Chemical Evolution Of Elliptical Galaxies

Carlo M. De Masi

Supervisor: Prof. F. Matteucci

1. Introduction

The origin and evolution of elliptical galaxies is still a matter of debate. Cosmological hierarchical formation scenario suggest they should have formed at any redshift as the result of merging of spiral galaxies; on the other hand, the chemical properties observed at the present time in the dominant stellar populations suggest that these galaxies should have formed most of their stars at early time, and have consumed quickly their gas by means of a very intense star formation and galactic winds. The ***astroarchaeological approach*** consists in interpreting the chemical patterns observed today as a function of the evolution history of the galaxy, which allows us to reconstruct the history of star formation of these objects.

2. Dataset

Consists of 3360 early-type galaxies in the redshift range $0.05 < z < 0.06$, which have been morphologically inspected and classified as early-types out of an initial sample extracted from the Data Release 4 (DR4) of the Sloan Digital Sky Survey (SDSS).

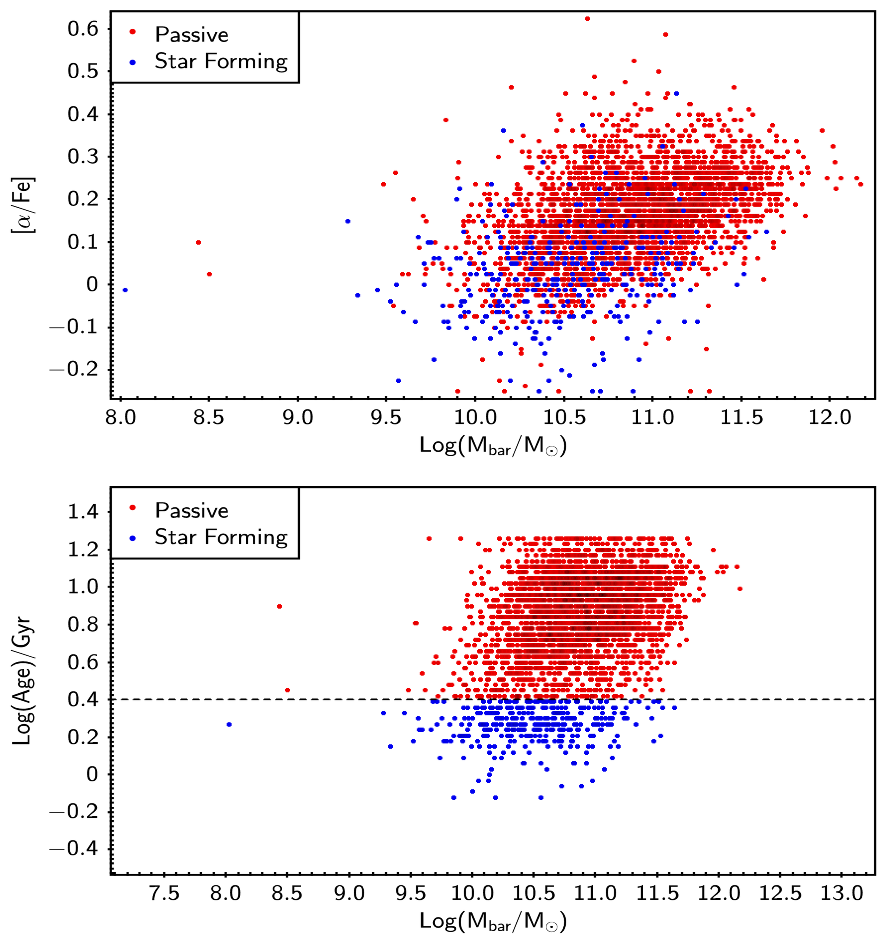


Figure 1. [α/Fe] ratio (top panel) and age (bottom panel), as a a function of the internal velocity dispersion σ for the galaxies in the catalog. Passive galaxies are marked in red, while blue points indicate galaxies with signs of recent star formation.

