Surface Brightness Fluctuations:

Preliminary approach to unveiling metal-poor components in elliptical galaxies.

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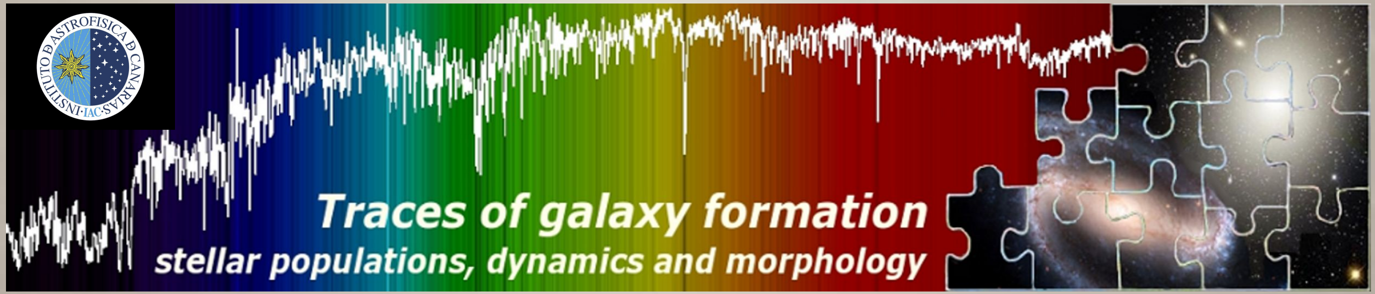


Abstract

Besides the standard analysis based on mean properties, Surface Brightness Fluctuations (SBF) spectra provide an alternative way for studying stellar populations in galaxies. Metal-poor populations are predicted in galaxy formation models, but so far remain undetected beyond the Local Group. The SBF spectra have the potential to unveil these metal-poor components in galaxies dominated by old, metal-rich stars. We have computed SBF magnitudes and we propose fluctuation color diagrams to study composite populations in nearby elliptical galaxies.

Brief introduction:

- Stellar population analysis has been mainly tackled on the basis of the *mean* properties of single stellar populations (SSP).

- The Surface Brightness Fluctuations (SBF: *variance over mean of SSP*) have been traditionally used to determine galaxy distances with high precision (Tonry, J., & Schneider 1988).

- The aim of this project is to **combine the mean and SBF properties** and show its potential **to unveil metal-poor components in metal-rich elliptical galaxies.**

