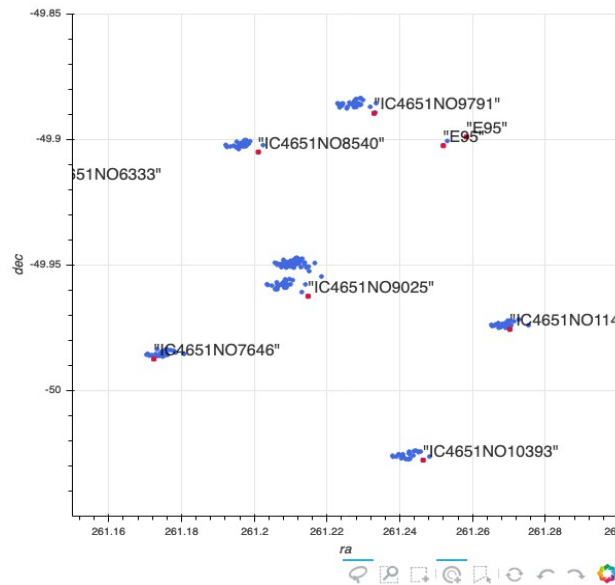
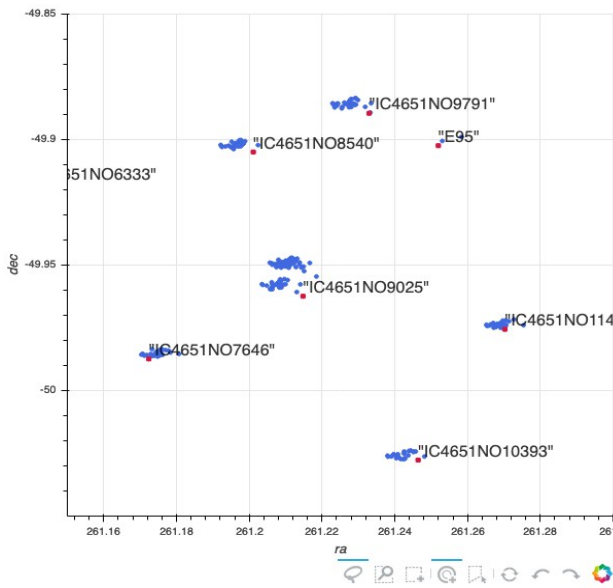
Unique Objects - Name-based

HD128621	19698
• HD10700	9272
• HD20794	6775
• Procyon	5704
• HD039060	5688
• HD121370	5175
• HD190248	5098
• Alp-Cir	4920
• HD128620	4780
• SUN	4155
• Eps-Indi-A	3808
• HD1581	3659
• 18_Sco	2833
• Beta-Hyi	2695
• HD203608	2625
• HD160691	2451
• HD188512	2263
• HD210302	2183
• 18Sco	2149
• Moon	2123
• tau-Cet	1988
• HD17051	1900
• HD192310	1835
• HD165341A	1795
• HD19994	1736
• HD63077	1693
• HD216956	1577
• HD139211	1520
• HD-209625	1287
• HD115617	1213
• HD49933	1212
• HD85512	1180
• HD46375	1158
• HD199288	1146
• HD23249	1126
• HD-101065	1123
• HD167858	1084
.	

