

Spectral Components

Nuclear Continuum

$$F_{\lambda, \text{PL}} = F_{\text{PL},0} \left(\frac{\lambda}{\lambda_0} \right)^\alpha \quad (1)$$

where $F_{\text{PL},0}$ is the power-law normalization, α is the power-law slope and λ_0 is the median wavelength of the data wavelength range.

Priors

Code Parameters

- **slope:** description of parameter here
- **normalization:** description of parameter here

Balmer Continuum

If we assume gas clouds with uniform temperature T_e , that are partially optically thick, for wavelengths bluer than the Balmer edge ($\lambda_{\text{BE}} = 3646 \text{ \AA}$, rest frame), the Balmer spectrum can be parameterized as (Grandi et al., 1982):

$$F_{\lambda, \text{BC}} = F_{\text{BE}} B_\lambda(T_e) (1 - e^{-\tau_{\text{BE}}(\frac{\lambda}{\lambda_{\text{BE}}})^3}), \quad \lambda < \lambda_{\text{BE}} \quad (2)$$

where $B_\lambda(T_e)$ is the Planck function at the electron temperature T_e , τ_{BE} is the optical depth at the Balmer edge, and F_{BE} is the normalized flux density at the Balmer edge.

Priors

Code Parameters

- **param1:** description of parameter 1 here

FeII & FeIII

Linear combination of N broadened and scaled iron templates:

$$F_{\lambda, \text{Fe}} = \sum_{i=1, \dots, N} F_{\text{Fe},0,i} \text{FeTempl}_{\lambda,i}(\sigma_i) \quad (3)$$

where $\text{FeTempl}_{\lambda,i}$ is the iron template, $F_{\text{Fe},0,i}$ is the template normalization, and σ_i is the width of the broadening kernel.

Priors

Code Parameters

- **param1:** description of parameter 1 here

Host Galaxy

Linear combination of N galaxy templates:

$$F_{\lambda, \text{Host}} = \sum_{i=1, \dots, N} F_{\text{Host}, 0, i} \text{HostTempl}_{\lambda, i} \quad (4)$$

where $\text{HostTempl}_{\lambda, i}$ is the host galaxy template, and $F_{\text{Host}, 0, i}$ is the template normalization.

Priors

Code Parameters

- param1: description of parameter 1 here

Host Galaxy Reddening

Priors

Code Parameters

- param1: description of parameter 1 here

Nuclear Reddening

Priors

Code Parameters

- param1: description of parameter 1 here

Emission lines

Functional fitting to broad and narrow emission-line components.

- **Broad Emission Line List, $\lambda_{0, b}$**
 - Ly α λ 1215 (actual $\lambda = 1215.670\text{\AA}$)
 - N v λ 1240 (doublet at $\lambda\lambda 1238.808, 1242.796\text{\AA}$)
 - “1400 Feature”: Si iv (doublet at $\lambda\lambda 1393.755, 1402.770\text{\AA}$) plus O iv] blend ($\lambda\lambda 1397.210, 1399.780, 1404.790, 1407.390\text{\AA}$)
 - N iv] λ 1486 (actual $\lambda = 1486.500\text{\AA}$)
 - C iv λ 1549 (unresolved doublet at $\lambda\lambda 1548.188, 1550.762\text{\AA}$)
 - He ii λ 1640 (actual $\lambda = 1640.720\text{\AA}$)
 - O iii] λ 1663 (doublet at $\lambda\lambda 1660.800, 1666.140\text{\AA}$)
 - C iii] λ 1909: actually a blend of Al iii $\lambda\lambda 1854.720, 1862.780\text{\AA}$, Si iii] $\lambda = 1892.030\text{\AA}$, and C iii] $\lambda = 1908.734\text{\AA}$.
 - Mg ii λ 2798 (doublet at $\lambda\lambda 2796.350, 2803.530\text{\AA}$)
 - H δ $\lambda = 4101.735\text{\AA}$
 - H γ $\lambda = 4340.450\text{\AA}$
 - He ii λ 4686 (actual $\lambda = 4685.650\text{\AA}$)

- H β $\lambda = 4861.320\text{\AA}$
- He I $\lambda 4922$ (actual $\lambda = 4921.9\text{\AA}$)
- He I $\lambda = 5016\text{\AA}$
- He I $\lambda 5876$ (actual $\lambda = 5875.680\text{\AA}$)
- He I $\lambda 6678$ (actual $\lambda = 6678.000\text{\AA}$)
- He I $\lambda 7065$ (actual $\lambda = 7065.300\text{\AA}$)
- H α $\lambda = 6562.780\text{\AA}$

