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The GIST pipeline: A multi-purpose tool for the analysis and visualisation of (integral-field) spectroscopic data

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Abstract. We introduce the **G**alaxy **I**FU **S**pectroscopy **T**ool (`GIST`), a convenient, all-in-one and multi-purpose tool for the analysis and visualisation of already reduced (integral-field) spectroscopic data. In particular, the pipeline performs all steps from read-in and preparation of data to its scientific analysis and visualisation in publication-quality plots. The code measures stellar kinematics and non-parametric star formation histories using the `pPXF` routine (Cappellari & Emsellem 2004; Cappellari 2017), performs an emission-line analysis with the `GandALF` procedure (Sarzi *et al.* 2006; Falcón-Barroso *et al.* 2006), and determines absorption line-strength indices and their corresponding single stellar population equivalent population properties (Kuntschner *et al.* 2006; Martín-Navarro *et al.* 2018). The dedicated visualisation routine `Mapviewer` facilitates the access of all data products in a sophisticated graphical user interface with fully interactive plots.

Keywords. methods: data analysis, techniques: spectroscopic, galaxies: individual: NGC 1433, galaxies: kinematics and dynamics, galaxies: stellar content, galaxies: structure

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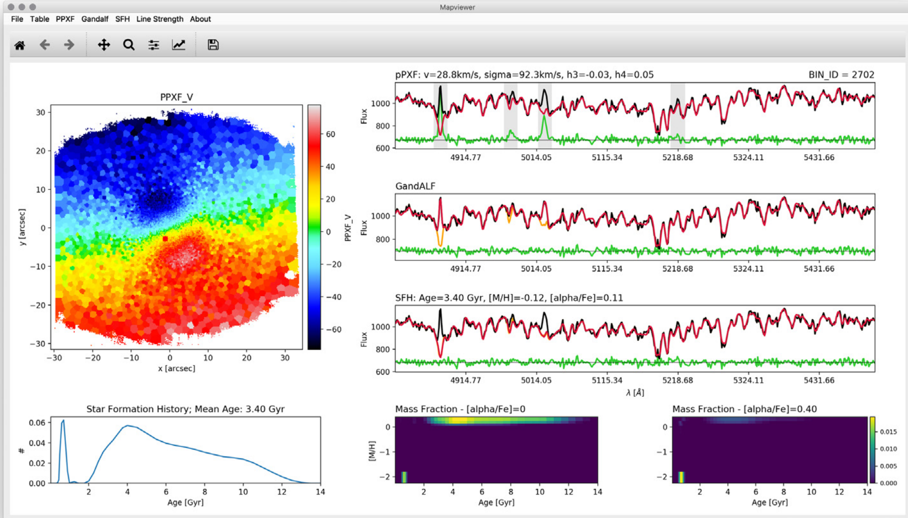

Figure 1. Screenshot of the `Mapviewer` routine which allows easy access of all data products. Shown is a map of the stellar kinematics of NGC 1433 (upper left panel), as well as observed spectra (black), fits (red), and residuals (green) of a particular bin, as generated by the PPXF, GANDALF, and SFH-modules (upper right panels). The lower panels show the non-parametric star formation history (left) and the weight distribution of the models, as derived by the SFH-module (centre and right). Maps of all data products can be plotted by selecting the quantity from the menu bar. To plot individual spectra and fits, the corresponding spaxel/bin is selected by performing a mouse-click on the map. All plots are fully interactive and allow, for instance, zooming and saving the panels.

With this software package, we aim to provide an extensive analysis framework that is suitable for a large variety of scientific objectives. Thus, the `GIST` pipeline is not specific to any scientific project, fitting routine or instrument. It has already been used to analyse data obtained with MUSE, PPAK (CALIFA), and SINFONI, and applied to simulated data from WEAVE and HARMONI. In line with this concept, the pipeline features a highly modular code architecture, making it easy for the user to modify or expand the functionality, in order to meet more specific requirements. Moreover, the `GIST` pipeline is capable of analysing multiple spectra simultaneously, thanks to the implementation of a well-tested Python-native parallelisation. The extensive visualisation options of `GIST` include the automatic generation of publication-quality plots. In addition, the dedicated routine `Mapviewer` allows to access all derived quantities in a sophisticated graphical user interface with fully interactive plots (see Fig. 1).

Details on the implementation of the `GIST` pipeline are described in Bittner *et al.* (2019). The pipeline and its documentation, together with instructions on its installation and a tutorial, are freely available at https://ascl.net/1907.025.

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