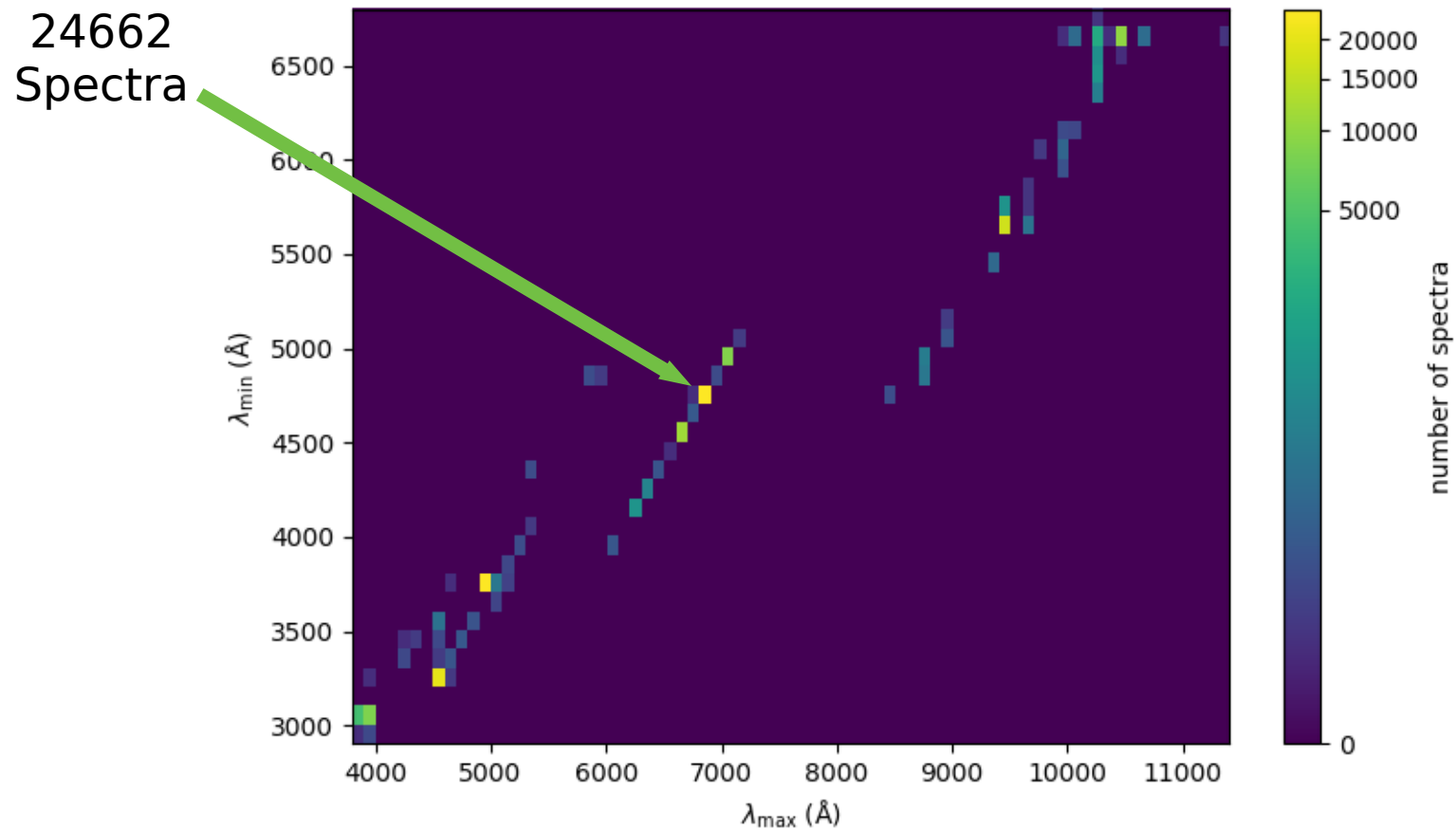
=> 7007 unique "target_name"s

Unique Objects by Clustering

- **DBSCAN (based on KD-Tree)**

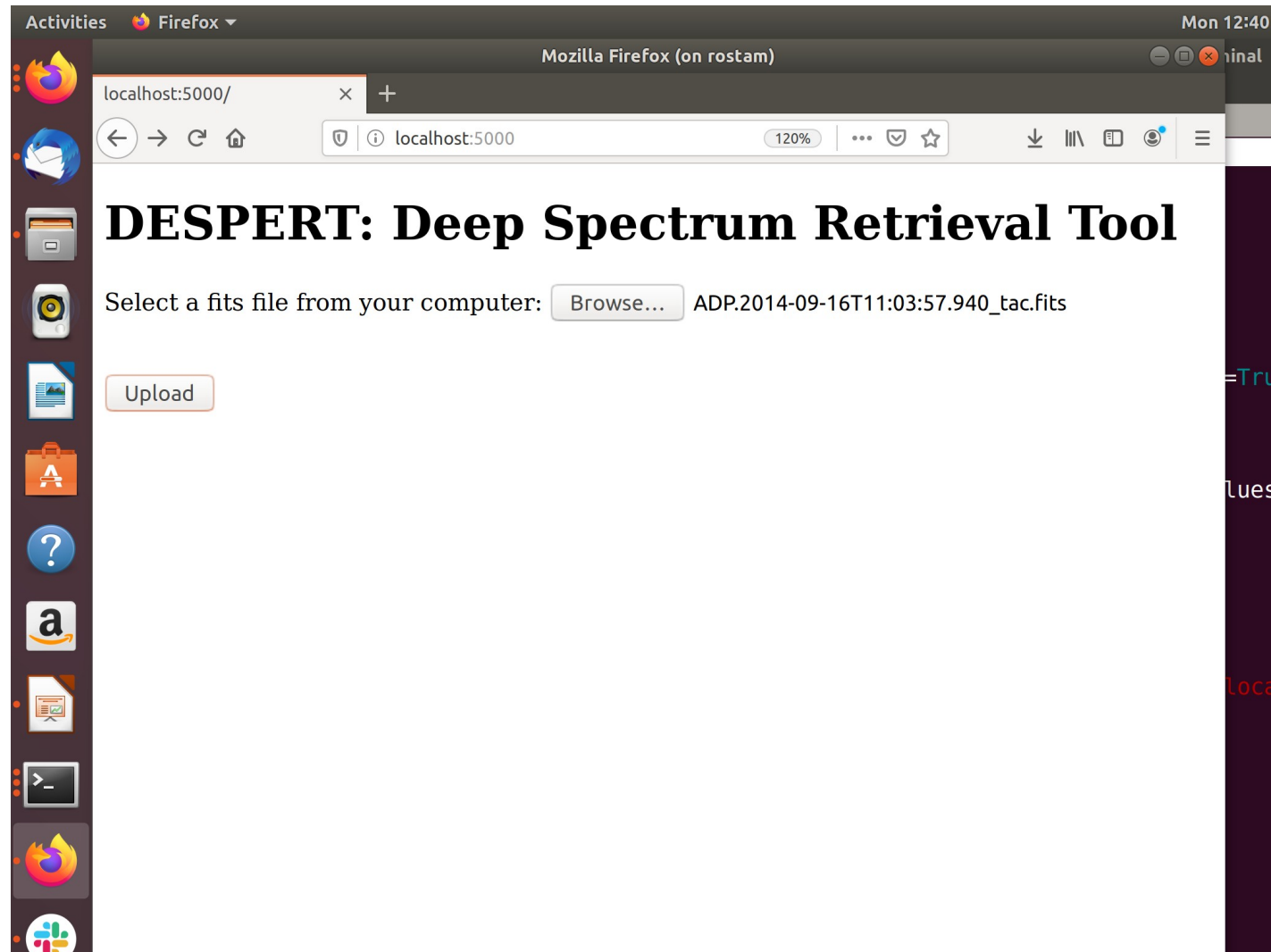


(H)UVES: Harps-like UVES



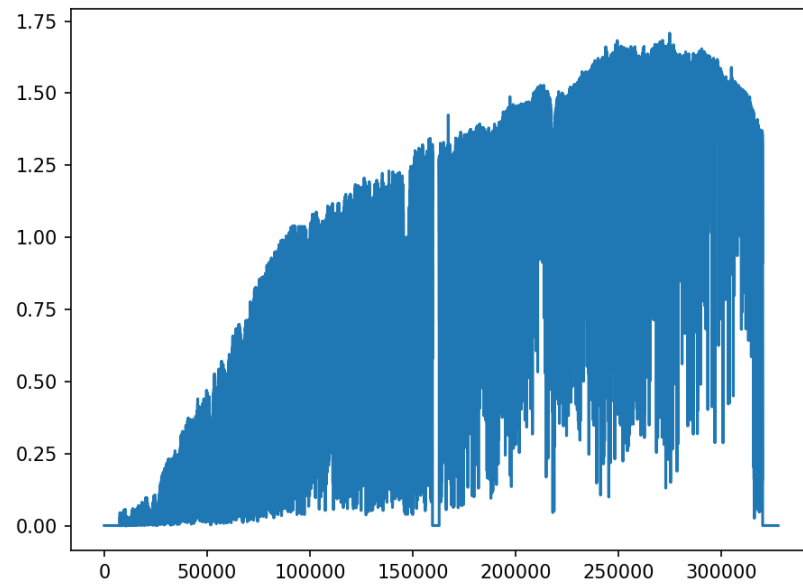
Topocentric \neq Barycentric

DESPERT (alpha version)

