Astronomical Data Analysis Software and Systems IV
ASP Conference Series, Vol. 77, 1995
R. A. Shaw, H. E. Payne, and J. J. E. Hayes, eds.

Interactive Fitting of EUVE Emission Line Spectra

M. Abbott

Center for EUV Astrophysics, 2150 N. Kittredge St., Berkeley, CA 94720-5030

Abstract. An interactive IRAF task for the analysis of *Extreme Ultraviolet Explorer* (*EUVE*) emission line spectra is presented. The line flux in extracted spectra may be measured by multiple techniques, including fitting individual lines. Blended lines may be fit simultaneously with the *EUVE* spectral PSF. To aid in identifying lines, the positions of known lines may be marked on the spectrum during the fitting process. Also, model *EUVE* spectra may be constructed and overlaid using plasma emissivities and source emission measures supplied by the user. The task is fully compatible with the calibration data set distributed by the *EUVE* Guest Observer (GO) Center and retrieves all needed instrumental parameters from that data set. It also makes use of the newly available IRAF support for windowing graphical user interfaces.

1. Rationale

Fitlines is an IRAF task currently under development at the Center for EUV Astrophysics. It was originally conceived of as a tool to aid in the wavelength calibration of the *EUVE* spectrometers, but may also prove useful as a spectral analysis tool. It was also a pilot project to investigate the development of tasks using the IRAF X11 support package.

The goal of **fitlines** is to provide an integrated environment in which to identify and measure the flux of emission lines in extracted *EUVE* spectra. The identification of lines is the most difficult part of the *EUVE* wavelength calibration effort. Observations of many different sources are used and most do not have previously published spectral analyses in the EUV regime.

Most of the capabilities of **fitlines** (plus a lot of additional ones) will be made available in the future in windows-based spectral reduction tasks already under development at NOAO. **Fitlines** is not intended as a general spectral reduction task, but rather seeks to complement such software by providing *EUVE*-specific functionality.

2. Implementation

Fitlines is implemented as an IRAF task and uses the newly released X11 IRAF support package for its user interface. It is written in SPP. Two separate major capabilities are present. The first is the ability to read in a table of line emissivities, display the tabulated lines on a plot of the spectrum, fold the

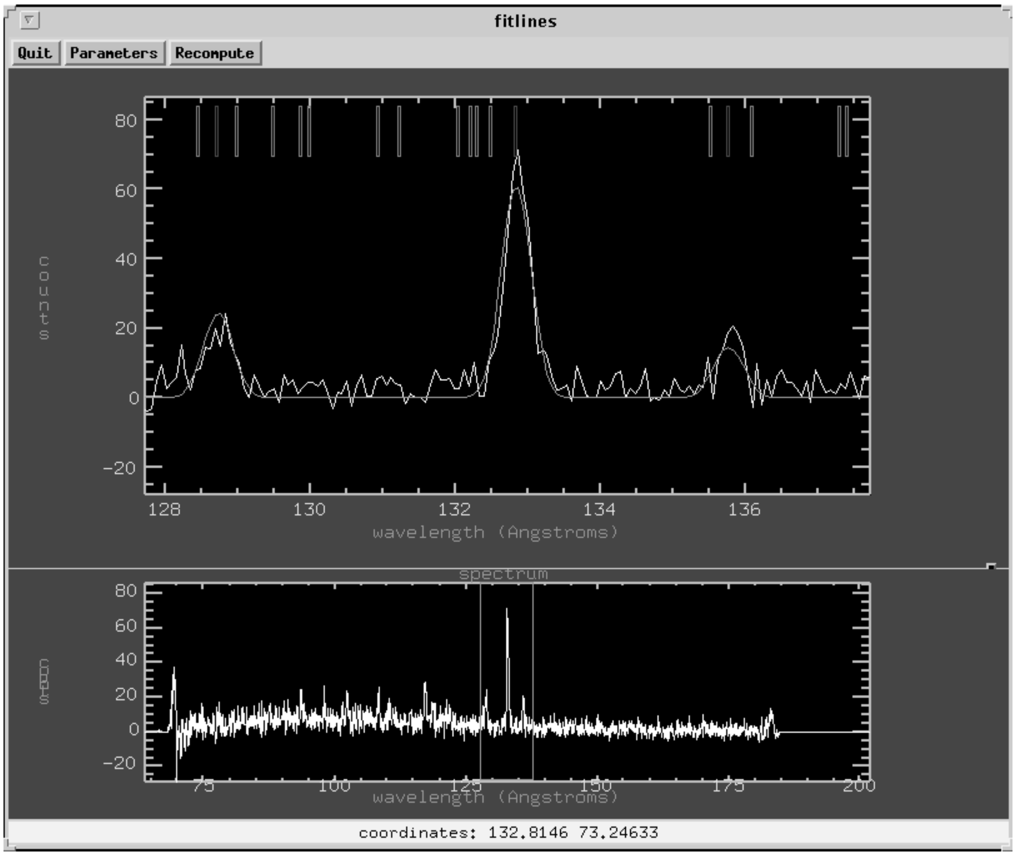

Figure 1. The main window of **fitlines**.

emissivities for selected lines with a user-specified emission measure model for the source and the *EUVE* instrumental parameters to get a simulated spectrum, and overplot that on the observed spectrum. The goal is to help the user to decide which of many candidate IDs for a line are most plausible.

