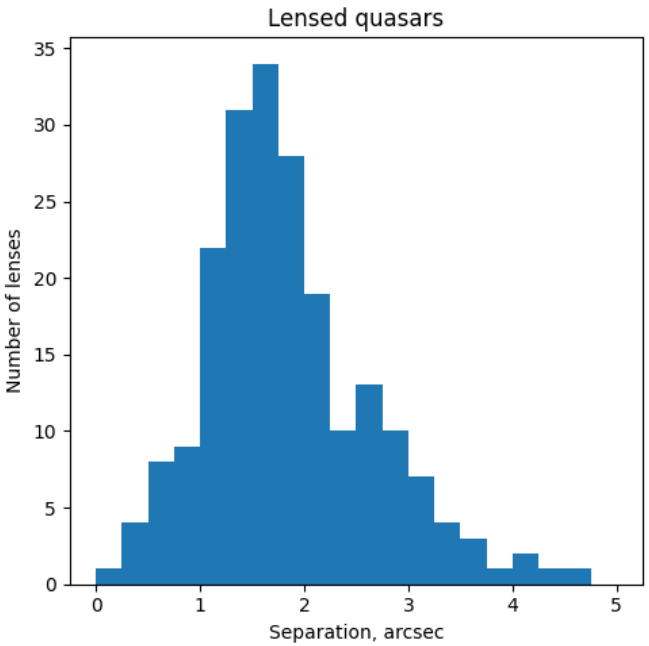
Gravitationally lensed quasars in the JPAS survey

Alexey V. Sergeyev

October 21, 2024

How to looks gravitationally lensed quasars

- Separaion between quasar images



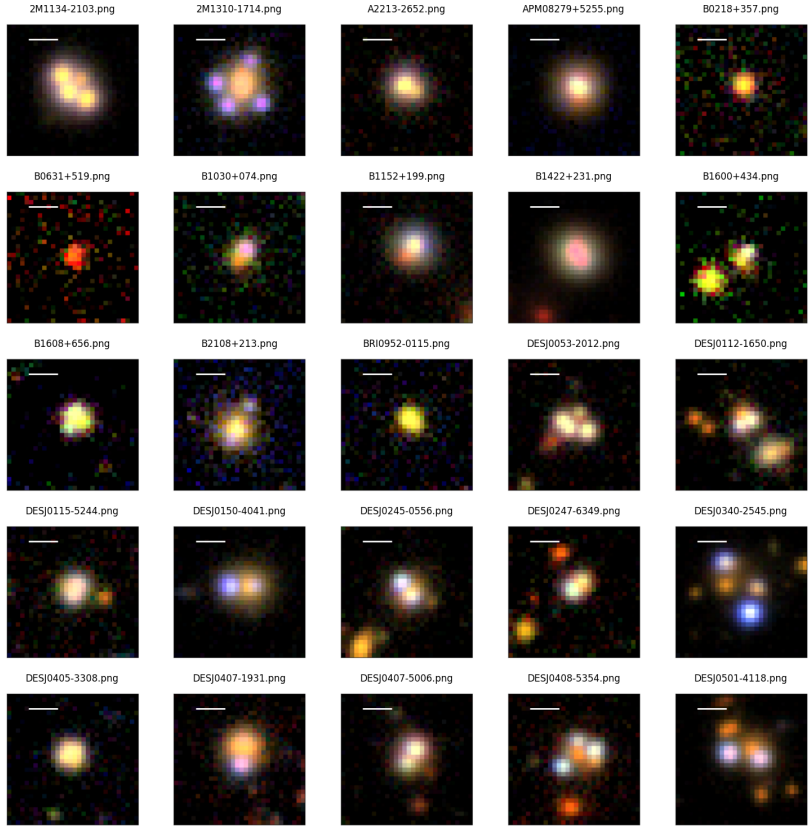
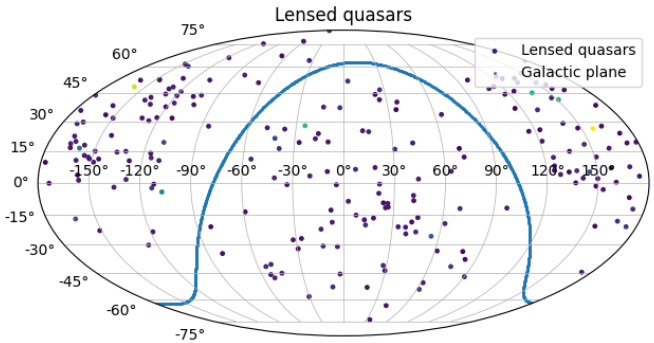


