# Cosmic Web Imager

**August 15, 2011**

## Overview

The Cosmic Web Imager (CWI) is a medium resolution integral field spectrograph for the Hale 200" telescope. The instrument was designed with the goal of detecting line emission from the circum-galactic medium. CWI saw first light in July 2009 and is currently on location at Palomar. CWI requires observing support by expert personnel.

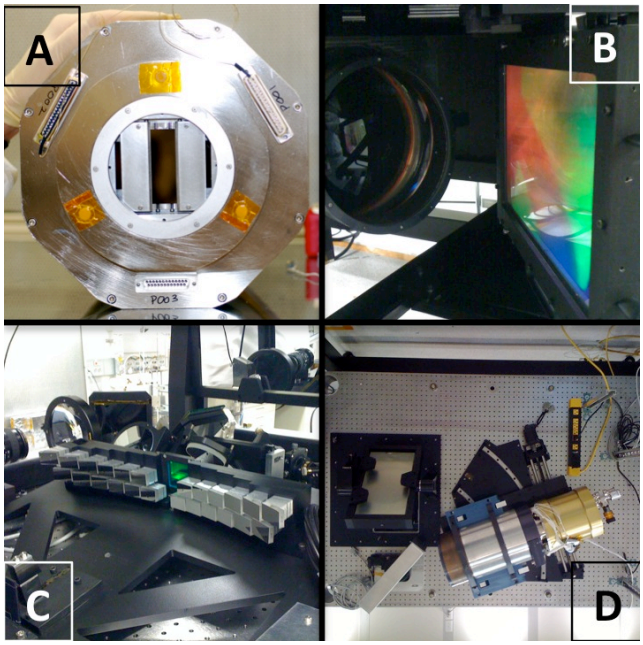


**Figure 1: (Panel A) The CWI detector is a large format, low noise e2v CCD with an integral nod and shuffle mask designed to provide excellent background subtraction. (Panel B) CWI uses large, high efficiency VPH gratings, and has repurposed the Norris camera. (Panel C) The CWI IFU was assembled and aligned in-house at Caltech with a diamond-turned aluminum image slicer and flexure mounted glass pupil mirrors. (Panel D) The CWI spectrograph operates in Littrow configuration with camera and detector mounted on an articulation stage that rotates about the grating.**

CWI is configured for masked nod-and-shuffle observations to achieve the precise background subtraction required for faint sources. As a consequence, only one third of the device (in the spectral direction) is exposed to light. Approximately 15 nm of spectral range can be exposed simultaneously. It is possible to remove the nod-and-shuffle mask and expand the spectral throughput to roughly 45 nm. This task requires significant engineering effort prior to and after an observing run but will be considered for motivating science cases.

## Instrument Specifications

| Parameter | Value |
|---|---|
| **Field-of-view:** | 60 x 40 arcseconds |
| **Spatial resolution** | 2.5 x 1 arcseconds |
| **Field orientation** | 0 to 90 degrees |
| **Accessible spectral range**[1] | 405 to 440 nm<br>450 to 540 nm<br>630 to 760 nm |
| **Spectral bandpass** | ~15 nm N&S<br>~45 nm unmasked |
| **Spectral resolution** | $R = \lambda/\Delta\lambda \sim 5000$<br>$\Delta\lambda \sim 0.1$ nm |
| **Efficiency**[2] | 10% |
| **CCD Format** | 4096x4096 |
| **Pixel Size** | 15 microns |
| **Binning** | 1x1, 2x2 |
| **Read noise**[3] | <2.8 $e^-$ |
| **Readout** | 1, 2, or 4 amplifiers |
| **Readout time (2x2)** | 2, 1, or 0.5 minutes |
| **Scripted Nod and Shuffle** | Yes |

## CWI Collaborations

The CWI team wants to form scientific collaborations that will generate interest in this instrument. We will endeavor to share experience, existing data reduction software, and help with associated questions and concerns to the extent possible. Collaborators should be aware that operation of the spectrograph requires *at least* one member of the CWI team who is familiar with the instrument design and function. Collaborating observers may be asked to aid in instrument operation.

## Contact Information

Members of the community are invited to contact the Principal Investigator, Professor Chris Martin (cmartin@srl.caltech.edu). The CWI team includes Matt Matuszewski (Post-doc), Anna Moore (Project Manager), Patrick Morrissey (Project Scientist), and Shahin Rahman (Graduate student). This summary was prepared by PM and MM.

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[1] The 405-440 and 630-760 nm gratings are on order. The bluest grating is a development effort for KCWI.

[2] $\sim 10^{-18}$ ergs/cm$^2$/s/arcsec$^2$ after 3 hours on target and 3 hours on background

[3] The exposures become sky background limited after about 20 minutes, though the exact time depends on the nature of the criterion used.