The FAST Spectrograph

The SAO FAST Spectrograph is a high-throughput optical spectrograph mounted at the Cassegrain focus of the 1.5-meter Tillinghast Reflector at Fred L. Whipple Observatory on the ridge of Mt. Hopkins in Arizona. It has a 3-arcminute-long slit and is typically operated at resolutions between 1 and 6 A. In its most common configuration, with a 300 line/mm grating and a 3.0 arc-second wide slit, it offers 4000 Å of spectral coverage at 3 Å resolution. 600 and 1200 line/mm gratings can also be used with narrower apertures for increased resolution over smaller spectral ranges. Optics are primarily reflective, for a maximum 26% throughput, and the graphite-epoxy composite construction results in low flexure and good focus stability for high throughput.

The FAST Data Reduction Pipeline

Since first light in January, 1994, FAST has had 4 different CCD detectors, but we have run the same pipeline since the beginning, although for many years, it was run only on data observed in the standard configuration of the 300-line grating.

FASTLOG creates a digital log for the night.

FASTSORT sends the raw data for a night to separate reduction directories for each configuration observed.

FASTHEAD is run in each directory to make sure that the FAST configuration is really the same for each spectrum image match.

ROADRUNNER is then run to process the images. The original pipeline processed the images, extracted a single object spectrum, and then applied a wavelength solution to the entire image, preserving the spectrum of the entire slit length in a 2-dimensional image.

BEEPBEEP finds the object on the slit, extracts it into a one-dimensional sky-subtracted spectrum image (preserving the original, sky, and variance spectra), finds a velocity using RVSAO, and allows the user to check the results and assign a quality (0,7,9). At this point the user can switch to the result from an alternative template or manually repair the spectrum and re-cross-correlate it.

FASTARC adds the resulting spectrum metadata to a catalog and moves the spectra to the data archive.

FAST Observations

138,000 spectra of 62,000 different objects have been observed by FAST and reduced into our archive. As every configuration is now reduced, we are working backward to reduced spectra taken in nonstandard configurations.

FAST has been used to observe everything from Near-Earth asteroids to more distant solar system objects to stars near and far, alone or in clusters, and galaxies. Here are some of FAST’s major observing projects:

CFA Galaxy Redshift Survey – Margaret Geller and John Huchra
Supernova Followup Program – Robert Kirshner and Iam
Symbiotic Stars – Scott Kenyon
White Dwarfs – Warren Brown
2MASS Redshift Survey – John Huchra and team
DASH Long-Period Variable Stars – Su Min Tang

FAST Catalog Sample

Here are the first 5 and last 5 entries in the flat tab-separate table database. Configuration is B(binning)[G(grating lines)][T(grating tilt)][A(aperture)]