3. Chemical Evolution Model

Revised version of the Pipino, Matteucci (2004) model:

- multi-shell representation of the galaxy;
- Type I/II SNe feedback;
- initial infall episode;
- models obtained by varying the star formation efficiency, infall time-scale, IMF;

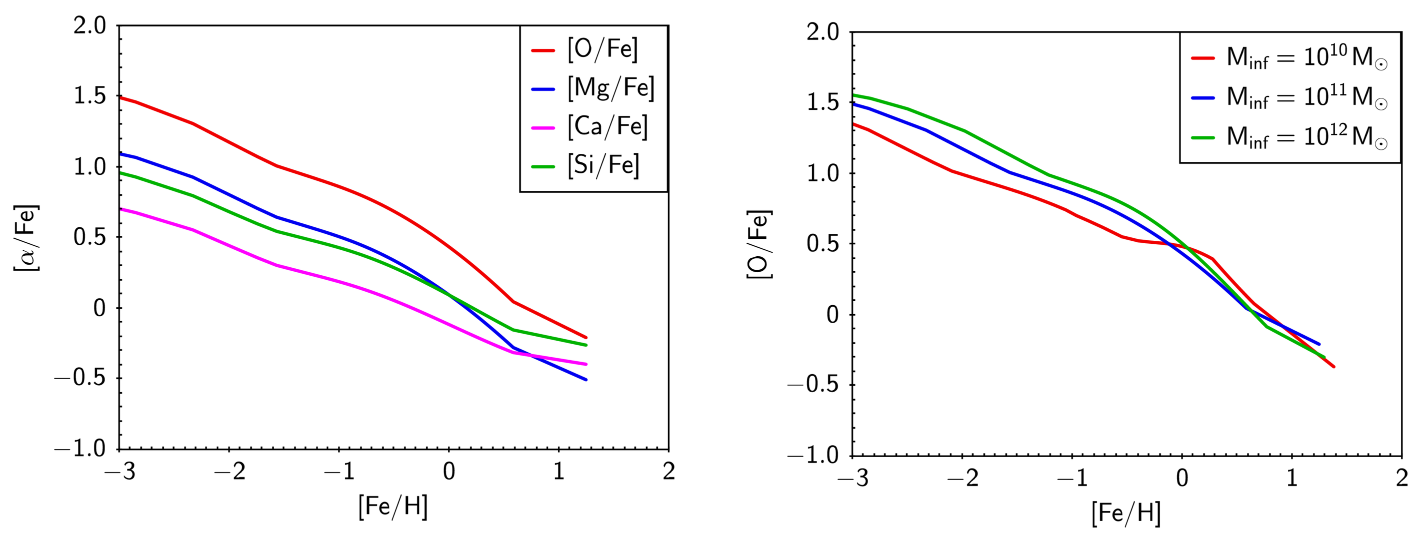


Figure 2. Output of the chemical evolution code. O, Mg, Si, Ca/Fe abundance ratios in the ISM as functions of [Fe/H] for the core of a 10^{11} M_{Sun} galaxy (left), and O/Fe abundance ratio in the ISM as function of [Fe/H] for the core of galaxies with different stellar masses (right).

