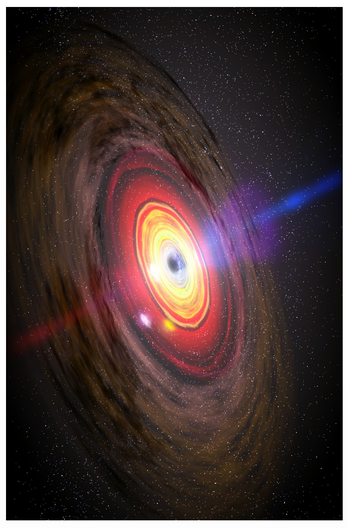

QSFit: a new software for AGN optical spectral analysis

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QSFit is a new software to automatically perform the analysis of Active Galactic Nuclei (AGN) optical/UV spectra. The software provides estimates of:
* AGN continuum luminosities and slopes at several rest frame wavelengths;
* host galaxy luminosities (for sources with z < 0.8);
* luminosities, widths and velocity offsets of 20 emission lines (Hα, Hβ, MgII, [OIII], CIV, etc...);
* luminosities of iron blended lines at optical and UV wavelengths;
* several "quality flags" to assess the reliability of the results.

QSFit fits all components simultaneously, using a smoothly broken power law to account for the **broad band AGN continuum,** which extends over the entire available spectrum.

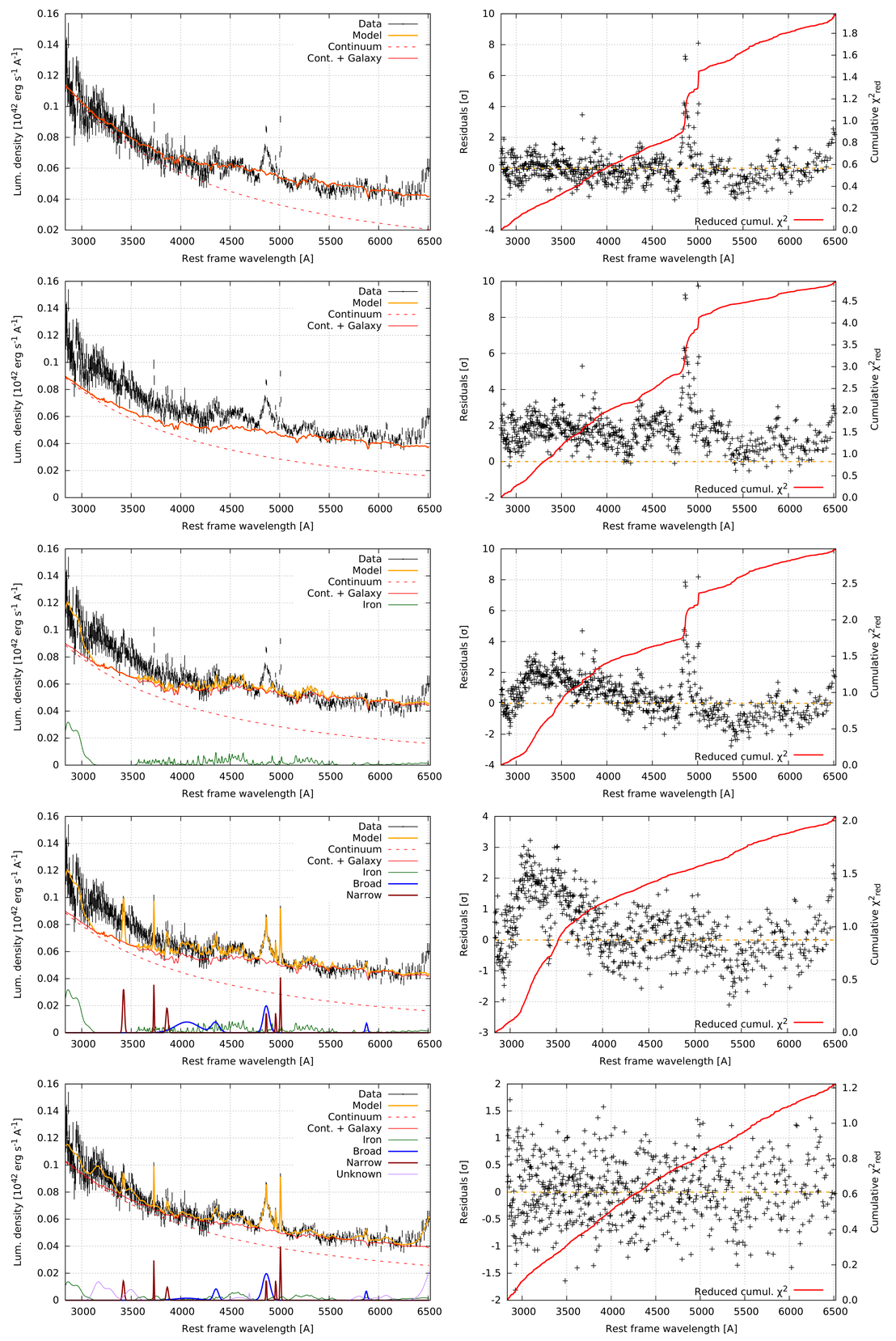
QSFit aims to provide the community with a **standardized framework** to share the AGN spectral analysis recipes, allowing easy reproducibility of the results.

