# FSPS StellarPopulation parameter descriptions

| Param Names | Default | Descriptions |
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| **Compute_vega_mags** | FALSE | A swicth that sets the zero points of the magnitude system: True uses Vega magnitudes versus AB magnitudes. Can only be changed during initialization. |
| **vactoair_flag** | FALSE | If ***True***, output wavelengths in air (rather than vacuum). Can only be changed during initialization. |
| **zcontinuous** | 0 | Flag specifying how interpolation in metallicity of the simple stellar populations (SSPs) is performed before computing composite stellar population (CSP) model.<br>0: No interpolation, use the metallicity index specified by ***zmet***.<br>1: The SSPs are interpolated to the value of ***logzsol*** before the spectra and magnitudes are computed, and the value of ***zmet*** is ignored.<br>2: The SSPs are convolved with a metalicity distribution function specified by the ***logzsol*** and pmetals parameters. The value of ***zmet*** is ignored<br>3: Use all available SSP metallicities when computing the composite model, for use exclusively with tabular SFHs where the metallicity evolution as a function of ags is given (see ***set_tabular_sfh***()). The values of ***zmet*** and ***logzsol*** are ignored. Furethermore ***add_neb_emission*** must be set to False. Can only be changed during initialization. |
| **add_agb_dust_model** | TRUE | Switch to turn on/off the AGB circumstellar dust model presented in Villaume (2014). The AGB dust emission is scaled by the parameter ***agb_dust***. |
| **add_dust_emission** | TRUE | Switch to turn on/off the Draine & Li 2007 dust emission model. |
| **add_igm_absorption** | FALSE | Switch to include IGM absorption via Madau (1995). The zred parameter must be non-zero for this switch to have any effect. The optical depth can be scaled using the ***igm_factor*** parameter. |
| **add_neb_emission** | FALSE | Switch to turn on/off a nebular emission model (both continuum and line emission), based on Cloudy models from Nell Byler. Contrary to FSPS, this option is turn off by default. |
| **add_neb_continuum** | TRUE | Switch to turn on/off the nebular continuum component (automatically turned off if ***add_neb_emission*** is False). |
| **add_stellar_remnants** | TRUE | Switch to add stellar remnants in the stellar mass computation. |
| **redshift_colors** | FALSE | Flag specifying how to compute magnitudes. This has no effect in python-FSPS. Magnitudes are always computed at a fixed redshift specified by ***zred*** or the redshift paramter of ***get_mags***. See ***get_mags*** for details. |
| **compute_light_ages** | FALSE | Flag specifying wheter to compute light- and mass-weighted ages. If True then the returned are actually light-weighted age (in Gyr) at every wavelength, the returned magnitude are filter transmission weighted averages of these, the ***log_lbol*** atrribute is the bolometric luminosity weighted age, and the ***stellar_mass*** attribute gives the mass-weighted age. |
| **nebemliineinspec** | TRUE | flag to include the emission line fluxes in the spectrum. Turning this off is a significant speedup in model calculation time. If not set, the line luminosities are still computed. |
| **smooth_velocity** | TRUE | Switch to choose smoothing in velocity space (True) or wavelength space (False). |
| **smooth_lsf** | FALSE | Switch to apply smoothing of the SSPs by a wavelength dependent line spread function. See the ***set_lsf***() method for details. Only takes effect if ***smooth_velocity*** is ***True*** |
| **cloudy_dust** | FALSE | Switch to include dust in the Cloudy tables. |
| **agb_dust** | 1 | Scales the circumstellar AGB dust emission. |
| **tpagb_norm_type** | 2 | flag specifying TP-AGB normalization scheme.<br>0: Padova 2007 isochronez<br>1: Conroy & Gunn 2010 normalization<br>2: Villaume, Conroy, Johnson 2015 normalization |
