



# GALEV evolutionary synthesis models on the web

<http://www.galev.org>

Ralf Kotulla<sup>1</sup>, Uta Fritze<sup>1</sup>, Peter Weilbacher<sup>2</sup>, and Peter Anders<sup>3</sup>: the GALEV team

<sup>1</sup> Centre for Astrophysics Research, University of Hertfordshire, College Lane, Hatfield AL10 9AB, United Kingdom

<sup>2</sup> Astrophysikalisches Institut Potsdam, An der Sternwarte 16, 14482 Postdam, Germany

<sup>3</sup> Sterrekundig Instituut, Princetonplein 5, 3584 CC Utrecht, The Netherlands

r.kotulla@herts.ac.uk – u.fritze@herts.ac.uk – pweilbacher@aip.de – p.anders@astro.uu.nl – info@galev.org



GALEV evolutionary synthesis models describe the evolution of stellar populations in general, of star clusters as well as of galaxies, both in terms of resolved stellar populations and of integrated light properties over cosmological timescales of  $\geq 13$  Gyr from the onset of star formation shortly after the Big Bang until today.

GALEV includes a simultaneous treatment of the chemical evolution of the gas and the spectral evolution of the stellar content, allowing for what we call a chemically consistent treatment: We use input physics (stellar evolutionary tracks, stellar yields and model atmospheres) for a large range of metallicities and consistently account for the increasing

gas abundances and hence increasing initial abundances of successive stellar generations. Here we present the latest version of the GALEV evolutionary synthesis models that are now interactively available at <http://www.galev.org>.



## Galaxy Evolutionary Synthesis Models

help you understand your data on star clusters and galaxies from the early universe until today in terms of their relevant physical and chemical properties and their evolutionary state.

[Home](#) [About GALEV](#) [Members](#) [Projects](#) [Run your model](#) [Data](#) [Publications](#)

### Detailed information

**Initial mass function**  [\(help\)](#)  
Salpeter (1955): constant slope of -1.35, mass-range 0.1-100 $M_{\odot}$  or 0.1-120  $M_{\odot}$   
Kroupa: not yet available, coming soon  
Chabrier: not yet available, coming soon

**Gas emission**  [\(help\)](#)  
Full Emission lines: click here for list of supported emission lines  
Continuum only: No emission lines, but continuum is still considered  
No gas emission: Disable both continuum and line emission

**Metallicity**  [\(help\)](#)  
Choose either chemically consistent treatment or fix the metallicity to a specific value

**Galaxy type**  [\(help\)](#)  
to change the galaxy type please use your browser's "back" option.

**Total mass**  solar masses [\(help\)](#)  
Initial mass of the galaxy in solar masses

**Burst strength**  [\(help\)](#)  
Fraction of the gas-mass at the onset of the burst that will be converted into stars

**Burst duration**  [\(help\)](#)  
e-folding timescale of the exponential decline of the burst (in years)

**Time of burst**  [\(help\)](#)  
Age of the galaxy (in years) when the burst sets in

### Extinction

**Extinction law:**  [\(help\)](#)  
maximum extinction  $E(B-V)$   [\(help\)](#) mag  
extinction steps  $\Delta E(B-V)$   [\(help\)](#) mag

### Cosmological parameters:

**Hubble  $H_0$**    $\text{km s}^{-1} \text{Mpc}^{-1}$  [\(help\)](#)  
Formation redshift:  [\(help\)](#)  
 $\Omega_M$  Matter:  [\(help\)](#)  
 $\Omega_{\Lambda}$  Lambda:  [\(help\)](#)  
 $\Omega_K$ :  [\(help\)](#)  
Z-max:  [\(help\)](#)

### Output options

**time evolution**  all [\(help\)](#)  
 spectra (~20 MB) [\(help\)](#)  
 absolute magnitudes as function of time (<1 MB pro extinction step) [\(help\)](#)  
 statistics (stellar and gas-masses, SFRs, etc) (~100 kB) [\(help\)](#)

**cosmology**  all [\(help\)](#)  
 redshifted spectra with and without attenuation (Madou 1995) (~50 MB III) [\(help\)](#)  
 absolute observed frame magnitudes (<1 MB) [\(help\)](#)  
 apparent magnitudes without attenuation (<1 MB) [\(help\)](#)  
 apparent magnitudes with attenuation (Madou 1995) (<1 MB) [\(help\)](#)  
 e-corrections (evolutionary correction factors) (<1 MB) [\(help\)](#)  
 k-corrections (<1 MB) [\(help\)](#)  
 k-corrections including attenuation (<1 MB) [\(help\)](#)  
 statistics (stellar and gas masses, SFR, galaxy age, distance modulus, etc) (~150 kB) [\(help\)](#)

**Normalization**  Normalize magnitudes to fit RC3 (only for standard types) ? [\(help\)](#)

### Filters

Filter #1   [\(help\)](#)  
Filter #2   [\(help\)](#)  
Filter #3   [\(help\)](#)

### Check parameters

## Model parameters

- We offer a selection of the most frequently used **Initial Mass Functions (IMFs)**: Salpeter and Kroupa
- **Gaseous emission** can be switched off or on, and contains line and/or continuum emission.
- The **metallicity** can be fixed or set to chemically consistent.

### To describe galaxies you specify:

- **Galaxy mass**
- **Galaxy type**: We offer
  - standard spectral types E . . . Sd,
  - exponentially declining SFRs,
  - SFRs proportional to the gas-mass,
  - constant SFRs, and
  - user-defined SFHs for which the user specifies the SFR at each time.

- **Starbursts** or **Truncation** scenarios can be added to all galaxy types.

### To describe observations the user can also specify:

- **Extinction** We offer the following extinction-laws:
  - Calzetti for starburst galaxies
  - Cardelli for more quiescent galaxies
- **Cosmological models** can be specified via:
  - Hubble constant  $H_0$
  - Energy density  $\Omega_M$  and  $\Omega_{\Lambda}$
  - Formation redshift
- **Filter sets** are required to compute magnitudes in the Vega-, AB- or ST-system

## Output options

### Direct output from GALEV

- **Integrated spectra and magnitudes** as function of time
- **Stellar and gaseous masses**
- **Star formation rates** and
- **ISM metallicities**

### Combined with a cosmological model:

- **Redshifted spectra** with and without attenuation
- **Absolute magnitudes**
- **Apparent and attenuated apparent magnitudes**
- **Cosmological k-corrections** with and without attenuation
- **Evolutionary e-corrections**

### If extinction was specified:

- All above parameters for each extinction step

## How long does it take?

- To configure your model:  $\approx 5$  min.
- To compute it:  $\lesssim 10$  minutes, depending on parameters, output and CPU load on our server

## Upcoming features of the web-interface

### New input physics

- Extended isochrone sets
- Further and/or higher resolution spectral libraries
- User-defined IMF shapes (only for SSPs)

### New output options

- Stellar absorption features, e.g. Lick indices
- Colour magnitude diagrams
- Detailed chemical abundances