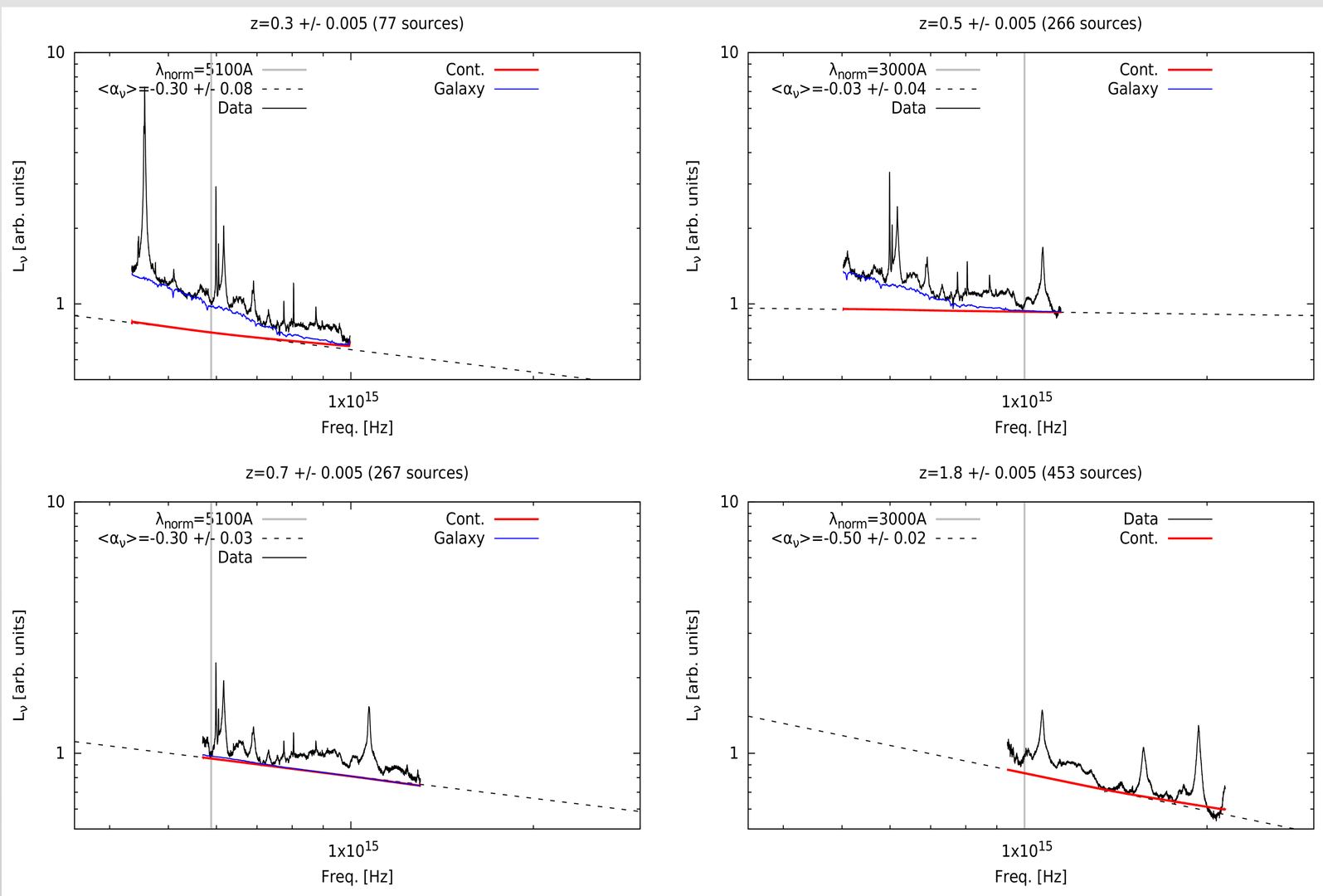
QSFit is written in IDL and will be publicly released as **free software** (under the GPL license).

