Astronomical Databases and Stellar Population in Active Galactic Nuclei

II Summer School in Astronomy

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Plan of The Talk

- Astronomical Databases
- HyperLeda Database
- Stellar Population in Active Galactic Nuclei

Astronomical Databases

- NED (NASA/IPAC Extragalactic Database) 

- HyperLeda Database 

- CDS 

- SIMBAD in France or at Harvard 

What can we search for in Astronomical DBs

Basic data

- Designation
- Heliocentric cz
- Position angles
- Nature, Morphology, Nuclear Activity
- Size

What can we search for in Astronomical DBs

Internal Kinematics

- Velocity dispersion
- Rotational velocity (stars and gas)

What can we search for in Astronomical DBs

Photometry & spectrophotometry

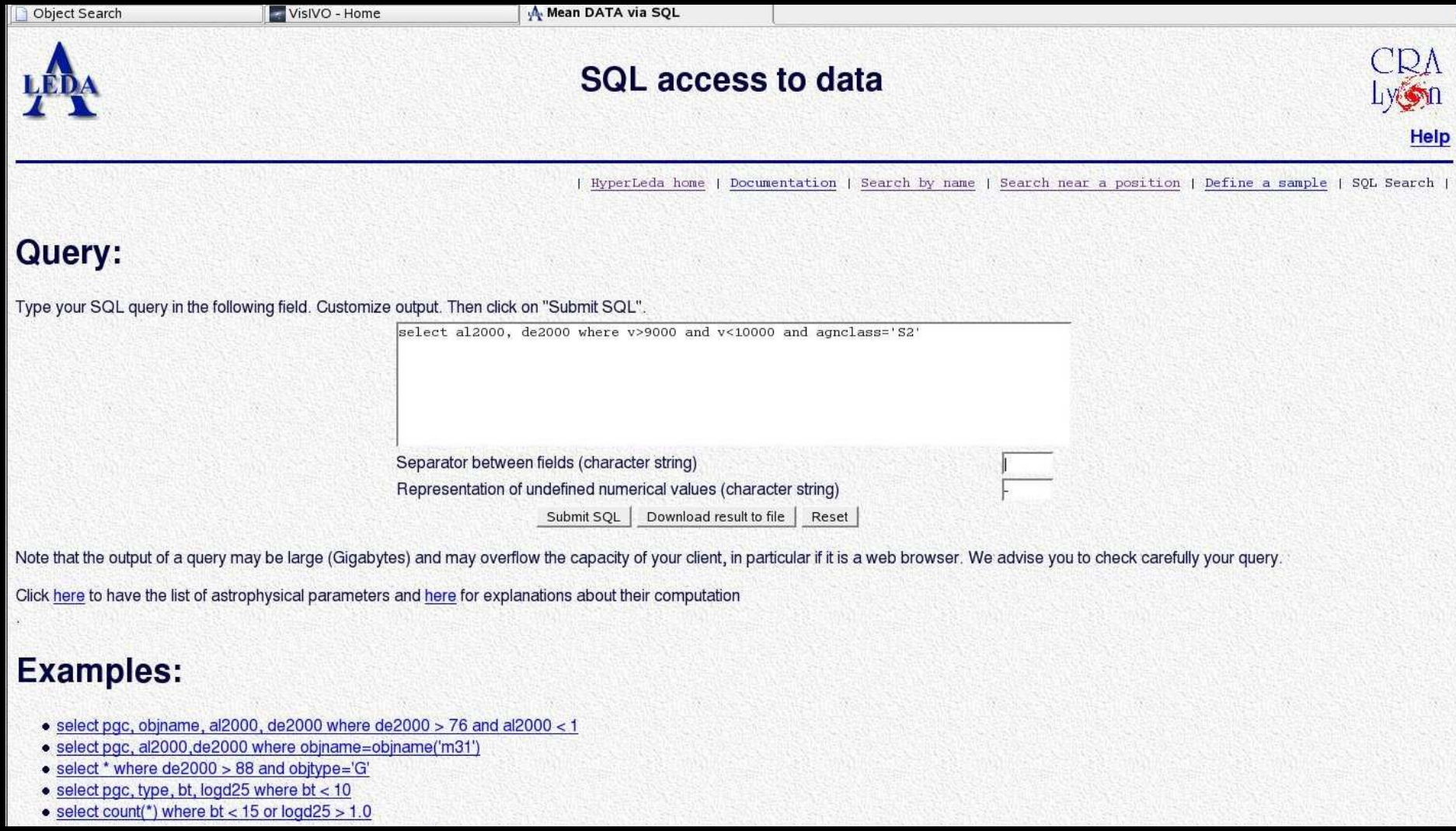
- Integrated photometry
- Magnitudes
- Colors
- Surface brightness
- Line strength indice Mg2
- FITS archive