| **dell** | 0 | Shift in ***logLbol*** of the TP-AGB isochrones. Note that the meaning of this parameter and delt has changed to reflect the updated calibrations presented in Conroy & Gunn (2009). That is, these parameters now refer to a modification about the calibrations presented in that paper. Only has effect if ***tpagb_norm_type*** = 1 |
| **delt** | 0 | Shift in logTeff of the TP-AGB isochrones. Only has effect if ***tpagb_norm_type*** = 1 |
| **redgb** | 1 | Modify weight given to RGB. Only available with BaSTI isochrone set. |
| **agb** | 1 | Modify weight given to TP-AGB. This only has effect for FSPS v3.1 or higher. |
| **fcstar** | 1 | Fraction of stars that the Padova isochrones identify as Carbon stars that FSPS assigns to a Carbon star spectrum. Set this to 0.0 if for example the users wishes to turn all Carbon stars into regular M-type stars. |
| **sbss** | 0 | Specific frequency of blue straggler stars. See Conroy et al. (2009a) for details and a plausible range. |

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| **fbhb** | 0 | Fraction of horizontal branch stars that are blue. The blue HB stars are uniformly spread in logTeff to 10,000 K. See Conroy et al (2009a.) |
| **pagb** | 1 | Weight given to the post-AGB phase. A value of 0.0 turns off post-AGB stars; a value of 1.0 implies that the Vassiviadis & Wood (1994) tracks are impolemented as-is. |
| **frac_xrb** | 1 | Scaling factor for the X-ray source spectrum to be added to the SSPs. |
| **zred** | 0 | Redshift. If this value is non-zero and if ***redshift_colors*** = 1, the magnitudes will be computed for the spectrum paced at redshift ***zred***. |
| **zmet** | 1 | The metalicity is specified as an interger ranging between 1 and nz. If ***zcontinuous*** > 0 then this parameter is ignored. |
| **logzsol** | 0 | Parameter describing the metallicity, given in united of log(Z/Z_sun). Only used if ***zcontinuous*** > 0. |
| **pmetals** | 2 | The power for the metallicity distribution function (MDF). The MDF is given by (Ze^-Z)^pmetals where Z = z/(z_sun * 10^ ***logzsol***) and z is the metallicity in linear units (i.e. z_sun = 0.019). Using a negative value will result in smoothing of the SSPs by a three-point traingular kernel before linear interpolation (in logZ) to the requested metallicity. Only used if ***zcontinuous*** = 2 |
| **imf_type** | 2 | Common variable defining the IMF type:<br>0: Salpeter (1955)<br>1: Chabrier (2003)<br>2: Kroupa (2001)<br>3: van Dokkum (2008)<br>4: Dave (2008)<br>5: tabulated piece-wise power law IMF, specified in imf.dat file located in the data directory. |
| **imf_upper_limit** | 120 | The upper limit of the IMF, in solar masses. Not that if this is above the maximum mass in the isochrones then those stars will not contribute to the spectrum but will affect the overall IMF normalization. |
| **imf_lower_limit** | 0.08 | The lower of the IMF, in solar masses. Note that if this is below the minimum mass in the isochrones then those stars will not contribute to the spectrum but will affect the overall IMF normalization. |
| **imf1** | 1.3 | Logarithmic slope of the IMF over the range 0.08 < M < 0.5 M_sun. Only used if ***imf_type*** = 2 |
| **imf2** | 2.3 | Logarithmic slope of the IMF over the range 0.5 < M < M_sun. Only used if ***imf_type*** = 2 |
| **imf3** | 2.3 | Logarithmic slope of the IMF over the range M_sun < M < 120 M_sun. Only used if ***imf_type*** = 2 |
| **vdmc** | 0.08 | IMF parameter defined in van Dokkum (2008). Only used if ***imf_type*** = 3 |
| **mdave** | 0.5 | IMF parameter defined in Dave (2008). Only used if ***imf_type*** = 4 |
| **evtype** | -1 | Compute SSPs for only the given evolutionary type. All phases used when set to -1 |
