

# GMOS

The two Gemini Multi-Object Spectrographs (GMOS) are almost identical facility instruments located on each of the Gemini

Telescopes. They provide 360-1000 nm long-slit spectroscopy, multi-slit spectroscopy, and imaging over a 5.5'x5.5' field of view (FOV). They are both outfitted with Integral Field Unit (IFU) fiber modules that provide spatially-resolved 2D spectroscopy over a 5"x7" FOV with 0.2" sampling. Both GMOS-N and GMOS-S are capable of using the Nod-and-Shuffle (N&S) technique to obtain Poisson-noise-limited sky subtraction residuals for long-slit and multi-slit spectroscopy. Additionally, the GMOS-S IFU provides the N&S capability over a restricted 5"x5" FOV. The GMOS instruments were built by a collaboration between the UK (Astronomy Technology Center at ROE and University of Durham) and Canada (HIA), with NOAO providing the CCD imaging systems.

## Overview of GMOS Capabilities

### Science Modes

Imaging: Broad band and narrow band filters over a 5.5'x5.5' FOV

Long-slit & Multi-Object Spectroscopy: R~ 300-4500 over 360-1000 nm

Integral Field Unit Spectroscopy: 5"x7" FOV with 0.2" sampling

Nod & Shuffle spectroscopy in all modes (IFU N&S at GMOS-S only)

### Detector

Three 2048x4608 pixel EEV CCDs yielding a 6144x4608 pixel array

Pixel scale: 0.0730"/pixel at GMOS-N, 0.0727"/pixel at GMOS-S

The gaps between the three CCDs are ~37 unbinned pixels wide

### Wavefront Sensing

Must use on-instrument wavefront sensor (OIWFS)

### Imaging

Field of view = 330"x330"

Available Filters at GMOS-N: g',r',i',z', CaT broadband and H $\alpha$ , H $\alpha_c$ , DS920 narrowband filters. At GMOS-S: u',g',r',z', CaT broadband, H $\alpha$ , H $\alpha_c$ , [S II], [O III], and [O III]<sub>c</sub> filters

## Spectroscopy

Custom cut slit masks over a 305"x305" FOV provide long-slit and multi-object capability. Slits can have any width larger than 0.25", any length within the FOV, and may be tilted. A set of long-slit masks with lengths of 305" and widths of 0.5"-5" are installed in both instruments. The current multi-object mask design process requires imaging with GMOS to derive accurate object positions. Future software is expected to allow mask designs from accurate astrometry without the need for GMOS pre-imaging. The spectral grating options are as follows:

grating	blaze $\lambda$ (nm)	R (at blaze $\lambda$ with 0.5" slit)	dispersion (nm/pix)	simultaneous wavelength coverage
R150	717	631	0.174	1071 nm
R400	764	1918	0.067	416 nm
B600	461	1688	0.045	276 nm
R600	926	3744	0.047	286 nm
R831	757	4396	0.034	207 nm
B1200	463	3744	0.023	143 nm

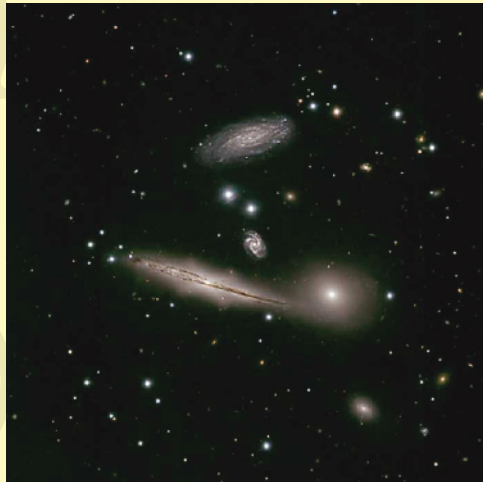
The GMOS IFUs consist of a 7"x5" object field and a 3.5"x5" sky field, each sampled with 0.2" fiber spacings. They re-image the object field into two "slits," and consequently have half the wavelength coverage of the normal long slits. Alternatively, the IFUs may be used in "one-slit" mode, which reduces the field size by half, but gives the full wavelength coverage. The IFU fibers have effective slit widths of 0.3" for calculating instrument resolution. The GMOS-S IFU is designed to utilize the N&S mode over a restricted 5"x5" FOV.

### Nod and Shuffle Mode

The N&S mode applies infrared observing techniques to optical spectroscopy, greatly improving the quality of sky subtraction in the red, where systematics usually dominate the uncertainties for faint objects. N&S mode shuffles the charge between "slit" and "storage" regions of the CCD while nodding between two positions on the sky every ~60 seconds. This places the sky spectrum on precisely the same pixels as the object spectra, eliminating the effects of sky and CCD fringe variability during sky subtraction. Details can be found at:

[www.gemini.edu/sciops/instruments/gmos/nod-and-shuffle](http://www.gemini.edu/sciops/instruments/gmos/nod-and-shuffle)

Information herein adapted from Gemini Web pages.  
For complete information, please see <http://www.gemini.edu/sciops/instruments/gmos/gmosIndex.html>



Hickson Compact Group 87, imaged with GMOS-S during commissioning in May 2003. This color image is a composite of images taken through g', r', and i' filters, and shows the excellent image quality of which the telescope and instrument are capable; the FWHM of the PSF is 0.36", 0.39", and 0.51" in the i', r', and g' bands, respectively.

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Queries for Gemini-specific issues should be directed to the  
Gemini HelpDesk at:

<http://www.gemini.edu/sciops/helpdesk/helpdeskIndex.html>

Cover image courtesy of the Gemini Observatory; HCG 87 image courtesy  
of the Gemini Observatory and the GMOS-S commissioning team.



December 2007

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## Optical Imager and Multi-Object Spectrograph



GMOS-S mounted on the up-looking port of Gemini  
South during instrument commissioning in February 2003

Offered at **Gemini North** and **Gemini South**

