

Spectral Indices in the NIR for Studying Stellar Populations



Elham Eftekhari^{1,2}, Alexandre Vazdekis^{1,2}, Francesco La Barbera³*

¹Instituto de Astrofísica de Canarias, E-38200 La Laguna, Tenerife, Spain

²Departamento de Astrofísica, Universidad de La Laguna, E-38205 La Laguna, Tenerife, Spain

³INAF-Osservatorio Astronomico di Capodimonte, sal. Moiarriello 16, Napoli I-80131, Italy

RAVET
Project

Abstract

TRACES
Group

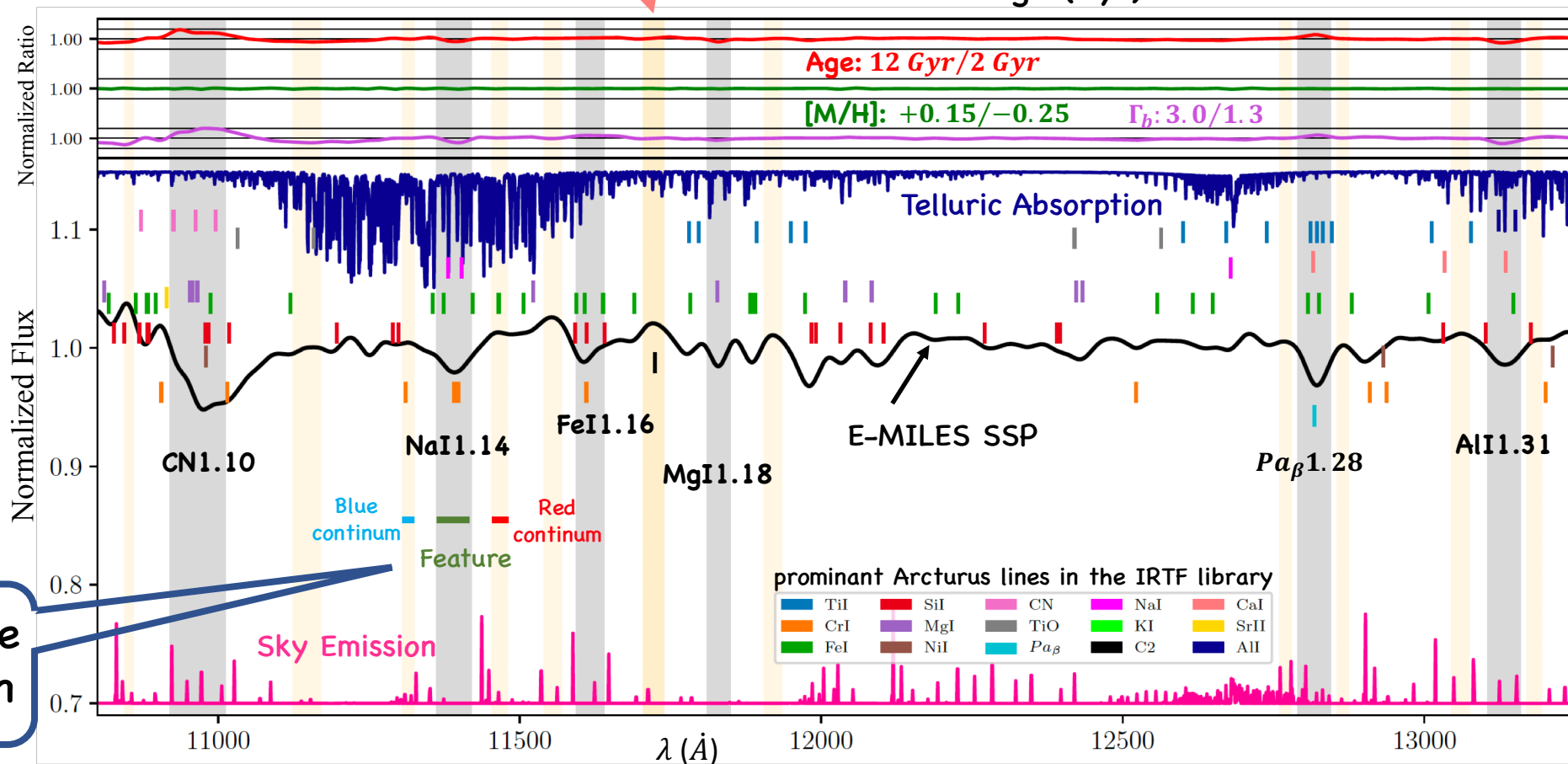
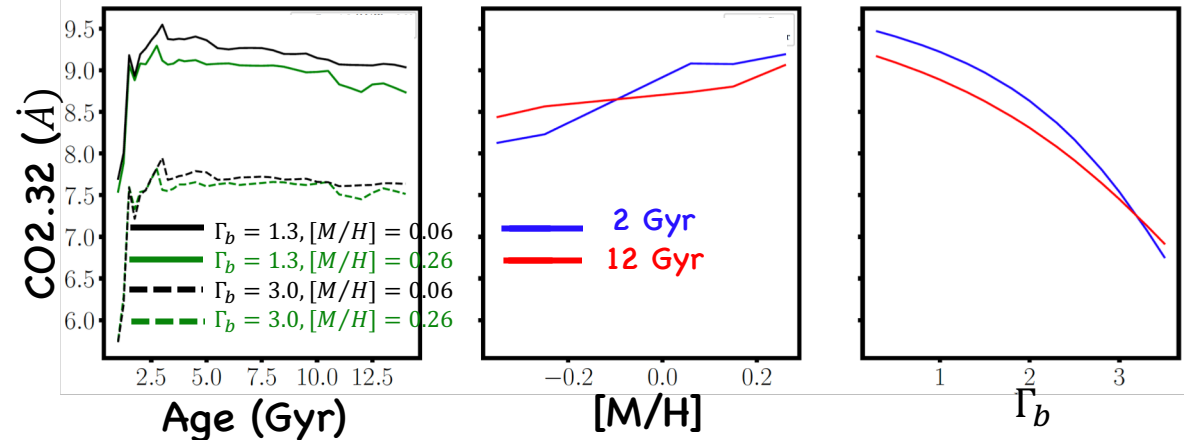
So far, detailed stellar population studies, based on the absorption line strengths have been concentrated mainly in the optical spectral range. In this work, we supplement spectral indices of the Lick system in the optical with additional indices in the near-infrared (NIR). We optimised the definition of the indices to be sensitive to the main stellar population parameters, i.e. age, metallicity and stellar initial mass function (IMF) and fully characterized them with velocity dispersion, signal-to-noise ratio and elemental abundance ratio effects.