HyperLeda database

Activity classification

- Data-base consists more than 4 million objects, among them 2 millions are galaxies and around 100.000 are quasars.
- The only database with the characterization of the activity class.
- We added activity information in order to make statistics of the active phenomena as a function of environment, morphological type, stellar population...
- http://leda.univ-lyon1.fr/

How to select the sample?



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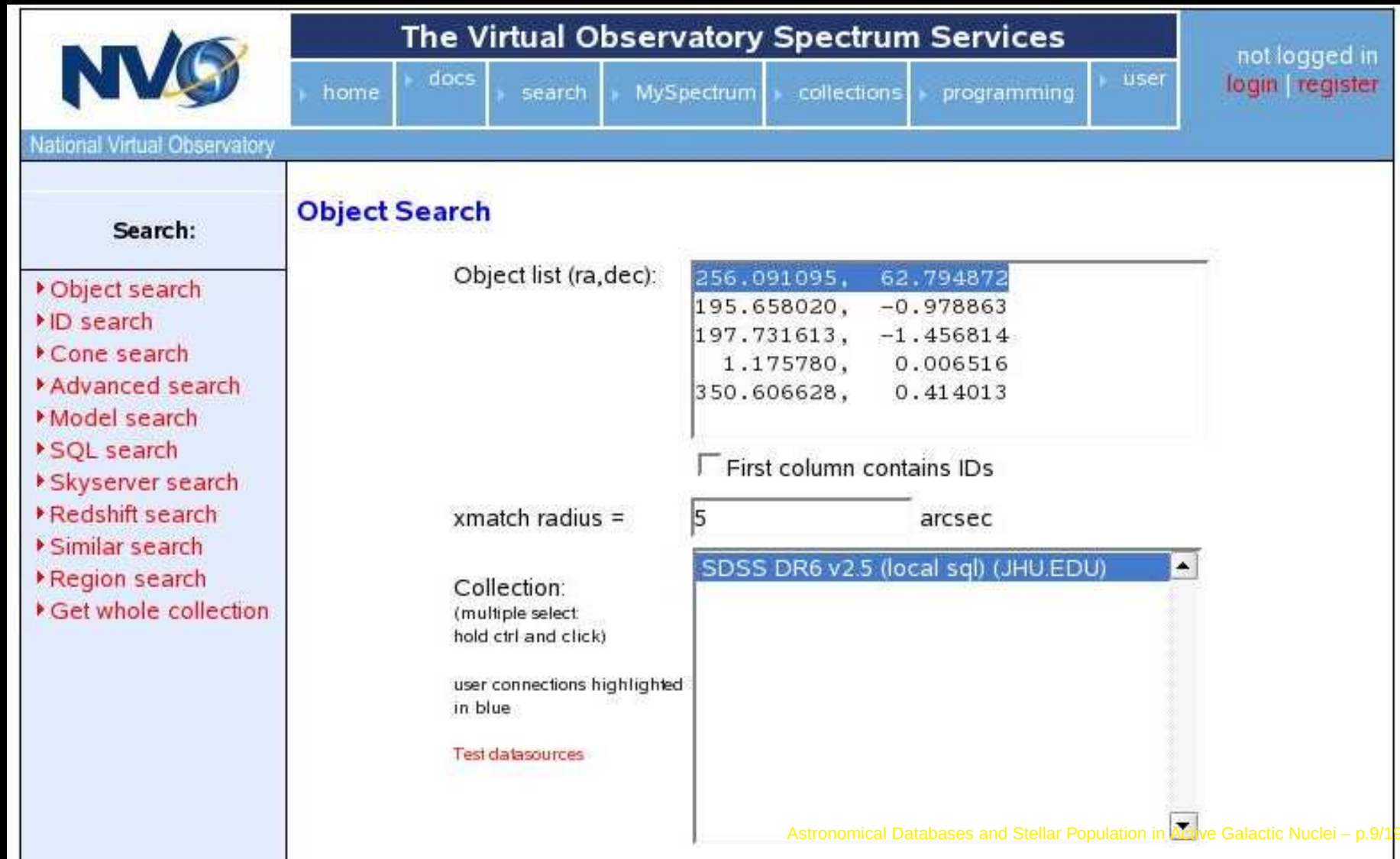
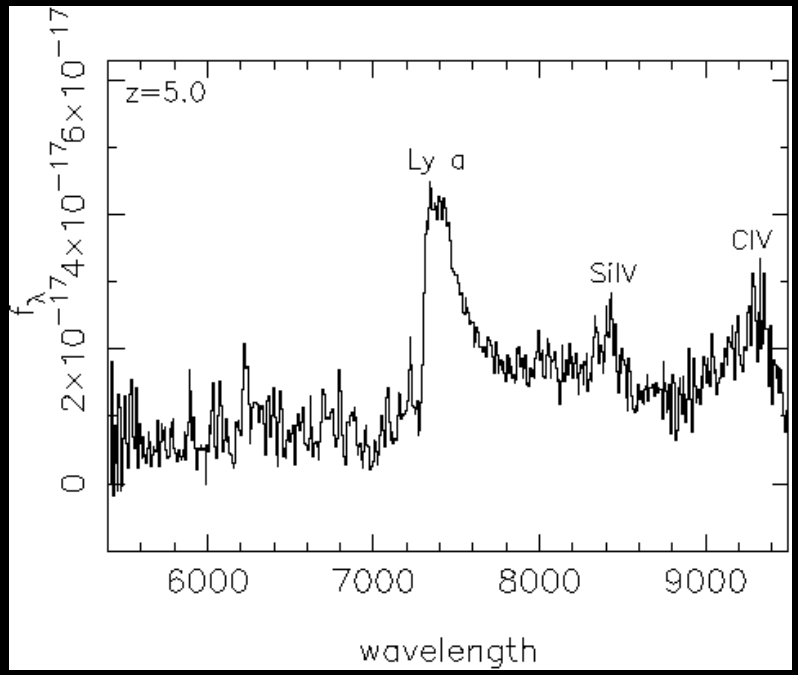
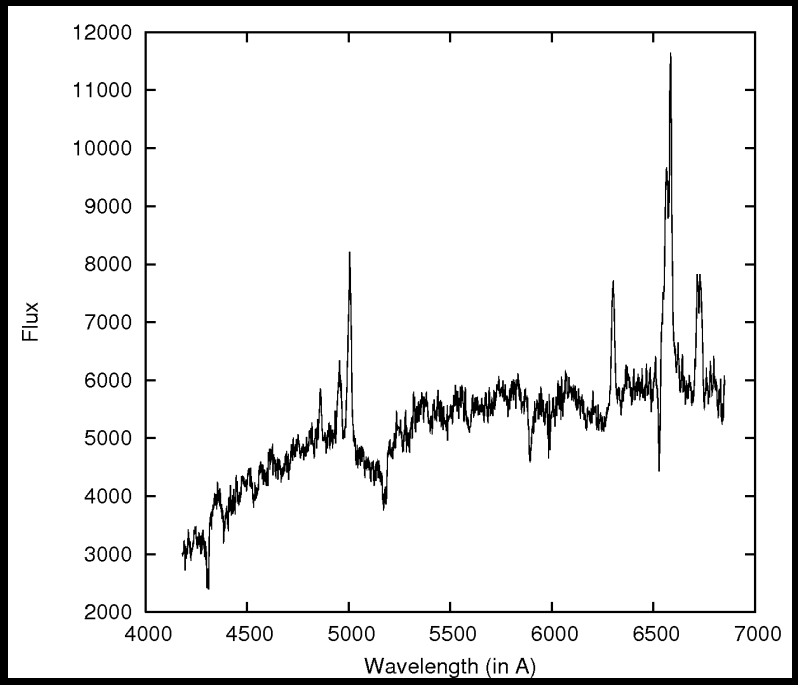


Why we are studying SP in AGN?