Figure: Gravitationally Lensed Quasar Database

How to looks gravitationally lensed quasars

- Distribution of quasar images on the sky



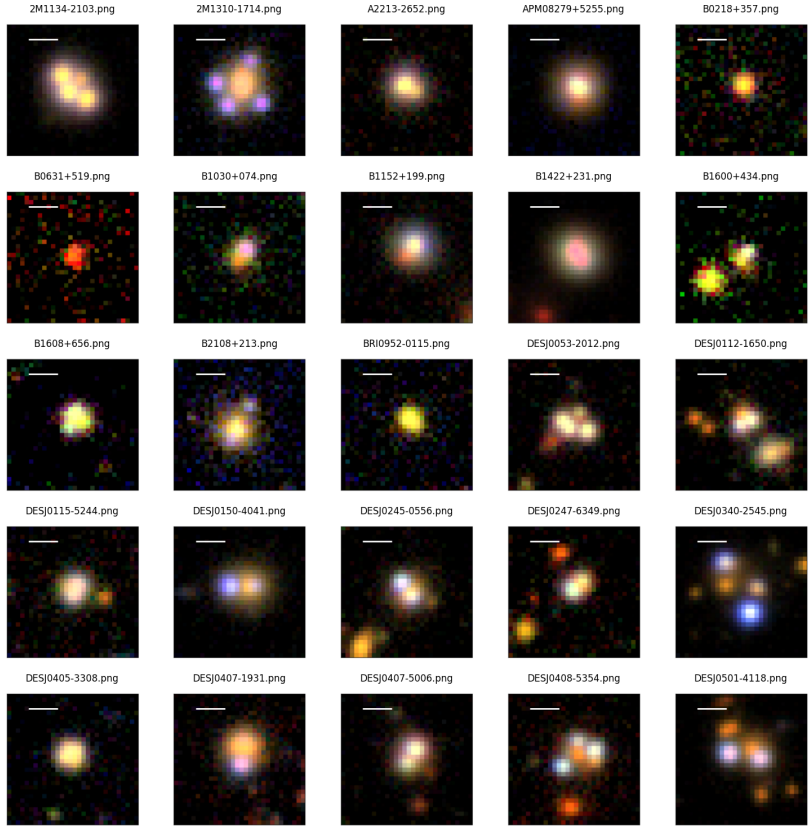
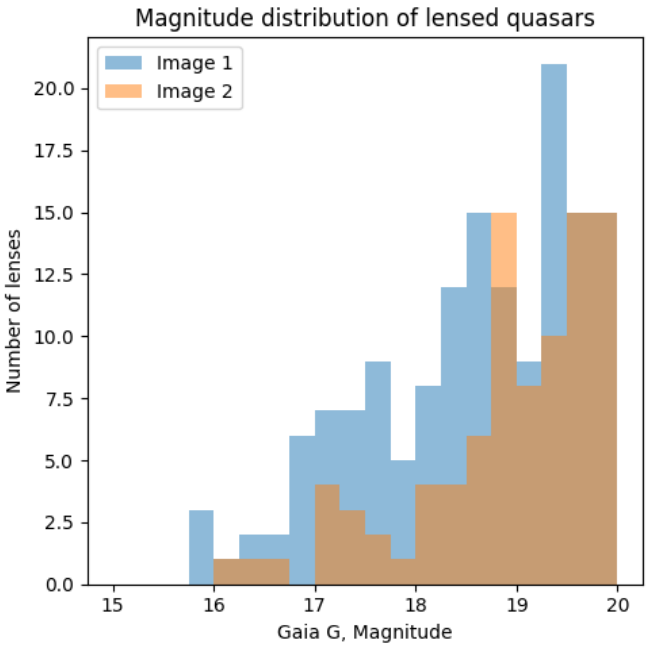