Spectroscopy-based Studies of Stellar Populations

- Population synthesis analysis of galaxies have mainly focused on the optical wavelength.
- Recent advances in the NIR instruments like **X-shooter**, **KMOS**, and **EMIR** have made it possible to extend the stellar population studies into the NIR domain.
- In this work, we introduce an optimized and fully characterized collection of spectral indices, covering the J, H and K bands of the NIR for stellar population analysis.
- We show the potential of our newly defined NIR indices to the general ETG population study.

Optimised Index Definition

Using **E-MILES*** models, we computed **response functions** and optimised the sensitivity of indices to age, metallicity, and IMF.



8 indices in J band
 +
 10 indices in H band
 +
 10 indices in K band

 28 indices

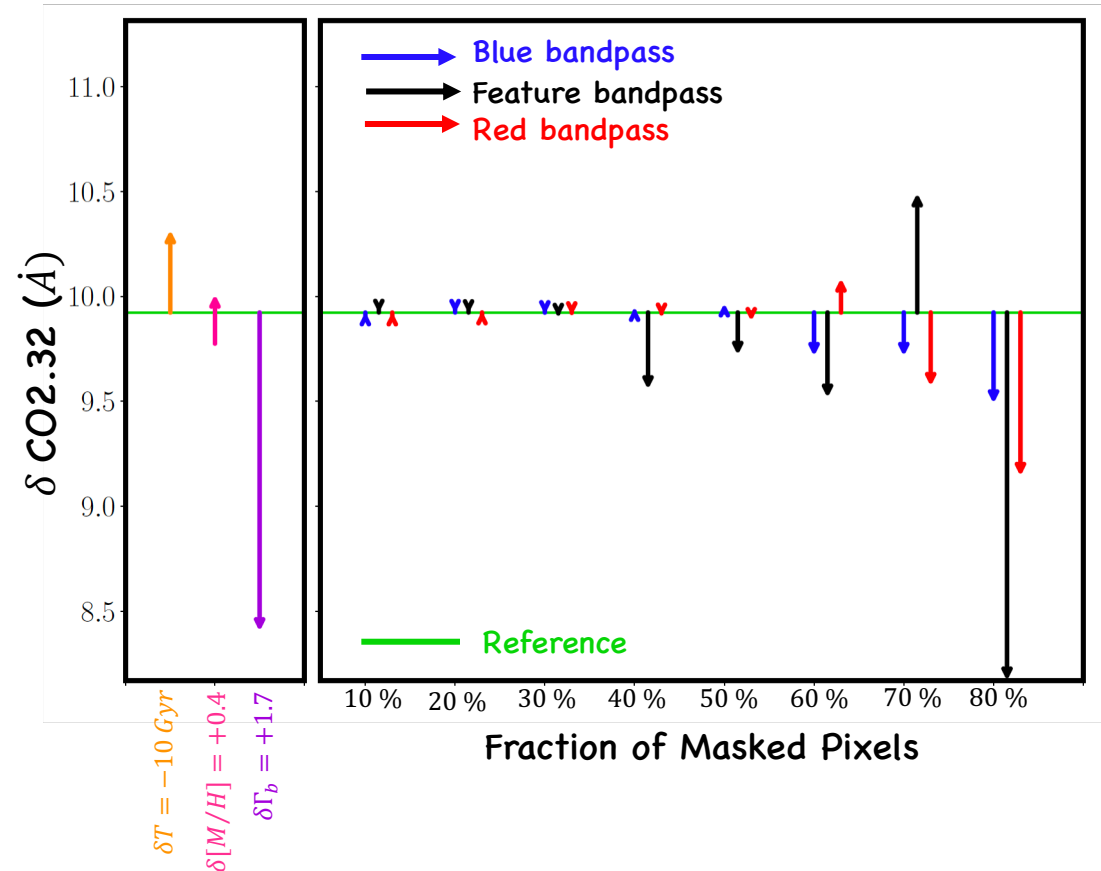
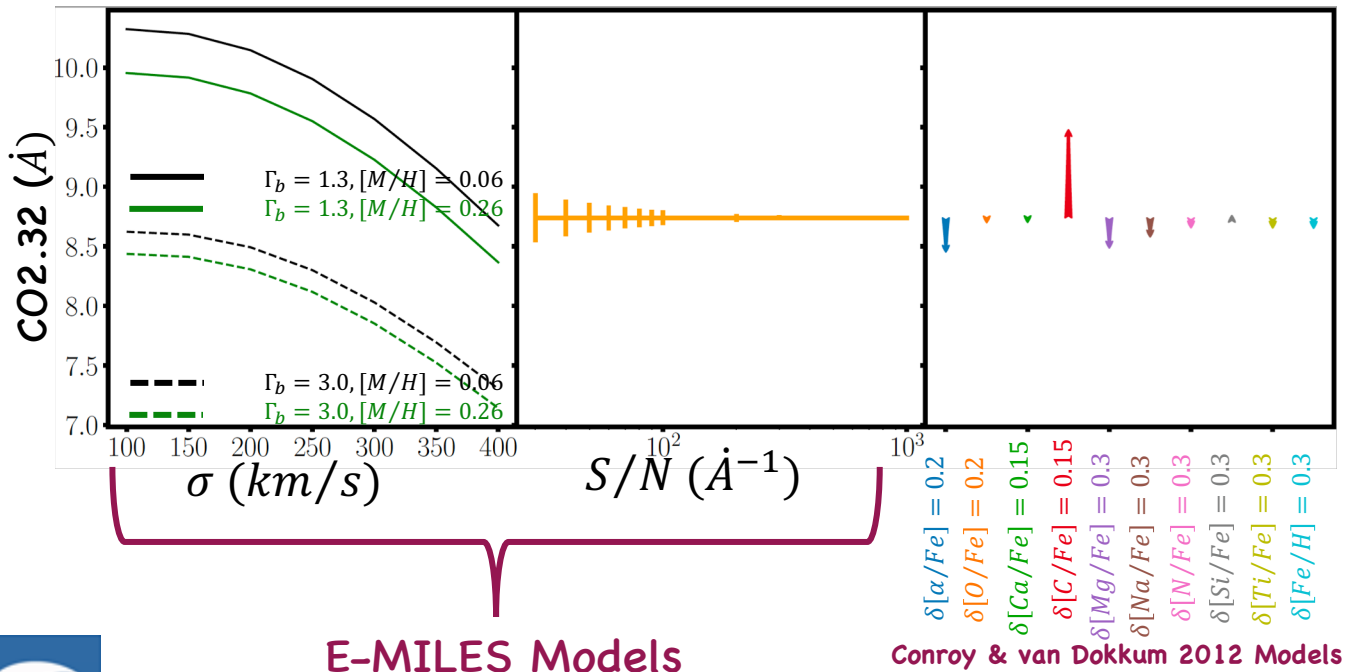
Lick-style definition