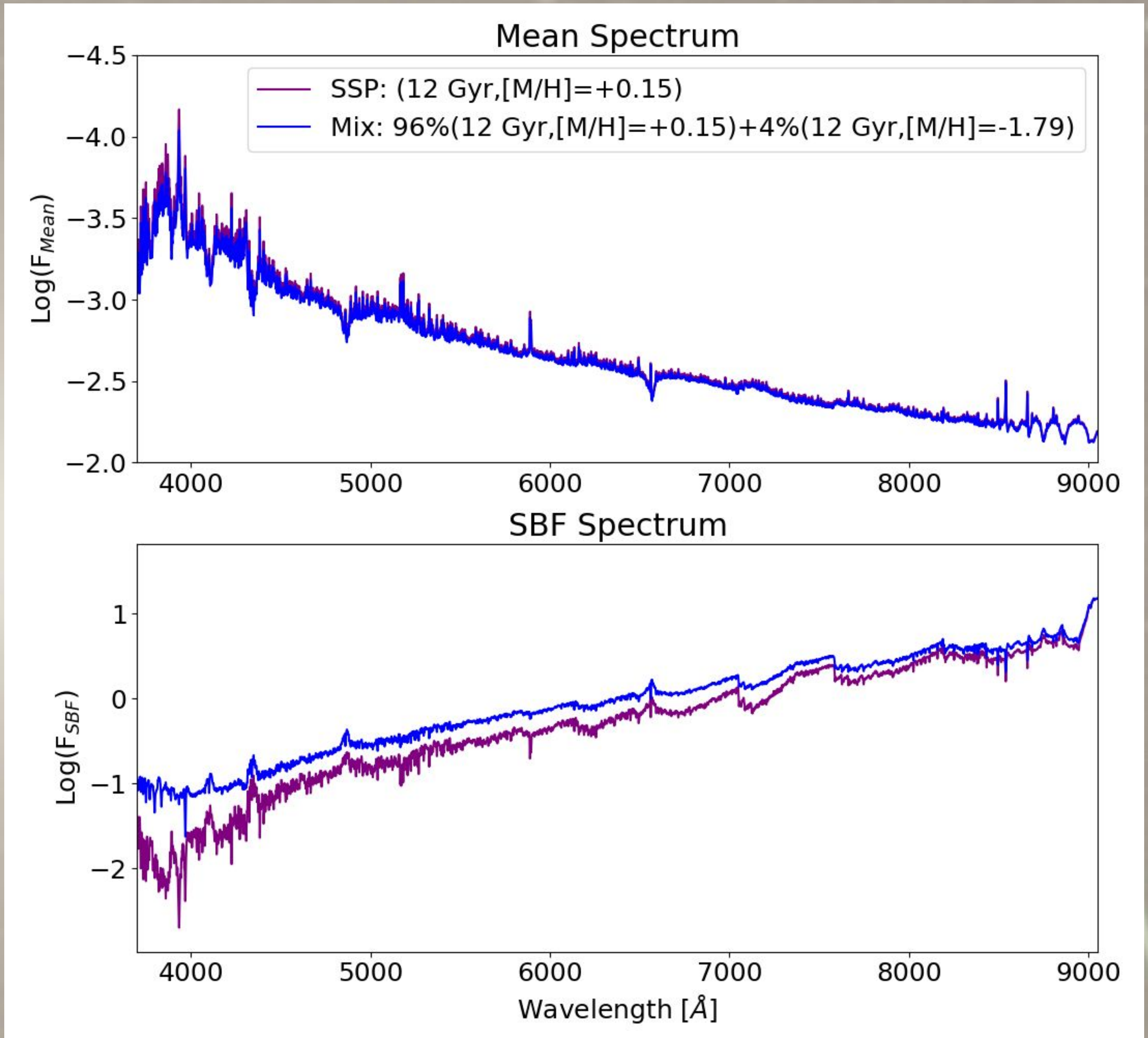
Methodology:

To demonstrate the potential of the SBF unveiling secondary populations **we compare the mean and SBF spectra of a simple and a composed population.**

We find:

- The mean spectra show little difference between the simple and composed SSPs.