Figure: Gravitationally Lensed Quasar Database

How to looks gravitationally lensed quasars

- Distribution of quasar images on the sky



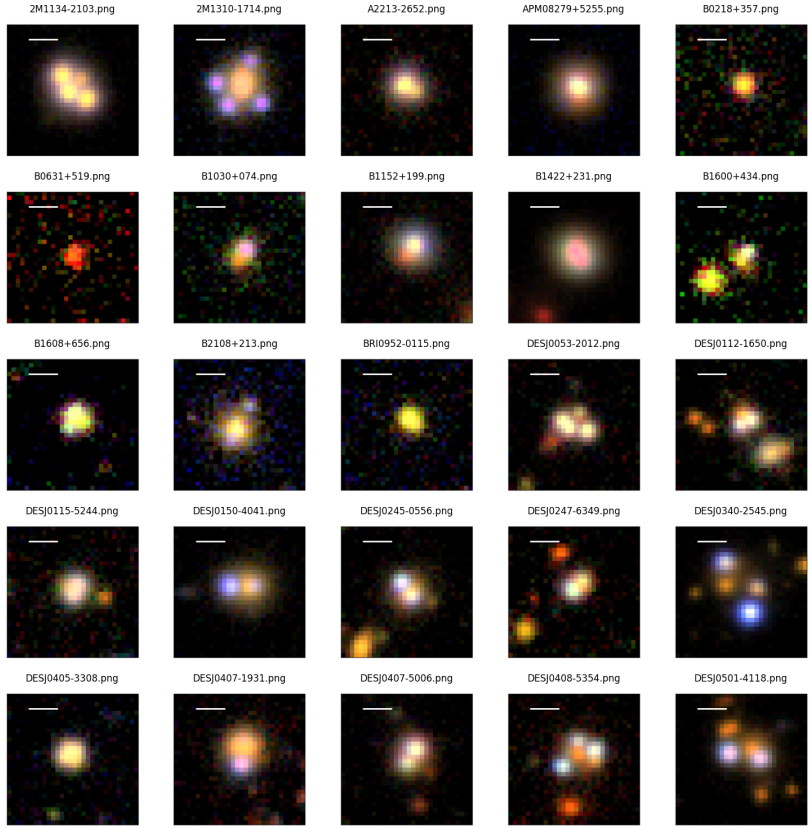


Figure: Gravitationally Lensed Quasar Database

The properties of gravitationally lensed quasars

- Multiple point-like images (sep $\approx 2''$)
- Presence of a lensing galaxy between the images
- Simmilary of the image colors (could be distorssed by the lensing galaxy)

Source selection

- Source Quasar surveys: SDSS: Advantages: have spectra (BOSS, e-BOSS etc.) Disadvantages: Have a limited number of sources with measured.
  GAIA sources: Advantages: have a proper motion and parallax maeasurements, as well as precise spatial resolution. Have a large number of sources. The DR3 have a catalog of quasars. Disadvantages: Limited of magnitude (¡=20), the only two bands (BP, RP) photometry (G band cover entire wavelenght range).

