What stellar populations can tell us about the evolution of the mass–metallicity relation in SDSS galaxies

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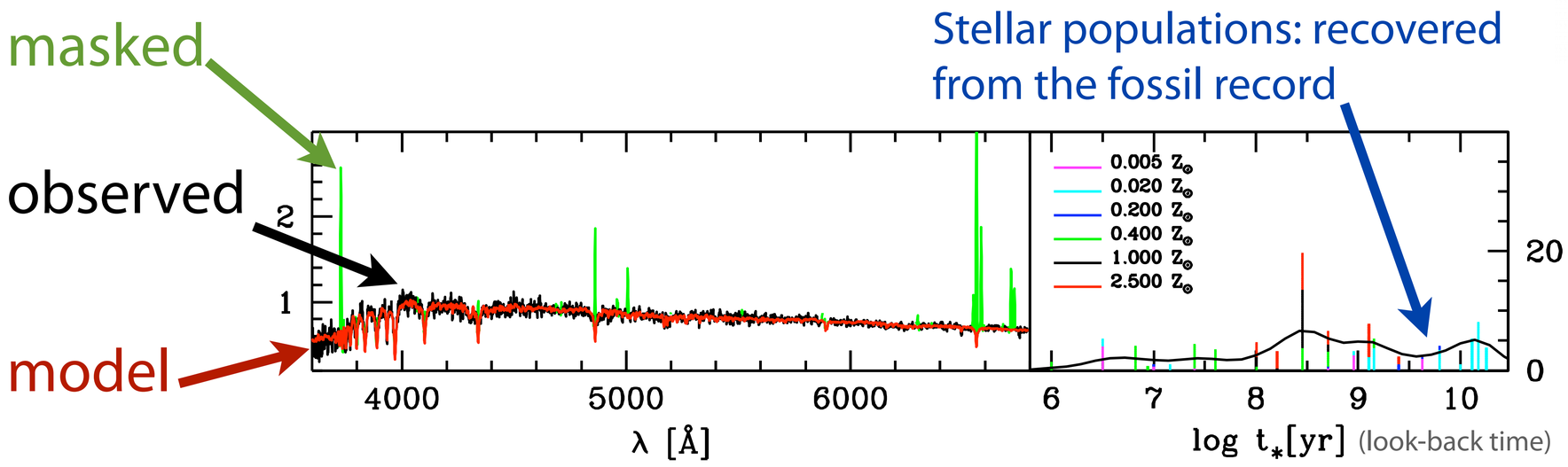
Astropaleontology

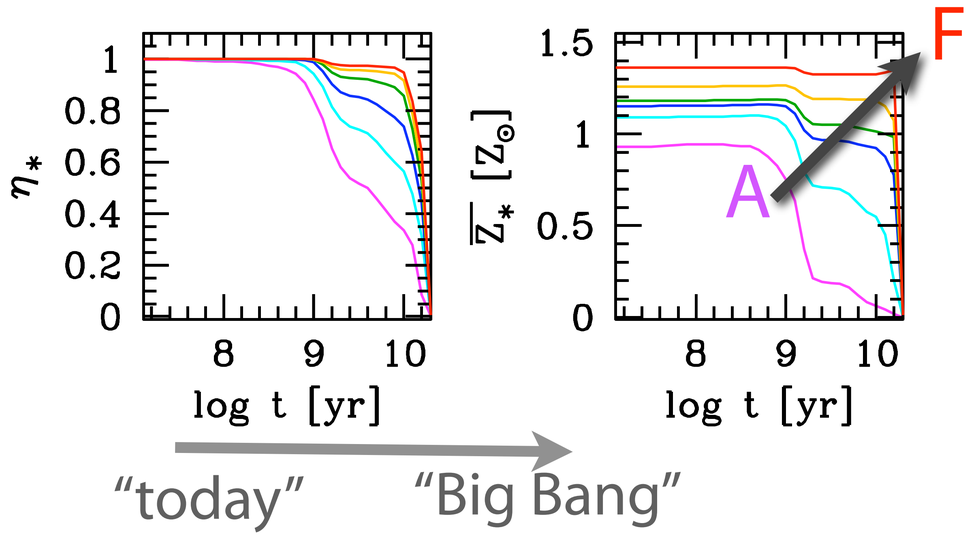


STARLIGHT fits a galaxy spectrum with a sum of simple stellar populations (SSPs) of different ages and metallicities. This is a fit for one galaxy out of the 573141 Sloan Digital Sky Survey objects we have analyzed.

Histories of mass and stellar metallicity

Bins in log M/M_{sun}, 0.3 dex-wide, centered in:

