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ATV: An Image-Display Tool for IDL

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Abstract. The IDL language offers a powerful environment for reduction and analysis of astronomical data. While there are numerous libraries of publicly available IDL routines, one major drawback has been the lack of an image-display program optimized for viewing astronomical images. ATV is a display program written entirely in IDL and designed to emulate the SAOimage and DS9 programs. It works equally well under the Unix, Linux, Windows, and MacOS versions of IDL, and includes features such as interactive control of color stretch, zoom, and image scaling; image blinking; and creation of publication-quality PostScript output. It also includes a simple photometry package suitable for quick-look reductions. The program is freely available via the Internet.

1. Introduction

Interactive Data Language (IDL) is an increasingly popular tool for astronomical data reduction and analysis. One long-standing drawback of IDL, for astronomical applications, has been the lack of a high-level display routine optimized for viewing astronomical images. IDL's built-in image display routines are primitive, and it is difficult to integrate stand-alone programs such as SAOimage and DS9 into an IDL session. ATV is an image-display program designed to solve this problem. It is written entirely in IDL and offers a range of features similar to the stand-alone image viewers.

ATV takes advantage of the IDL widget interface, which provides a simple mechanism for creating graphical user interfaces, as well as a number of preexisting routines in the IDL Astronomy User's Library. Thus, the ATV code itself is fairly compact, and in some respects it simply acts as a graphical front-end for various library routines. The initial release of the program in 1998 contained basic features such as control of image scaling and color stretch, blinking, and zooming, and since then the program has grown to include other features such as photometry, coordinate tracking, and creation of PostScript output. For IDL users, the major benefit of ATV is that it works within an IDL session, so the user can pass data or FITS filenames directly to ATV from the IDL command line. ATV can be customized to pass data to other IDL routines, and its internal data are stored in common blocks so that they can be accessed or modified by the user.

Since ATV is distributed as IDL source code, it can easily be modified for specialized use. For example, it has been adapted for displaying data from the *FUSE* satellite (`http://fuse.pha.jhu.edu/analysis/sw`), and a modified

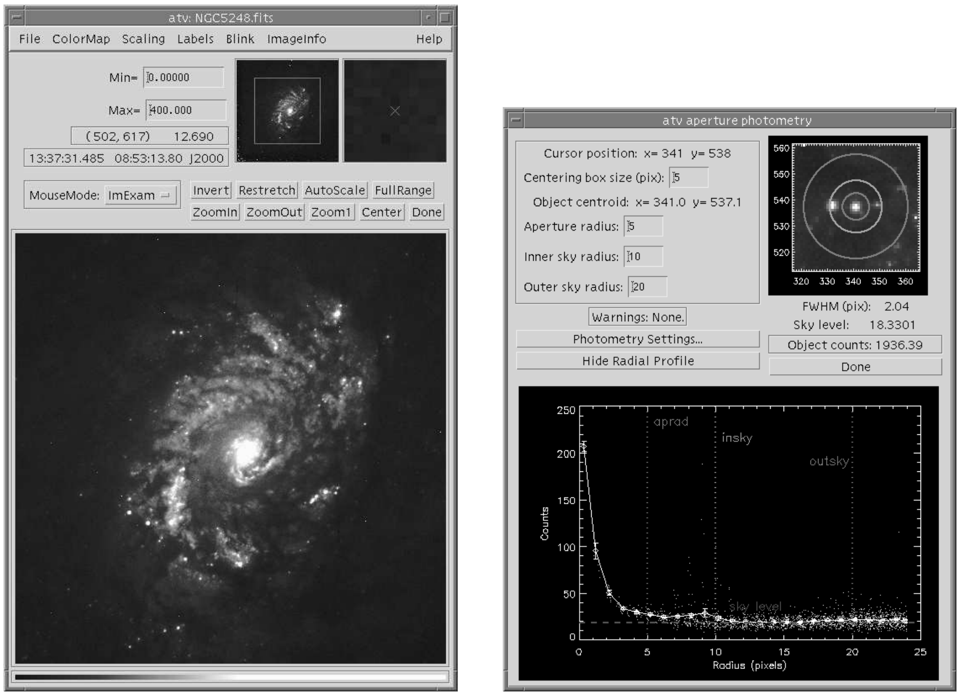

Figure 1. The main ATV display window and the ATV photometry window.

version of ATV is being used as part of the CEDAR software suite for the *HST* Cosmic Origins Spectrograph (Béland & Penton, this volume).

2. Features

The main ATV window is designed to look similar to SAOimage and DS9, with a panning window, a zoom window that tracks the cursor motion, and information boxes that track the pixel coordinates, pixel value, and world coordinates (Figure 1). ATV's features include:

- Ability to read in FITS images, including FITS extensions, and non-standard data types such as *HST* WFPC2 arrays.
- Image input via pull-down menus or from the IDL command line. Data arrays in memory can be passed directly to ATV from the IDL command line.
- Interactive control of zoom, color table, brightness and contrast, and data range mapped into the color table. As in other display programs such as SAOimage and DS9, brightness and contrast stretching are done by dragging the cursor over the main display window.
- Choice of linear, log, or histogram-equalized scaling.
- Tracking of the cursor position in pixel units and coordinate units if the image header specifies a coordinate system. User can choose RA/Dec, Galactic, or Ecliptic coordinates. For 2-D spectroscopic images with wavelength

information in the header (such as *HST* STIS images), the wavelength at the cursor position is displayed.
- Ability to overplot text, contours, or arbitrary line graphics over the image.
- Ability to plot a compass and scale bar for images with coordinate information in the header.
- Ability to create publication-quality PostScript output, and output in Tiff image format.
- Image blinking with up to three saved images.
- Row, column, surface, and contour plots.
- Point-and-click aperture photometry, including radial profile plots. In the photometry window, the user can control the sizes of the photometric and sky apertures, the centering box size, and photometric zeropoint. Output is in counts or magnitudes.
- Ability to view the image header in a separate window.
- ATV works in 8-bit and 24-bit color. (IDL currently does not support 16-bit color for the X window system, but may do so in the future.)
- ATV works equally well under the Unix, Linux, Windows, or MacOS versions of IDL. Some features require the use of a 3-button mouse (for example, storing 3 blink images), but the program has been designed so that almost all features can be accessed with a 1-button or 2-button mouse.

3. Future Development Goals

Development of ATV continues with new versions released every few months. Some areas for future development include:
- Improvements in speed and memory management.
- A more complete photometry package, including saved results in a log file.
- Ability to read and display multi-CCD mosaic images from various telescopes.
- Ability to handle extremely large images.
- Better user control over pixel ranges and plot details for line plots, and PostScript output for line plots.

4. Credits

Some important sections of the ATV code were written and contributed by David Schlegel, Douglas Finkbeiner, Michael Liu, and Wesley Colley. The FITS I/O, astrometry, and photometry routines used by ATV are part of the IDL Astronomy User's Library, maintained by Wayne Landsman at NASA/GSFC[1]. ATV also uses a PostScript configuration tool written by Craig Markwardt[2]. Instructions and complete documentation can be found at the ATV web page: `http://cfa-www.harvard.edu/~abarth/atv`.

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[1]`http://idlastro.gsfc.nasa.gov/homepage.html`

[2]`http://cow.physics.wisc.edu/~craigm/idl`