The spectrum of a the QSO (left) and of the LINER galaxy PKS 1514.

Stellar Population Analysis

Goals

- Fit the stellar population and continuum in AGN, in order to subtract them and analyse AGN emission lines,
- determine the contribution of the AGN emission,
- Analyse the correlation between the stellar and gas motion in AGN,
- determine characteristics of the SP spectra (velocity dispersion, age and metallicity).

Stellar Population Analysis

Fit procedure

- For the fit we have used the program NBURSTS developed on the Lyon's Observatory
- The program performs a Levenberg-Marquart minimization
- The population models are spline interpolated over an age-metallicity grid of models, generated with PEGASE.HR with free age, metallicity, velocity scale and a multiplicative polynomial continuum.
- The program is written in IDL/GDL starting from PPXF (http://www.strw.leidenuniv.nl/~mcappell/idl/) and uses the MPFIT (Markwardt, http://cow.physics.wisc.edu/~craigm/idl/idl.html) procedure

Stellar Population Analysis

Fit procedure

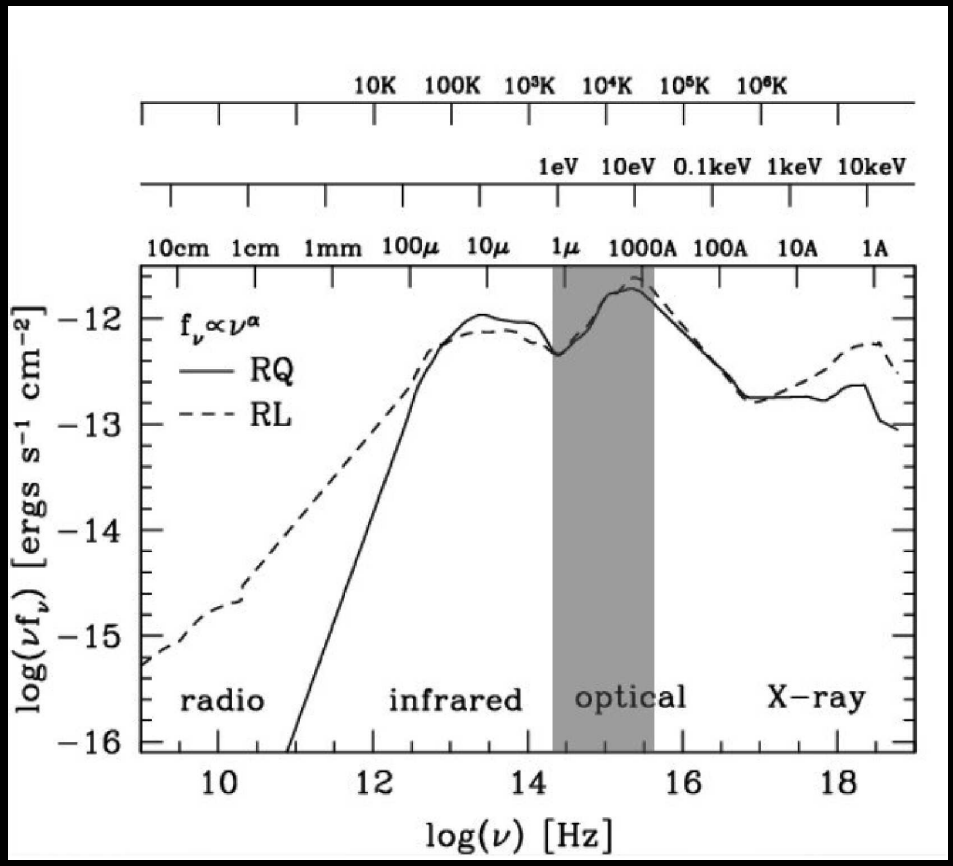
Following Barth et al. (2002), we build a model, M(x), that is the convolution of a stellar template spectrum, T(x), and a lineof- sight velocity broadening function approximated as a Gaussian function, G(x) :