The **QSFit** model is built step by step, by iteratively adding a component and re-running the minimization procedure. The plots on the right show the comparison between the data and the model, as well as the individual components being added (left panels). The right panels shows the residuals (data - model) in units of 1 σ uncertainties in the data, and the red lines show the cumulative χ^2_{red} across the available wavelength range.

The fitting **process runs through the following steps**:
(i) we add the AGN continuum (actually a smoothly broken power law) and the host galaxy template and run the minimization procedure;
(ii) In order to provide room for further components (namely the emission lines) we lower the continuum normalization until the positive residuals reach ~ 90%, and fix all parameters for next iterations;
(iii) we add the components for the iron templates at UV and optical wavelength, run the minimization procedure, and fix the resulting parameters at their best fit values;
(iv) we add the broad and narrow emission line components. run the minimization procedure, and fix the resulting parameters at their best fit values;
(v) we iteratively add up to 10 "unknown" (i.e. not a priori associated) emission lines, to account for specific features in the spectrum (e.g. in the region 3100-3600A in the figure) and run the minimization procedure leaving all parameters free to vary.

The recipe outlined above allows to **drive the minimization procedure towards a physically acceptable solution**, without human intervention. The typical analysis time of a SDSS optical spectrum on a modern laptop is **~8 s**. Hence, **QSFit** can be used to **quickly analyze large samples** of optical spectra.





We used **QSFit** to analyze a sample of 71,250 spectra of Type 1 AGN observed by SDSS. The whole procedure and the results will be discussed in a forthcoming paper.

The **whole catalog** with all the spectra, the **QSFit** results, analysis log and plots are already available at the following address:

http://ross2.iasfbo.inaf.it/qsfit/

The plots on the left show the reliability of **QSFit** in estimating the broad band AGN continuum:
the black lines show the composite spectrum of a subsample of sources within a very narrow redshift range. The composte spectrum is calculated as the geometrical mean of SDSS de-reddened spectra. The red and blue lines are the continuum and continuum+host galaxy composite spectra of the corresponding **QSFit** components. The average continuum slopes at 5100A (left panels) and 3000A (right panels) are shown with a dashed black line. The slope average and the standard deviation of the mean are shown in the legend.

The plots show that **QSFit** provides (at least on average) a reasonably **good representation of the underlying AGN continuum**, even if the galaxy contribute significantly to the overall luminosity.