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# GALEV evolutionary synthesis on the web – current state and future plans

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**Abstract.** 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 > 13 Gyr from the onset of star formation shortly after the Big Bang until today. A new web-interface now allows to run customized GALEV models with user-defined parameters. This web-interface, all data, and many more features to come, can be found at http://www.galev.org.

**Keywords.** stars: evolution – galaxies: star clusters – galaxies: evolution – methods: numerical

## 1. Introduction

GALEV (short for GALaxy EVolution) evolutionary synthesis models aim at describing the spectral and chemical evolution of stellar populations with a wide range of properties from simple stellar populations (SSPs) such as star clusters to galaxies with their generally complex star formation histories. Our philosophy is to use only a minimum of input parameters, mainly the star formation history and initial mass function (IMF), in order to reproduce a wealth of physical parameters such as spectra, colours, star formation rates, stellar and gaseous masses, mass-to-light ratios and metallicities for a wide range of galaxy types. Similar to other evolutionary synthesis models (e.g. Bruzual & Charlot 2003 or Leitherer *et al.* 1999) we use stellar evolution data (isochrones) and stellar spectra libraries. For young stellar population GALEV furthermore includes *emission lines.*

For galaxies, 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 initial abundances of successive stellar generations.

## 2. Run your own model online at http://www.galev.org

The latest GALEV version is reviewed in Kotulla *et al.* (2009) and is freely accessible online via an interactive web-interface that can be found at http://www.galev.org. There the user can specify all parameters that are necessary to fully customize the model. Several different IMFs and metallicities are available. Models by default include emission lines (for details see Anders & Fritze 2003) and, for galaxies, chemically consistent chemical evolution (also see Bicker *et al.* 2004 and Kotulla & Fritze 2009). Further parameters are a total mass, star formation history (exponentially declining star formation rates

(SFR), SFR proportional to the available gas-mass, constant SFR, or a user-defined arbitrary SFH) and optional parameters for a starburst or SFR truncation scenario (see, e.g., Falkenberg *et al.* 2009a,b). Dust extinction can be specified via extinction curves and a cosmological model can be chosen to trace evolution with redshift.

As output options we offer spectra or magnitudes, both as function of time or redshift. Magnitudes can be computed for a wide range of filters from most current instruments *including the new Wide Field Camera 3* that has recently been installed on HST. The user also has the choice of the magnitude system (Vega, AB or ST). Additionally we supply physical parameters (gaseous and stellar masses, SFR, metallicities etc.) for each time-step/redshift.

For undisturbed galaxy types E, S0 and Sa through Sd we offer pre-calibrated models for which the SFH was tuned to reproduce a wide range of observables (spectra and colours) and physical parameters (masses, gas-fractions, metallicities and mass-to-light ratios). A detailed comparison is given in Kotulla *et al.* (2009).

## 3. Recent additions and future plans

In Anders *et al.* (2009) we combined GALEV models with N-body simulations to study the impact of dynamical mass loss of star cluster in a tidal field on the observational properties. We find significant biases that arise if cluster dissolution is not accounted for.

To keep up with current innovations on both observational and theoretical fronts we are currently working on a new release of GALEV. This new version will offer a significantly improved suite of stellar evolution data including binaries (Anders & Izzard, in preparation; also see Li & Han 2008) and an improved treatment of TP-AGB stars (Marigo *et al.* 2008). A new high-resolution library (Anders, Brott & Hauschildt, in preparation) has recently been computed, allowing to model stellar populations at the highest resolutions currently available from modern spectrographs. For more information on these two aspects also see Anders *et al.* (2009, this proceeding).

Upcoming improvements furthermore include an extended set of user-definable IMFs for models of star clusters to offer more flexibility for the analysis of these systems. On the other end of the mass spectrum we will include a detailed treatment of stochastic attenuation in the line-of-sight to galaxies in the high-redshift universe to fully account for the resulting uncertainties.

Once these features are implemented and fully tested these will be made publicly available to the community, so stay tuned!

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