JPAS vs. SDSS spectra

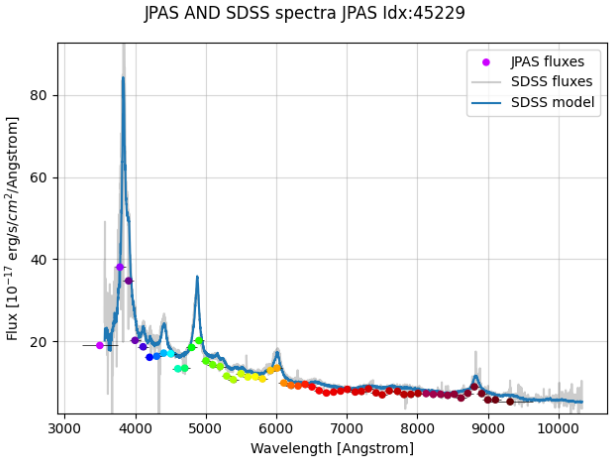
Table: SDSS spectra in JPAS-mini

Class	Number
GALAXY	514
STAR	238
QSO	182

JPAS vs. SDSS spectra

Table: SDSS spectra in JPAS-mini

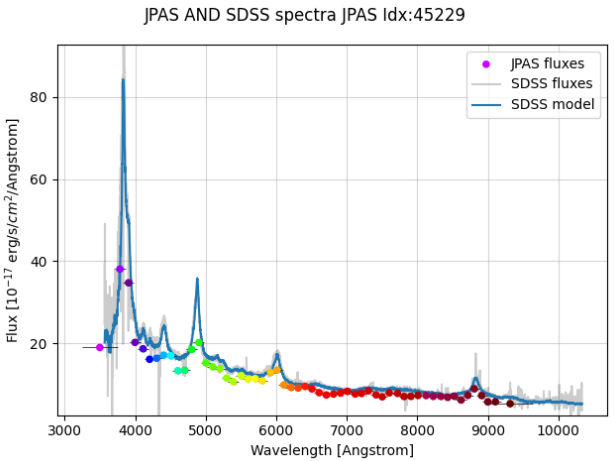
Class	Number
GALAXY	514
STAR	238
QSO	182

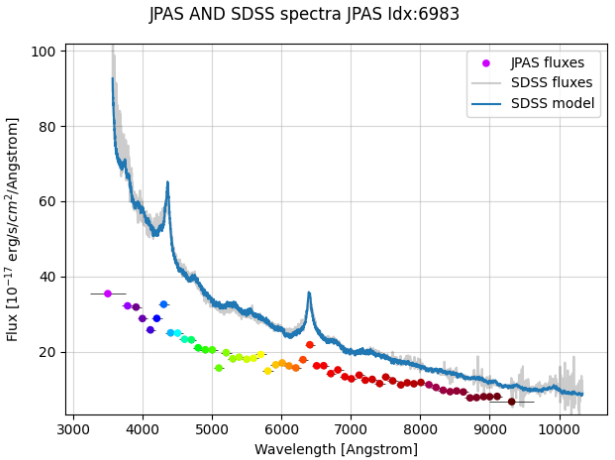


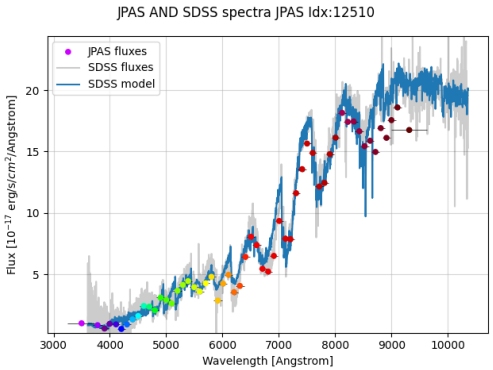
JPAS vs. SDSS spectra

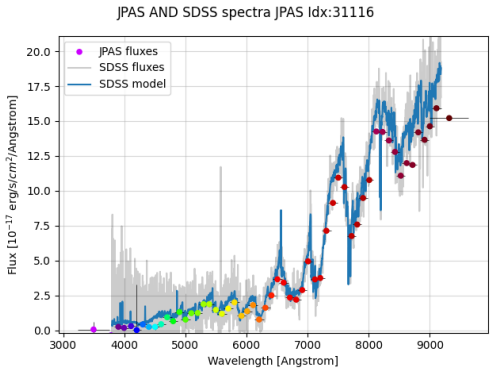
Table: SDSS spectra in JPAS-mini

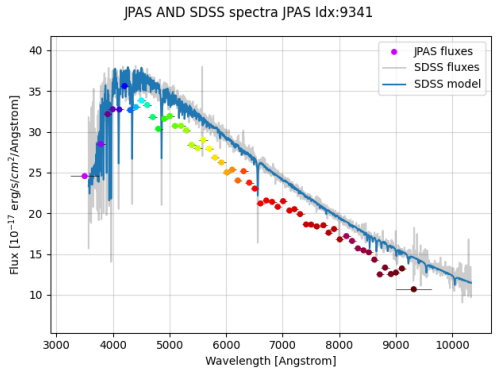
Class	Number
GALAXY	514
STAR	238
QSO	182