Contacts

Carlo M. De Masi

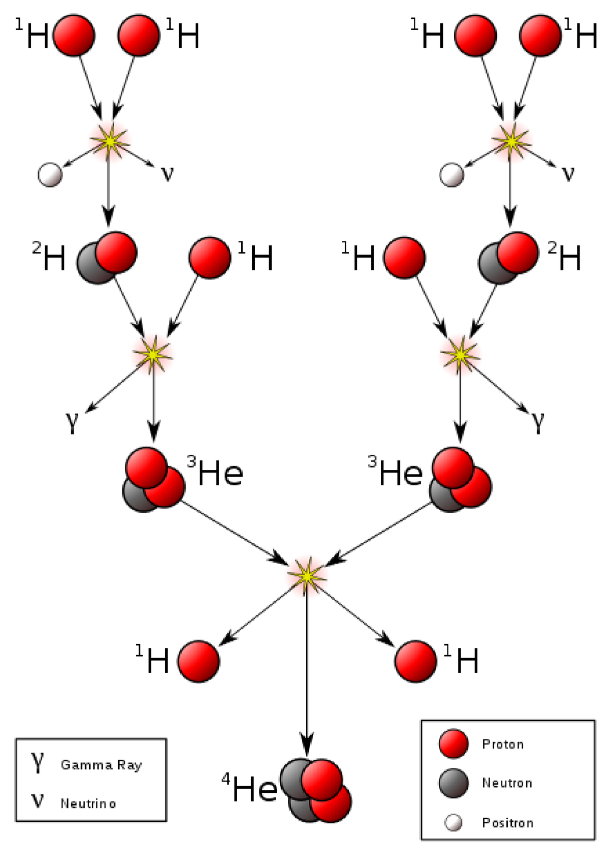
Email: demasi@oats.inaf.it

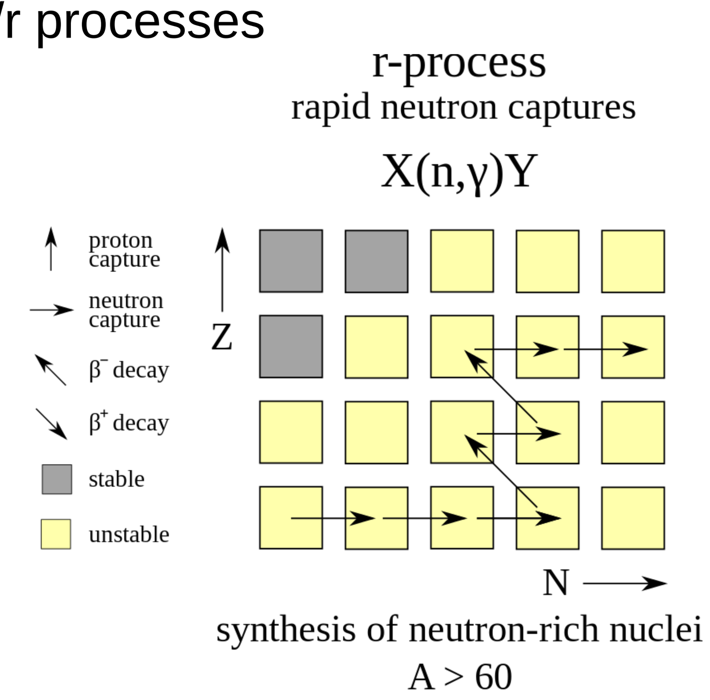
4. Stellar Yields

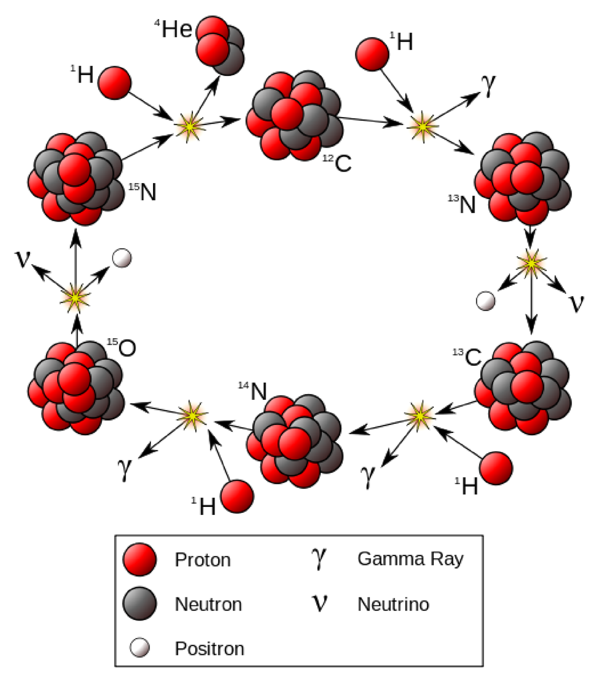
Amount of both newly formed and pre-existing elements ejected by stars of all masses at their death.

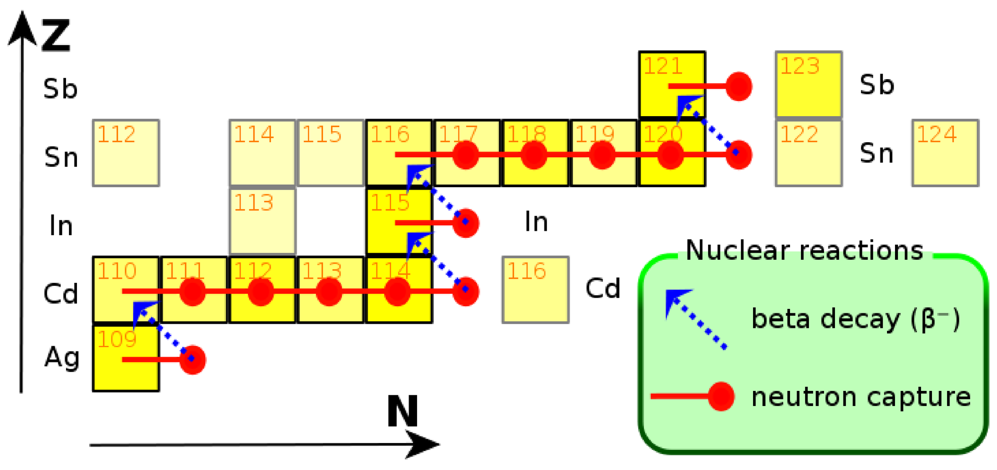
Elements with:

- **A< 60:** quiescent burning phases
  - p-p chain (1), CNO cycle (2): **H → He**
  - 3α process: **He → ^{12}C**
  - synthesis of α particles: **α elements**
- **A>60:** s/r processes









5. Model Predictions

We tested models obtained with different configurations of the parameters; the best results were obtained by assuming an IMF becoming top-heavier in more massive galaxies.