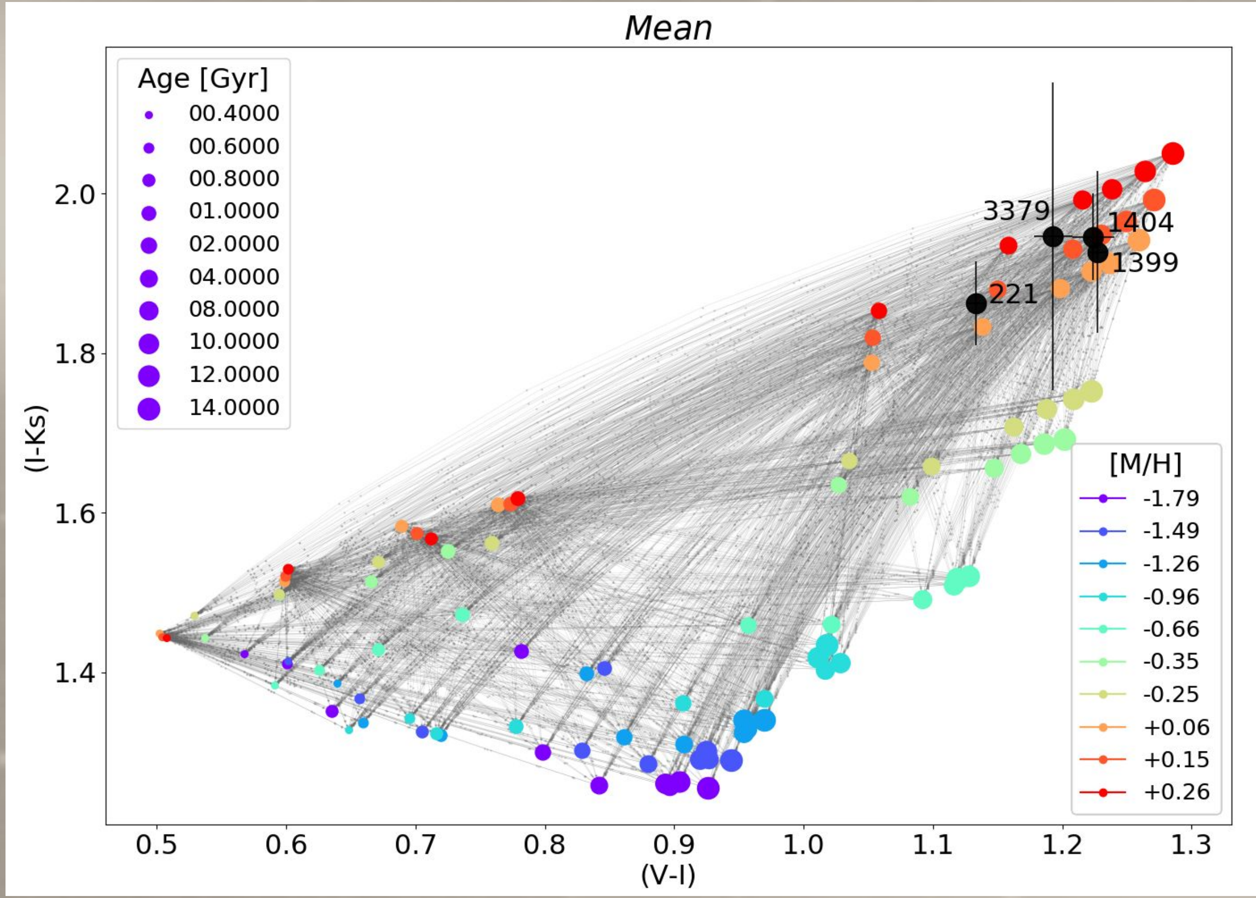
- **The SBF spectrum achieves enough differences** (bigger than the characteristic errors of observational measures) **to show the contribution of a secondary population** to the main one.