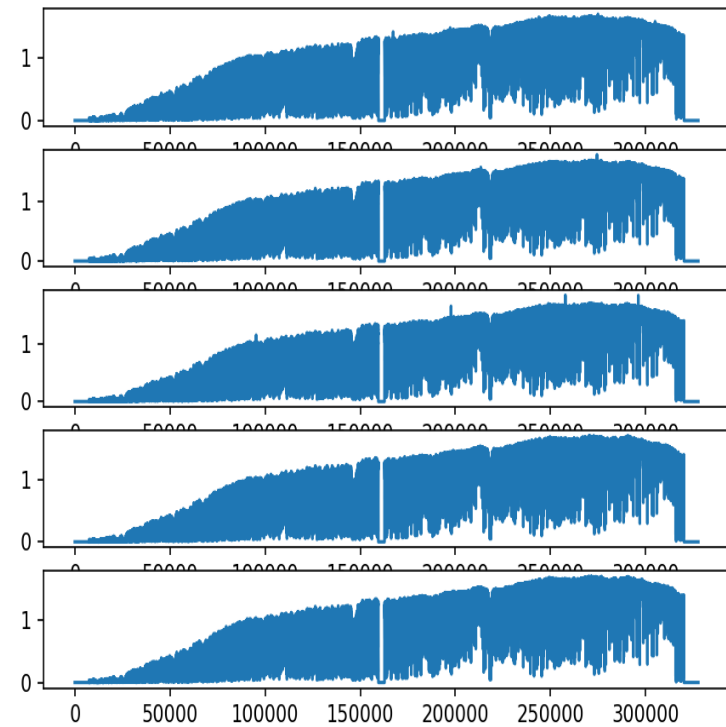


DESPERT (alpha version)

Query Spectrum



Search Results



Future Avenues - Research

- Imposing physics into the latent space
- Novelty detection
- etc.

Necessary Future Directions (IMHO)

- (Physical) validation of reconstruction/retrieval
- Generalization: Cross-dataset similarity search