$$M(x) = P(x)([T(x) \otimes G(x)] + C(x))$$

- C(x) is a model for the AGN continuum, here assumed to be a single power law, where the normalization, the amplitude and the slope are allowed to vary in the fit. This component could comprise other additive components, such as the Fe II emission from the BLR of the AGN that forms a "pseudocontinuum" throughout the optical spectrum (e.g., Francis et al. 1991)
- P(x), is required to account for variations in continuum shape between the template and the galaxy (see, e.g., Kelson et al. 2000), which, in our case, can result from a combination of internal reddening in the host galaxy (Galactic extinction is already accounted for), differing stellar populations, and residual calibration errors. The polynomial represents a linear combination of Legendre polynomials.

Stellar Population Analysis

Fit procedure-additive power-law continuum



Spectral energy distribution of AGN.

Stellar Population Analysis

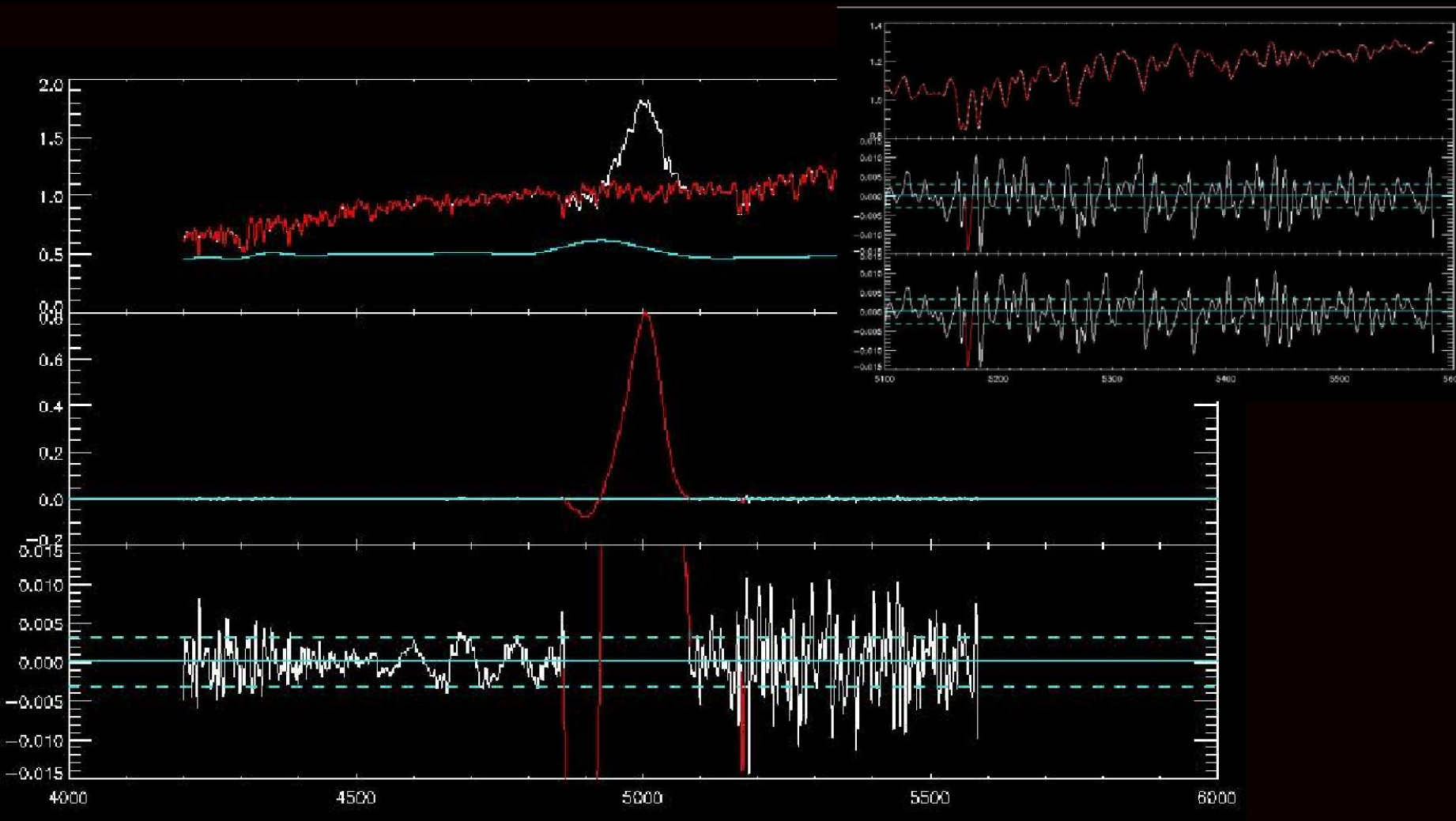
Fit procedure-additive power-law continuum