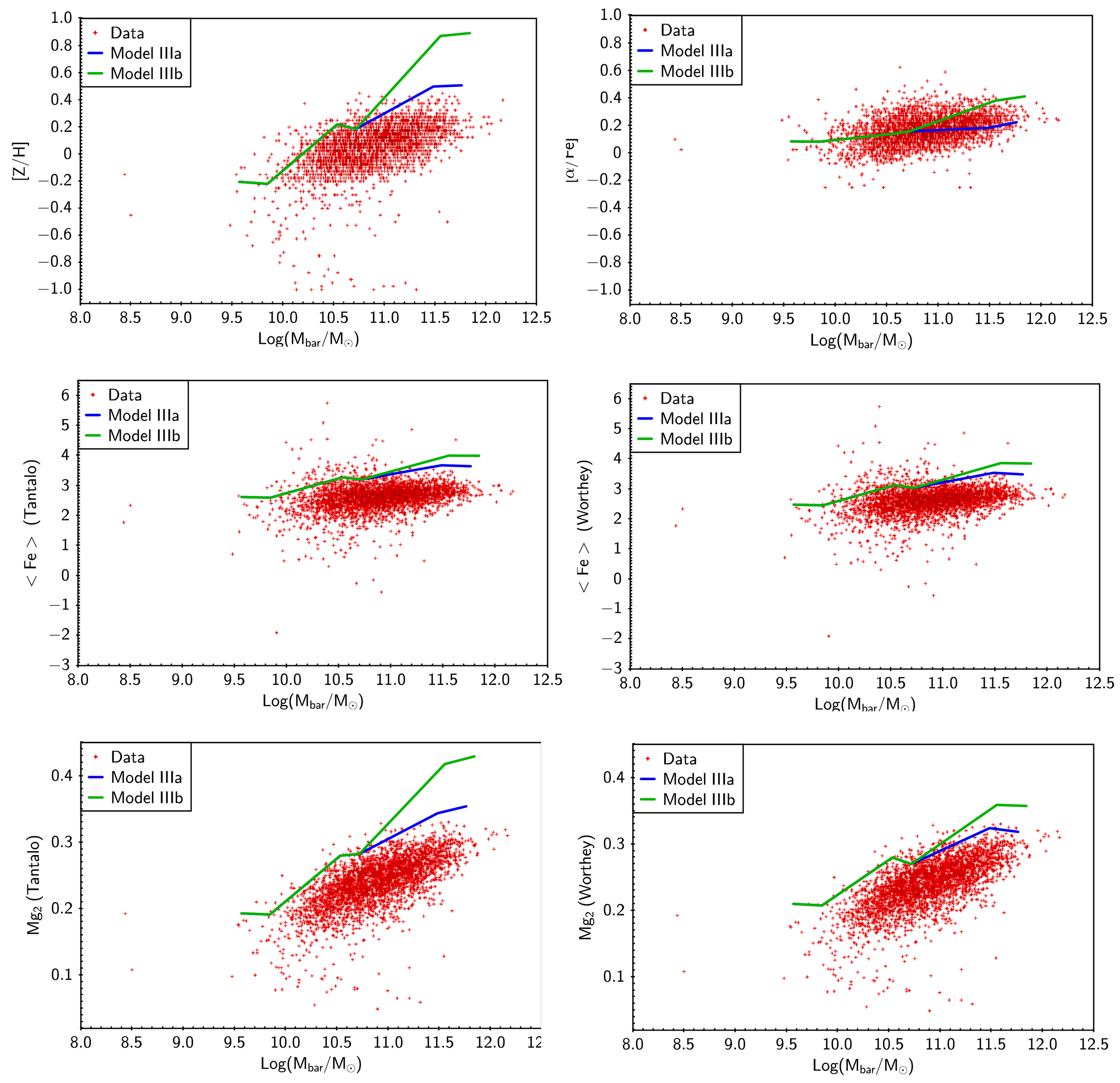


Figure 3. Comparison between the observed abundance patterns and the ones derived from the best-fitting models, assuming an IMF becoming top-heavier in more massive galaxies.

References

Matteucci F., 2012, Chemical evolution of galaxies (Astronomy and Astrophysics Library)

Matteucci F., 1994, A&A, 288, 57

Matteucci F., Ponzone R., Gibson B. K., 1998, A&A, 335, 855

Pipino A., Matteucci F., 2004, MNRAS, 347, 968