Category: Science

Estimating galaxy star formation histories

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Abstract

Studying the stars in galaxies and their histories reveals valuable information about how the universe changes through cosmic time, how galaxies likely formed and will continue to evolve. Simple stellar population (SSP) modeling is a method for estimating the star formation histories (SFHs) of distant galaxies from their integrated spectra, the combined light output of all the stars in the galaxy. Each SSP represents a single generation of stars, grouped by age and metallicity. These SSPs represent instantaneous bursts of star formation at different moments in time. Linear combinations of SSPs represent the SFH of a galaxy, from which we can derive information about how the galaxy evolved through time. However, it can be difficult and computationally expensive to account for all different physical properties of stellar populations in SSPs and accurately model the stellar composition of a galaxy. Our method for extracting SFHs uses an SSP modeling Python program called SSPMODEL. SSPMODEL uses nonlinear optimization algorithms to find the best linear combination of average SSPs defined by diffusion-k means. This program showed improved precision and accuracy for extracting SFHs in previous studies. We verified the effectiveness of this new Python implementation of SSPMODEL with synthetic galaxy data. We also selected a galaxy spectrum from the LEGA-C galaxy catalog and applied SSPMODEL code to it to study the star formation history of this galaxy. SSPMODEL results showed that the galaxy spectrum we selected was composed of mostly younger stellar populations. These are promising results for using SSPMODEL to study other galaxy spectra.