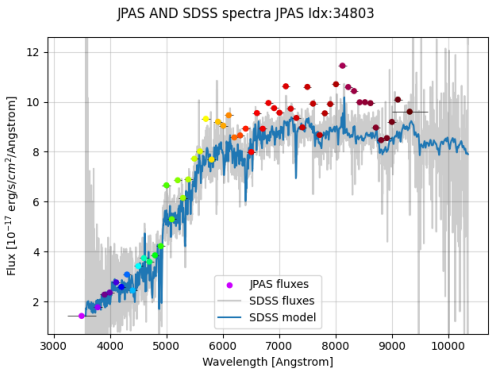


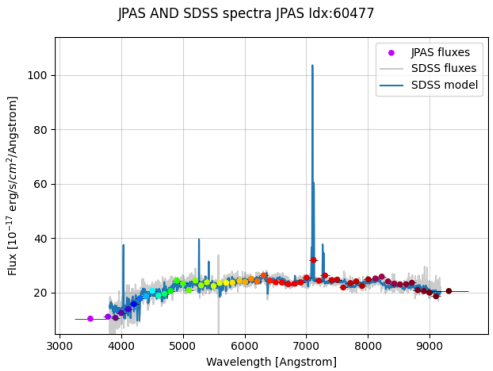


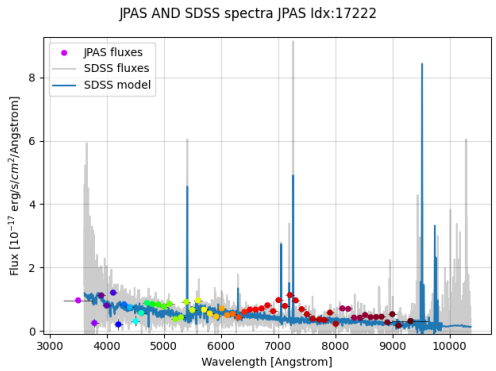

JPAS AND SDSS spectra JPAS Idx:12510
JPAS fluxes
SDSS fluxes
SDSS model
Flux [10^-17 erg/s/cm^2/Angstrom]
Wavelength [Angstrom]


JPAS AND SDSS spectra JPAS Idx:31116
JPAS fluxes
SDSS fluxes
SDSS model
Flux [10^-17 erg/s/cm^2/Angstrom]
Wavelength [Angstrom]