Figure 1 shows the main window of **fitlines**. The entire spectrum is plotted in the lower pane and a subsection is enlarged above. In the latter plot, the lines at the top mark the wavelengths of lines in the list of emissivities the user has supplied. Three of those lines have been selected and a model spectrum computed using them; it is overplotted on the actual spectrum.

Two more windows are illustrated in Figure 2. The lower window contains the user-specified emission measure of the source versus temperature. The user also supplies information about the distance to the source and the intervening interstellar absorption.

The upper window contains information about the list of plasma line emissivities. The three lines selected by the user are highlighted in the list and their emissivities versus temperature are plotted to the left. **Fitlines** attempts to simplify the identification procedure by forming aggregates of sets of closely-spaced lines that are not resolved with *EUVE*. Such aggregate lines are marked with an asterisk in the list in Figure 2 (all of them in this example). The user

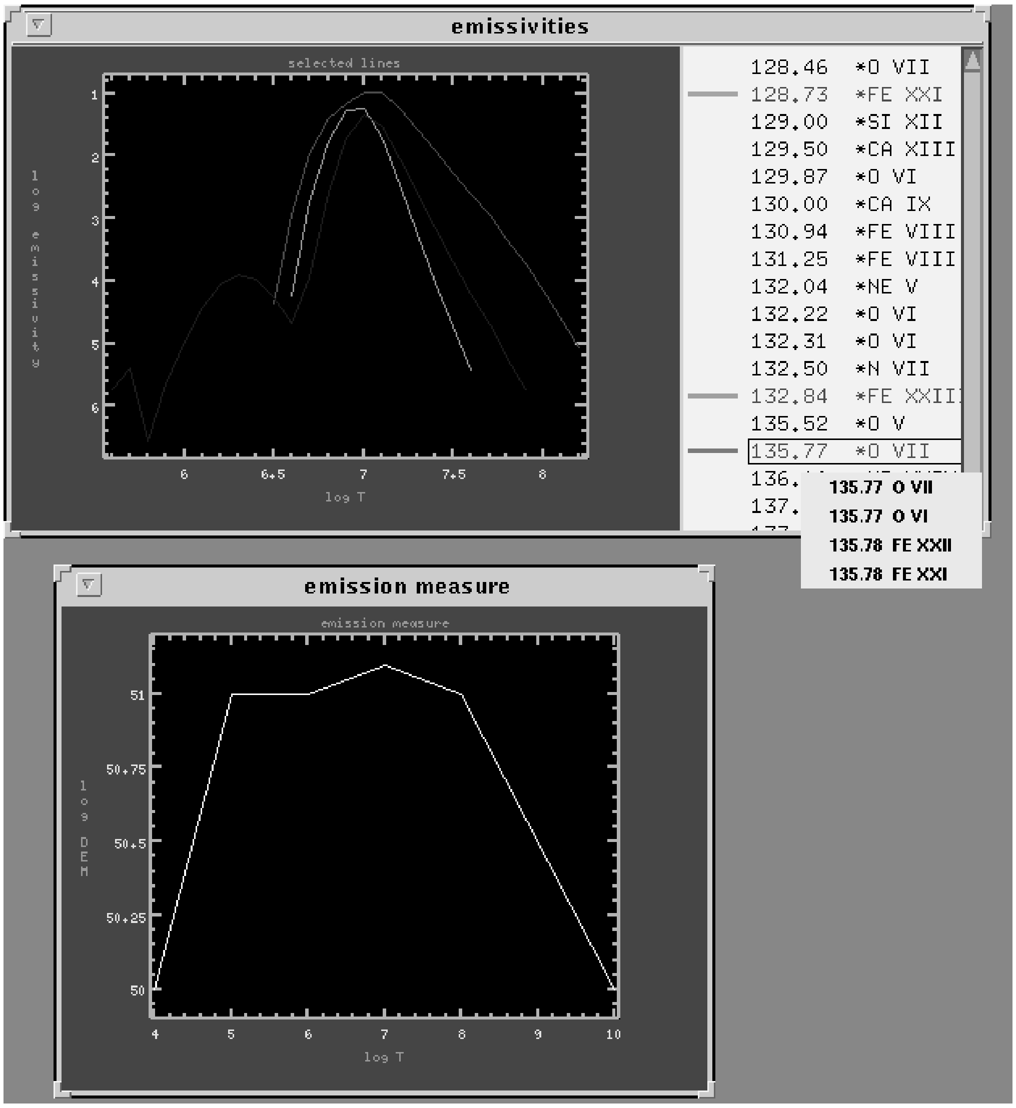

Figure 2. Display of line emissivities and the emission measure in the **fitlines** task.

can display the components of any aggregate as desired; in the example, the user has opened a pop-up window to see which lines make up the aggregate listed at a wavelength of 135.77 Å.

A second capability of **fitlines** is the measurement of line fluxes. Several common techniques are made available, including summing within regions, fitting functions, and fitting empirical line shapes. Where helpful, knowledge of the expected line width in an *EUVE* spectrum at any wavelength (determined from calibration data distributed by the *EUVE* Guest Observer Center) may be used to constrain fits.

Acknowledgments. This work was supported by NASA contract NAS5-30180.