CARNEGIE SCIENCE
Las Campanas Observatory

FIRE

FOLDED PORT INFRARED ECHELLETTE
A MODERATE RESOLUTION INFRARED ECHELLETTE

FIRE is a near-infrared dual-mode spectrometer developed for the 6.5m Magellan telescope. It is designed to deliver high sensitivity with minimal contamination from atmospheric foregrounds, opening the door for new angles of astronomical research. Its primary configuration is an echelle mode which delivers continuous single-shot spectra from Y through K bands at a resolution of R= 6000 - 8000 (37.5 - 50 km/s) for a 0.60" or 0.45" slit. It also includes a long-slit mode. With a higher spectral resolution than comparable existing instruments, FIRE is designed to take advantage of Magellan's excellent image quality to advance new research in infrared spectroscopy.

FIRE has a slit wheel with 10 positions. One slot is used for a pinhole focus mask and one contains an opaque blank. This leaves four slits apiece for echelle and longslit mode. The slits are oriented at right angles for the two modes. The echelle slits are 6" long and the long slits are 1' long. Slit widths: 0.45", 0.6", 0.75", 1.0'

WAVELENGTH COVERAGE: 0.82 - 2.51 micron

FIELD OF VIEW: 50x50 arcs

FILTER: Fixed MKO J band

SPECIFICATIONS

	High Resolution Echellete Mode	High Throughput Prism Mode
Spectral resolution	R=6000 (0.6" slit)	R_J=500, R_H=450, R_K=300
Spatial resolution	0.18"/pixel	0.15"/pixel
Continuous bandpass	0.82-2.51 microns	0.82-2.51 microns
Slit widths	nominal 0.6" - selectable 0.45"-1"	nominal 0.6", selectable 0.4"-1.0"

DETECTOR GAIN

There are two choices of amplifier gain:

- High gain mode offers more sensitivity and resolution and lower noise. This is suitable for most operations.
- Low gain mode is suitable for bright targets because it offers a wider dynamic range

	Conversion Gain	e- Read noise [Amps 1,2,3,4]	Saturation Level
High gain	1.3 e- / DN	[20,16, 22,17]	~ 20,000 ADU
Low gain	3.8 e- / DN	TBD	~ 32,000 ADU

READOUT MODES

FOWLER SAMPLING: in "Fowler N" mode, the detector is read N times before the start of the exposure, then the software waits for the requested exposure time and then it reads again N times. The pre- and post - integration reads are averaged respectively and the image signal is the difference between these averaged groups.

SAMPLE-UP-THE-RAMP (SUTR): The detector is read continuously during the exposure at regular cadence. At conclusion the software fits for the slope of charge accumulated as a function of elapsed time to estimate the science signal.

For more information: http://web.mit.edu/~rsimcoe/www/FIRE/

SENSITIVITY

The following figures provide an estimate of FIRE's sensitivity and zero point magnitude. This is defined as the AB magnitude which yields a detector flux of 1 DN per second per extracted 1-D pixel. The zero points do not include corrections for airmass, slit losses or telescope losses. The numbers are representative of reasonable conditions (clear, with 0.7" seeing, 0.6" slit) but somewhat high airmass (>1.4).

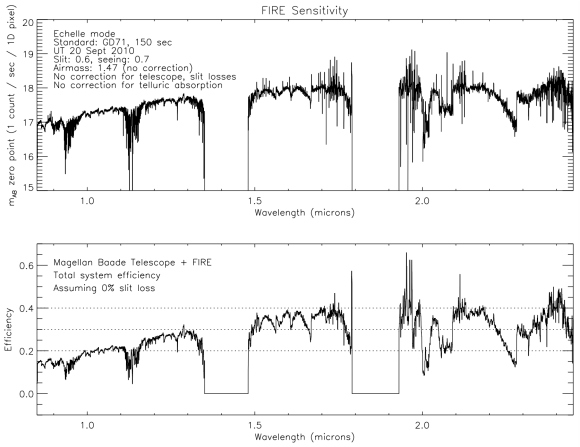

Fig.1 Zero point and efficiency for the echelle mode

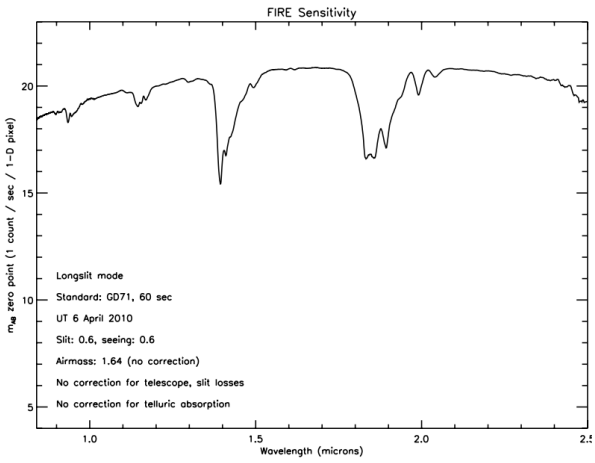

Fig.2 Zero point calibration in low dispersion mode