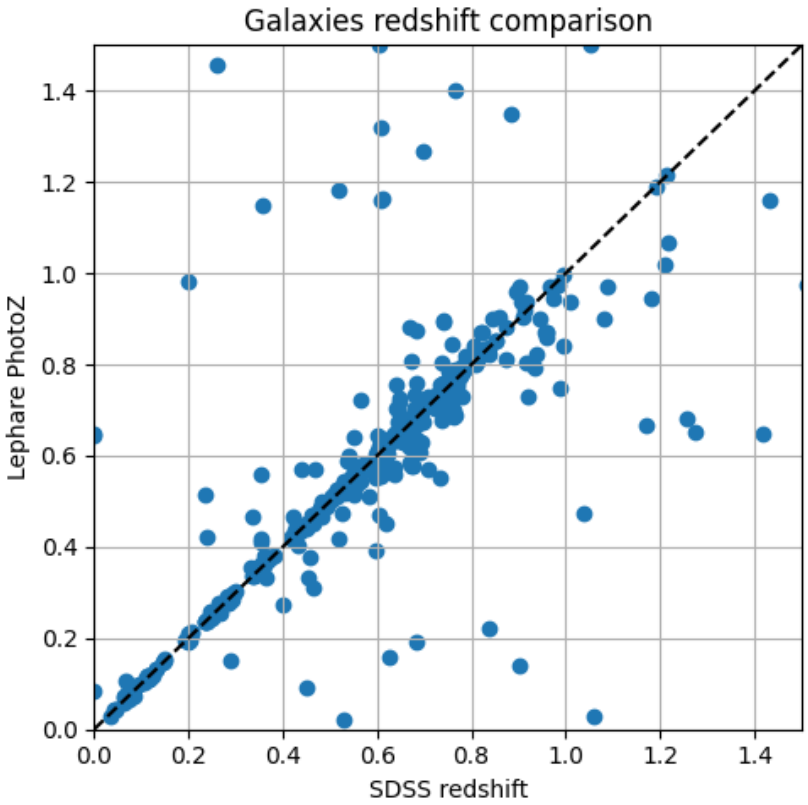

JPAS AND SDSS spectra JPAS Idx:9341
JPAS fluxes
SDSS fluxes
SDSS model
Flux [10^-17 erg/s/cm^2/Angstrom]
Wavelength [Angstrom]


JPAS AND SDSS spectra JPAS Idx:34803
JPAS fluxes
SDSS fluxes
SDSS model
Flux [10^-17 erg/s/cm^2/Angstrom]
Wavelength [Angstrom]

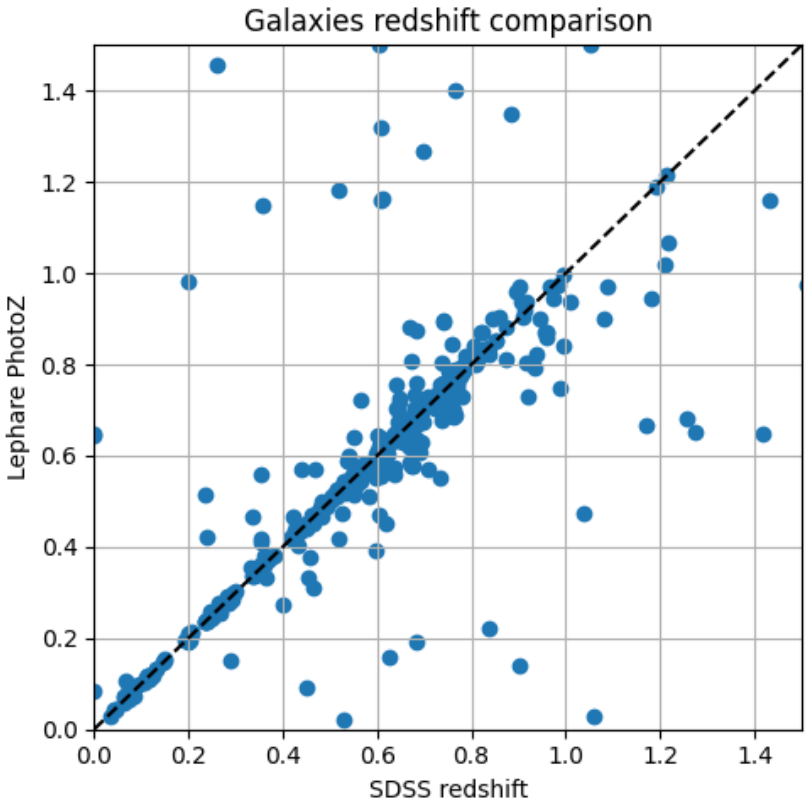

JPAS AND SDSS spectra JPAS Idx:60477
JPAS fluxes
SDSS fluxes
SDSS model
Flux [10^-17 erg/s/cm^2/Angstrom]
Wavelength [Angstrom]