The AGN continuum is well described with the power-law function $F_\nu \propto \lambda^\alpha$ over all electromagnetic spectrum. The spectral index α depends on the continuum slope, so in different spectral domains it has different values.

The values of spectral index in different electromagnetic domains of AGN.

Domain	Spectral index
RADIO	$-1 \leq \alpha \leq -0.5$
IR	$-1.2 \leq \alpha \leq -1$
OPTICAL/UV	$-2 \leq \alpha \leq 3$
X/γ	$-0.9 \leq \alpha \leq -0.7$

Stellar Population analysis in AGN

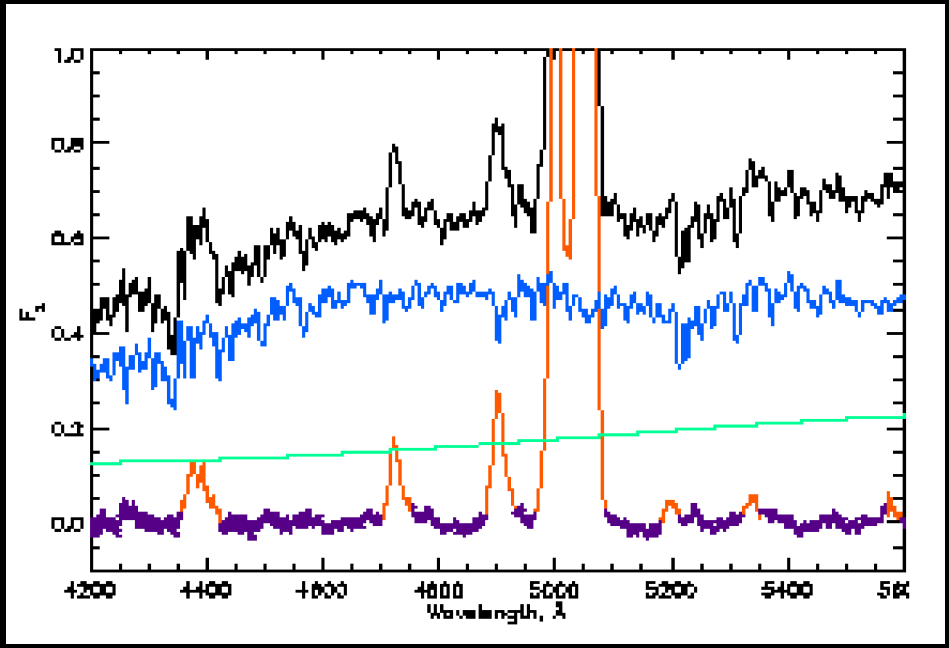


Stellar Population analysis in AGN

Table represents the best fit results. The variables in the table are: *v*-mean stellar velocity, σ- velocity dispersion, *z*-metallicity, a_coef-linear parameter of the power_law function, b_expo-spectral index, *f*-restored fraction of AGN and χ^2-the goodness of the fit.

v (km/s)	7.4166 $\pm$ 0.1642
$\sigma(km/s)$	100.7974 $\pm$ 0.1886
age (Myr)	5529.6152 $\pm$ 84.0009
z (dex)	-0.0227 $\pm$ 0.0050
f(%)	24.2717
a_coef	2.15e-7
b_expo	1.7232
χ^2	0.6786

Stellar Population Analysis



Chilingarian et al. 2005

Simulated spectrum (with 25% AGN) is fitted by stellar population and AGN continuum (polynomial). The AGN emission lines are excluded from the fit.

Thank You for Your attention!