| **use_wr_spectra** | 1 | Turn on/off the WR spectral library. If off (0), will use the main default library instead(?). |
| **logt_wmb_hot** | 0 | Use the Eldridge (2017) WMBasic hot star library above this value of logTeff or 25,000 K, whichever is larger. |
| **add_xrb_emission** | 0 | Turn on/off the x-ray binary population spectra from Garofali et al. |
| **masscut** | 150 | Truncate the IMF above this value |
| **sigma_smooth** | 0 | if ***smooth_velocity*** is ***True***, this gives the velocity dispersion in km/s. Otherwise, it gives the width of the gaussian wavelength smoothing in Anstroms. These widths are in terms of sigma, not FWHM. |
| **min_wave_smooth** | 1.00E+03 | minimum wavelength to consider when smoothing the spectrum |
| **max_wave_smooth** | 1.00E+04 | maximum wavelength to consider when smoothing the spectrum |
| **gas_logu** | -2 | Log of the gas ionization parameter; relevant only for the nebular emission model. |
| **gas_logzz** | 0 | Log of the gas-phase metallicity; relevant only for the nebular emission model. In united of log(Z/Z_sun) |
| **igm_factor** | 1 | Factor used to scale the IGM optical depth |

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| **sfh** | 0 | Defines the type of star formation history, normalised such that one solar mass of stars is formed over the full SFH. Default values is 0<br>0: compute a simple stellar population (SSP)<br>1: Tau-model. A six parameter SFH (tau model plus a constant component and a burst) with parameters ***tau***, ***const***, ***sf_start***, ***sf_trunc***, ***tburst***, and ***fburst*** (see below).<br>2: This option is not supported in python-FSPS<br>3: Compute a tabulated SFH, which is supplied through the ***set_tabular_sfh()*** method. See that method for details.<br>4: Delayed tau-model. This is the same as option 1 except that the tau-model component takes the form te^(-t/ ***tau***)<br>5: Delayed tau-model with a transition at a time ***sf_trunc*** to a linearly decreasing SFH with the slope specified by ***sf_slope***. See Simha et al. 2014 for details. |
| **tau** | 1 | defines e-folding time for the SFH, in Gyr. Only used if ***sfh*** = 1 or ***sfh*** = 4 |
| **const** | 0 | Defines the constant component of the SFH. This quantity is defined as the fraction of mass formed in a constant mode of SF; the range is therefore 0 <= C <= 1. Only used if ***sfh*** = 1 or ***sfh*** = 4. |
| **sf_start** | 0 | start time of the SFH, in Gyr. Only used if ***sfh*** = 1 or ***sfh*** = 4 or ***sfh*** = 5 |
| **sf_trunc** | 0 | truncation time of the SFH, in Gyr. If set to 0.0, there is no truncation. Only used if ***sfh*** = 1 or ***sfh*** = 4 or ***sfh*** = 5 |
| **tage** | 0 | if set to non-zero value, the ***fsps.StellarPopulation.compute_csp()*** method will compute the spectra and magnitudes only at this age, and will therefore only output one age result. The units are Gyr. (The default is to compute and return results from t ~ 0 to the maximum age in the isochrones. |
| **fburst** | 0 | Defines the fraction of mass formed in an instantaneous burst of star formation. Only used if ***sfh*** = 1 or ***sfh*** = 4. |
| **tburst** | 11 | Defines the age of the Universe when the burst occurs. If ***tburst*** > ***tage*** then there is no burst. Only used if ***sfh*** = 1 or ***sfh*** = 4. |
| **sf_slope** | 0 | For ***sfh*** = 5, this is the slope of the SFR after time ***sf_trunc***. |
| **fsps.StellarPopulation.<br>set_tabular_sfh()** | age, sfr, Z | ***age***: Time since the beginning of the Universe in Gyr. Must be increasing. Ndarray of shape (ntab,)<br>***sfr***: the SFR at each age, in Msun/yr. Must be an ndarray same length as ***age***, and contain at least one non-zero value.<br>***Z***: (optional) The metallicity at each ***age***, in units of absolate metallitiy (e.g. ***Z*** = 0.019 for solar with the Padova isochrones and Miles stelalr library) |