Index characterization

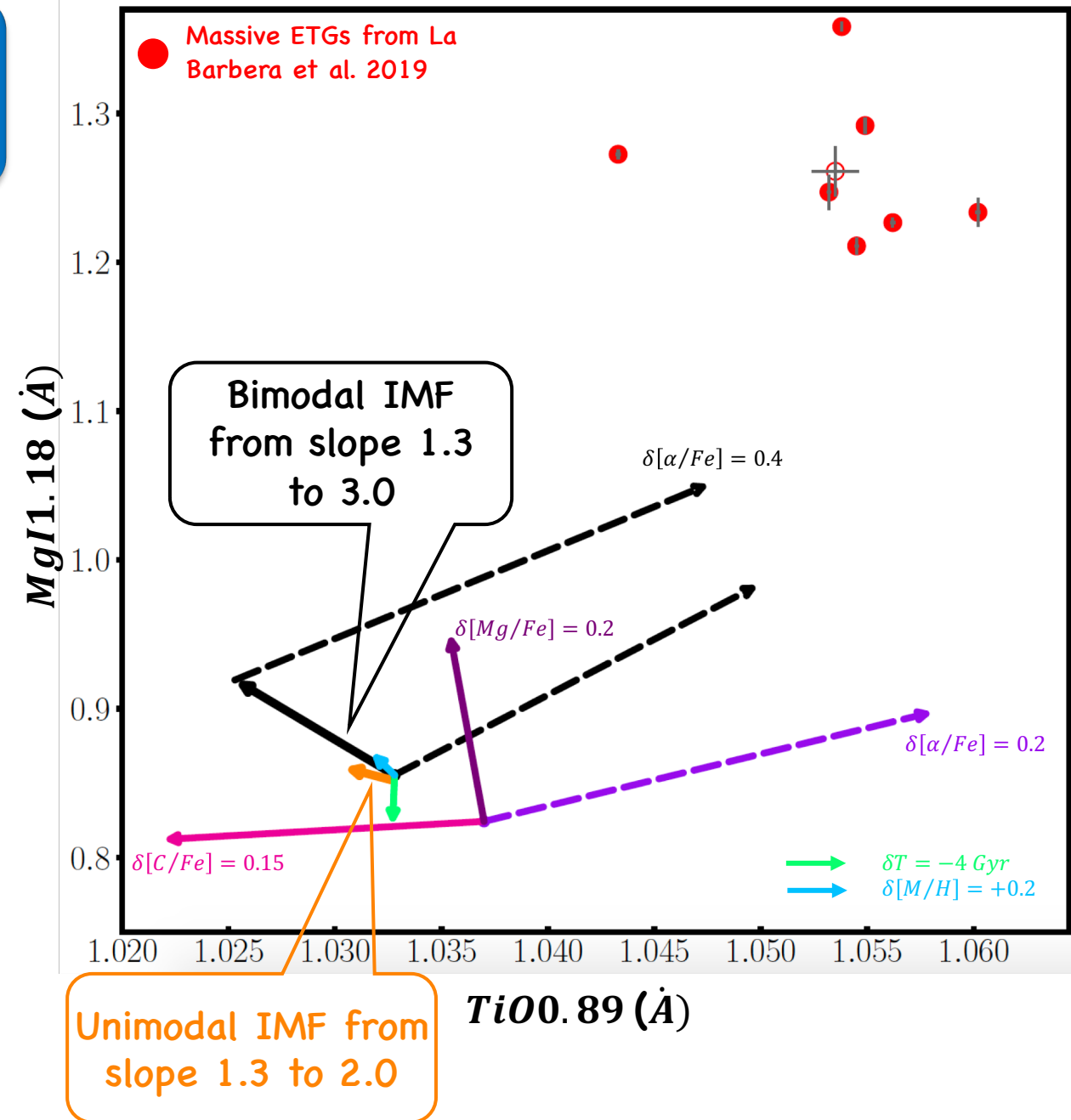
We characterized the indices as a function of velocity dispersion broadening, SNR requirement and elemental abundance variations.

We also assessed the robustness of our indices against systematic uncertainties due to sky subtraction, telluric correction, etc.



Application

We assessed the potential of our newly defined indices in the NIR for constraining the shape of the low-mass IMF.



Future

- This set of indices provides a basis for future NIR stellar population synthesis modeling.
- Our NIR spectral indices can be used for future science conducted with the observations of NIR instruments such as **EMIR**, **X-shooter**, **KMOS** and **JWST**.

Take-Home Message

- We have defined a new set of spectral indices in the NIR, optimised and fully characterized for stellar population analysis.