• **Narrow Emission Line List, $\lambda_{0,n}$**

- [Ne V] $\lambda 3425.900\text{\AA}$
- [O II] $\lambda\lambda 3726.000, 3728.800\text{\AA}$
- [Ne III] $\lambda 3868.800\text{\AA}$
- He II (actual $\lambda = 4685.650\text{\AA}$)
- H β $\lambda = 4861.320\text{\AA}$
- [O III] $\lambda\lambda 4958.920, 5006.850\text{\AA}$
- [N II] $\lambda\lambda 6548.060, 6583.39\text{\AA}$
- H α $\lambda = 6562.780\text{\AA}$
- [Si II] $\lambda\lambda 6716.420, 6730.780\text{\AA}$

Fitting Function Possibilities

- Narrow Lines
 - Single Gaussian with Prior (1)
 - Option (automatically test) for additional (broader) Gaussian to [O III] $\lambda\lambda 4959, 5007$ base.
- Broad Lines
 - Multiple Gaussians
 - Multiple Gauss-Hermite polynomials
 - Gaussian (very broad) plus Gauss-Hermite (broad)
 - Multiple Lorentzians

Functional Forms

- Gaussian:

$$F_\lambda = \frac{f_{\text{peak}}}{\sigma\sqrt{2\pi}} e^{-\frac{1}{2}\left(\frac{\lambda-\mu}{\sigma}\right)^2}, \quad (5)$$

where the Gaussian FWHM = $2\sqrt{2\ln 2}\sigma$ and $\mu = \lambda_0(\text{b,n})$.

Free parameters: f_{peak} (peak flux), μ , σ .

- 66th Order Gauss-Hermite Polynomial:

$$F_\lambda = [f_{\text{peak}}\alpha(w)/\sigma] \left(1 + \sum_{j=3}^6 h_j H_j(w) \right), \quad (6)$$

$$w \equiv (\lambda - \mu)/\sigma, \quad (7)$$

$$\alpha(w) = e^{-\frac{1}{2}w^2}. \quad (8)$$

where this follows the normalization of van der Marel & Franx (1993, ApJ, 407, 525; first equation). The H_j coefficients can be found in Cappellari et al. (2002, ApJ, 578, 787):

$$H_3(w) = \frac{w(2w^2 - 3)}{\sqrt{3}}, \quad (9)$$

$$H_4(w) = \frac{w^2(4w^2 - 12) + 3}{2\sqrt{6}}, \quad (10)$$

$$H_5(w) = \frac{w[w^2(4w^2 - 20) + 15]}{2\sqrt{15}}, \quad (11)$$

$$H_6(w) = \frac{w^2[w^2(8w^2 - 60) + 90] - 15}{12\sqrt{5}}. \quad (12)$$

Free parameters: f_{peak} , μ , σ , h_3 , h_4 , h_5 , h_6 .

- Lorentzian

$$F_\lambda = \frac{f_{\text{peak}}}{\pi} \frac{\frac{1}{2}\sigma}{(\lambda - \mu)^2 + (\frac{1}{2}\sigma)^2}, \quad (13)$$

where $\mu = \lambda_0(\text{b,n})$ and the Lorentzian FWHM = $\sigma = 2f_{\text{peak}}/(\pi F(\mu))$.

Priors

1. Width of narrow forbidden lines tied together and FWHM $< 1200 \text{ km s}^{-1}$
2. Narrow emission line redshift solution, i.e., $\mu = \lambda_{0,n}(1 + z) \pm \Delta\mu$ is constant.
3. Narrow line doublet ratios fixed:
 - [O II] $\lambda\lambda 3726.000, 3728.800 \text{ \AA}$; ??:??
 - [O III] $\lambda\lambda 4958.920, 5006.850 \text{ \AA}$; 1:3
 - [Si II] $\lambda\lambda 6716.420, 6730.780 \text{ \AA}$; ??:??
 - [N II] $\lambda\lambda 6548.060, 6583.39 \text{ \AA}$; ??:??
4. Fluxes must be non-negative.
5. Tie together the widths of Broad lines of identical species, e.g., He II $\lambda 1640$ and He II $\lambda 4686$? (To be discussed).
6. assumptions about CIV redshift?? Additional HeII component?
7. Suggested Parameter Space to search (to be discussed)
 - $f_{\text{peak}}/f_{\text{cont}} = [0, 1.\text{d}4, 1.\text{d}-3]$
 - $\mu = \lambda_{0,n}(1 + z) \pm 1000 \text{ km s}^{-1}$; $\Delta\mu \sim f(\text{pixscale})$
 - $\sigma = [100, 3.\text{d}4]$; $\Delta\sigma \sim f(\text{pixscale})$
 - $h_j = [-0.3, 0.3, 1.\text{d}-3]$

Code Parameters

- param1: description of parameter 1 here