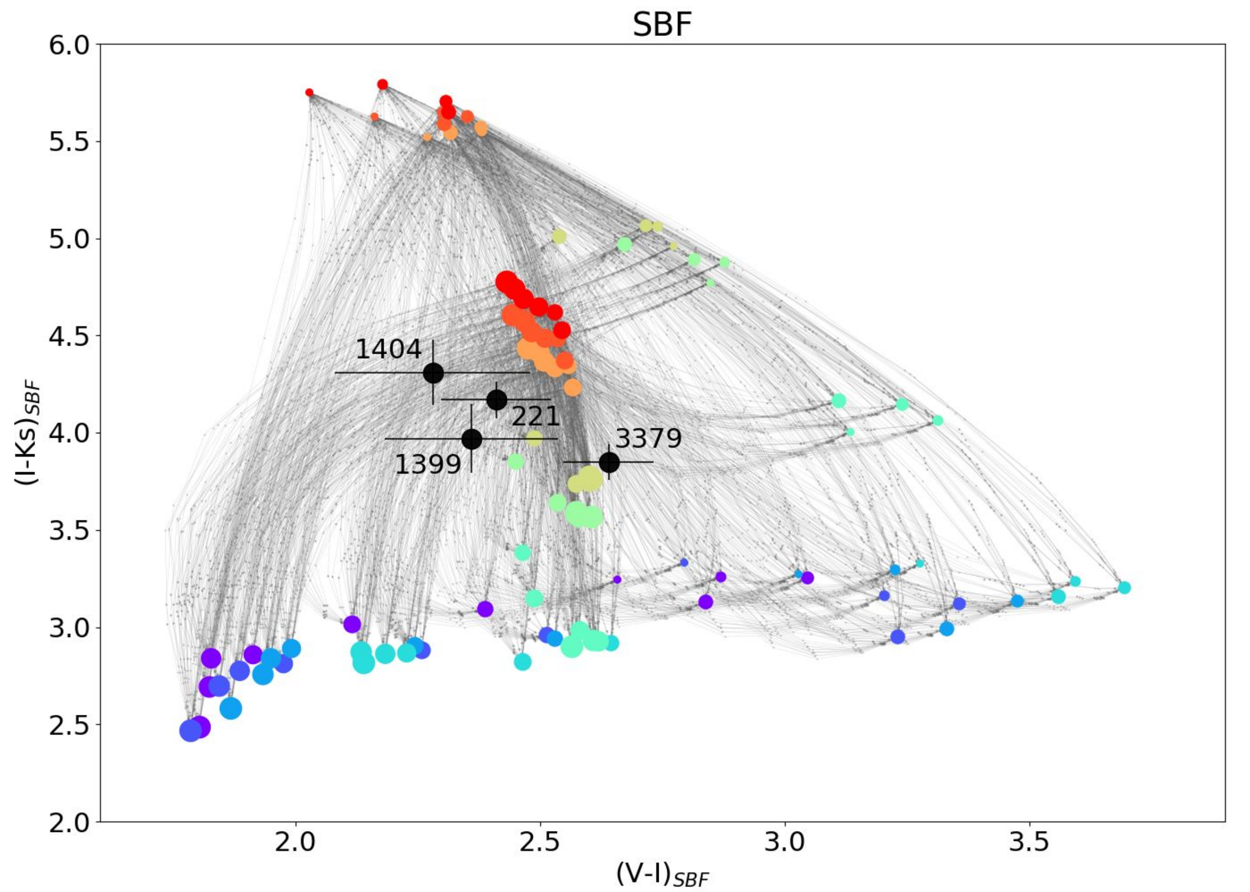


*We employ the E-MILES mean and SBF model spectra as presented in Vazdekis et al. (2020) and and calculate composed populations as linear combinations of two different SSP.

Results:

* NGC galaxy data: V and Ks mean magnitudes obtained from SIMBAD, Hyperleda and TWOMASSRSC - 2MASS Redshift Survey (2MRS) catalogs. V-I and fluctuation magnitudes obtained from Cantiello et al (2003).





The galaxies are located in a high metallicity region. It is difficult to determine if they have any secondary population.

In the SBF color diagram the galaxies fall in a region where only the composite populations are allowed. In particular, we find a trend in the lines associated with the mixture_of metal-rich and metal-poor populations.

The **grey lines** represent the **composed populations**: mixture of 2, 5, 10, 25, 50, 75, 90, 95, 98 % of every SSP with [M/H]<0 with every SSP with [M/H]>0.

Conclusions:

- The **SBF** has the potential to **reveal secondary populations** where mean spectra properties are not able to.

- **Combining** the standard analysis based on the **mean** spectrum **with the SBF** analysis we can **determine metal-poor components** in overwhelming dominated metal-rich elliptical galaxies. We show that this is virtually impossible to derive with the mean spectra.

Future expectations:

- **Fit observed galaxies to composed SSP models**, using different bands for both the mean and SBF magnitudes.

- **Work with larger and more precise catalogs of SBF magnitudes**. The results obtained here call for obtaining new SBF data in several filters in order to perform a well constrained stellar population analysis.

- Study the radial gradient of metal-poor components to draw the chemical enrichment history and discuss the build up of the galaxy.