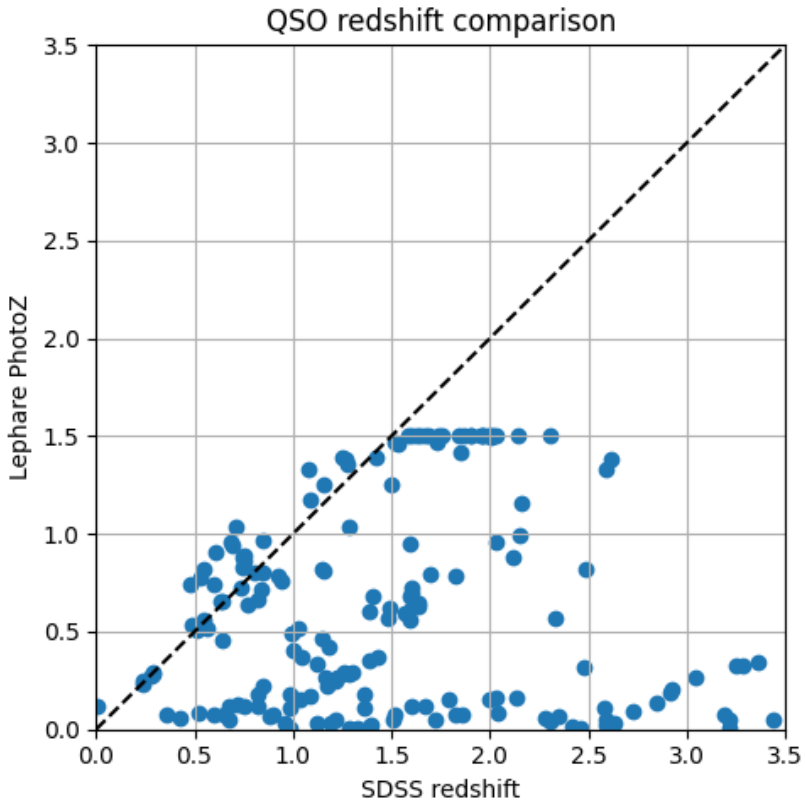

JPAS AND SDSS spectra JPAS Idx:17222
JPAS fluxes
SDSS fluxes
SDSS model
Flux [10^-17 erg/s/cm^2/Angstrom]
Wavelength [Angstrom]

Redshift comparision



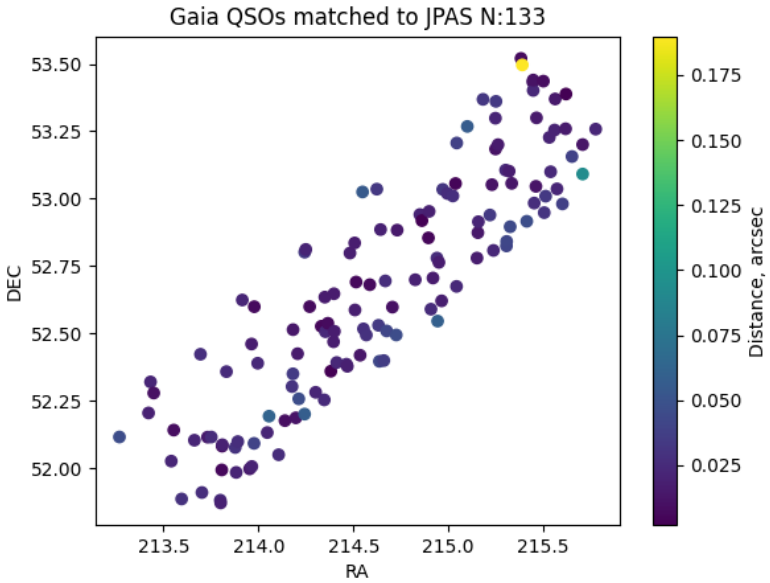
Redshift comparision





GAIA sources

GAIA DR3 quasar candidates (6,649,162 sources)



No multiplets in the GAIA DR3 quasar candidates in 10 arcsec radius

Galaxy-Galaxy lensing

Requires a deep learning methods (CNN) to find the lensed sources.

- Advantages: More numerous than quasars, have a large number of sources.
- Disadvantages: Have a low surface brightness.