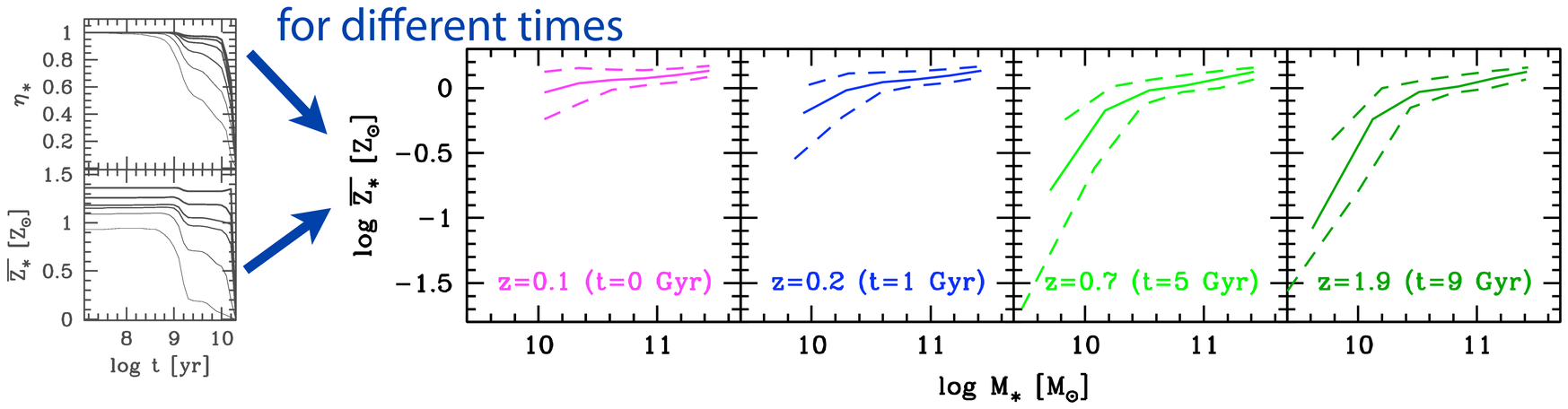
A: 10.0
B: 10.3
C: 10.6
D: 10.9
E: 11.2
F: 11.5



Given the ages and metallicities of the SSPs in a galaxy, we recover the history of the conversion of gas into stars and of metal formation. We group galaxies with similar present-day stellar mass. We find that the *more massive* a galaxy is today, the *faster* it has formed stars and produced metals.

The evolution of the $M_\star$–$Z_\star$ relation

Snapshots of $M_\star$–$Z_\star$ for different times



Another way to study the evolution of galaxies is to look at a snapshot of the mass vs. metallicity ($M_\star$–$Z_\star$) relation for a given look-back time. The snapshots we show are for the *same set* of galaxies and for the *stellar* metallicity. This is the first time such a study is made.

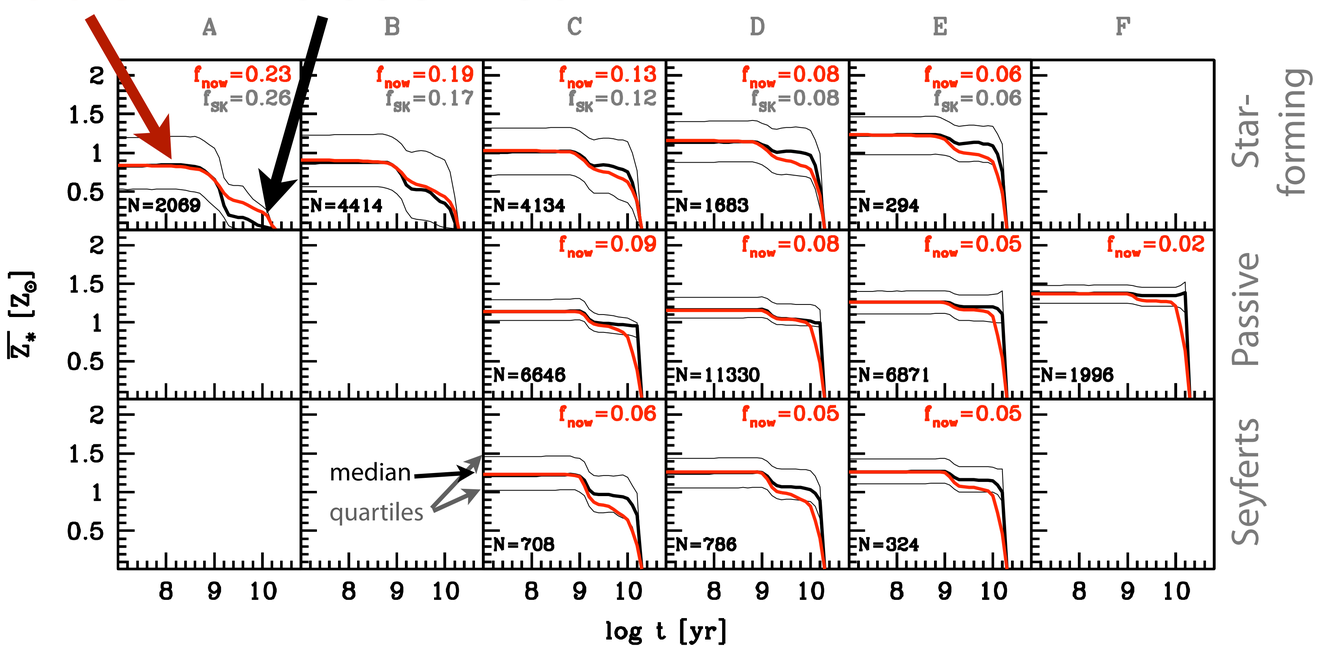
Simple chemical evolution models

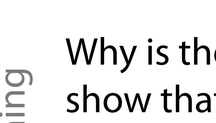
Observed Z(t) fitted with a closed-box model:

$Z(t) = Z(f_{now}; SFR(t))$

free parameter

STARLIGHT





Why is there a $M_\star$–$Z_\star$ relation? We show that a closed box fits the metallicity histories observed in the range of masses we studied and for different types of objects: Seyfert, passive and star-forming galaxies.

Our results suggest that the $M_\star$–$Z_\star$ relation for galaxies with present-day stellar masses down to 10^{10} M_{sun} is mainly *driven by the star formation history* and not by gas inflows or outflows.

More details

✳ Paper: Vale Asari, N.; Stasinska, G.; Cid Fernandes, R.; Gomes, J. M.; Schlickmann, M.; Mateus, A.; & Schoenell, W. 2009, MNRAS, 396, L71

✳ STARLIGHT and Virtual Observatory: http://starlight.ufsc.br/