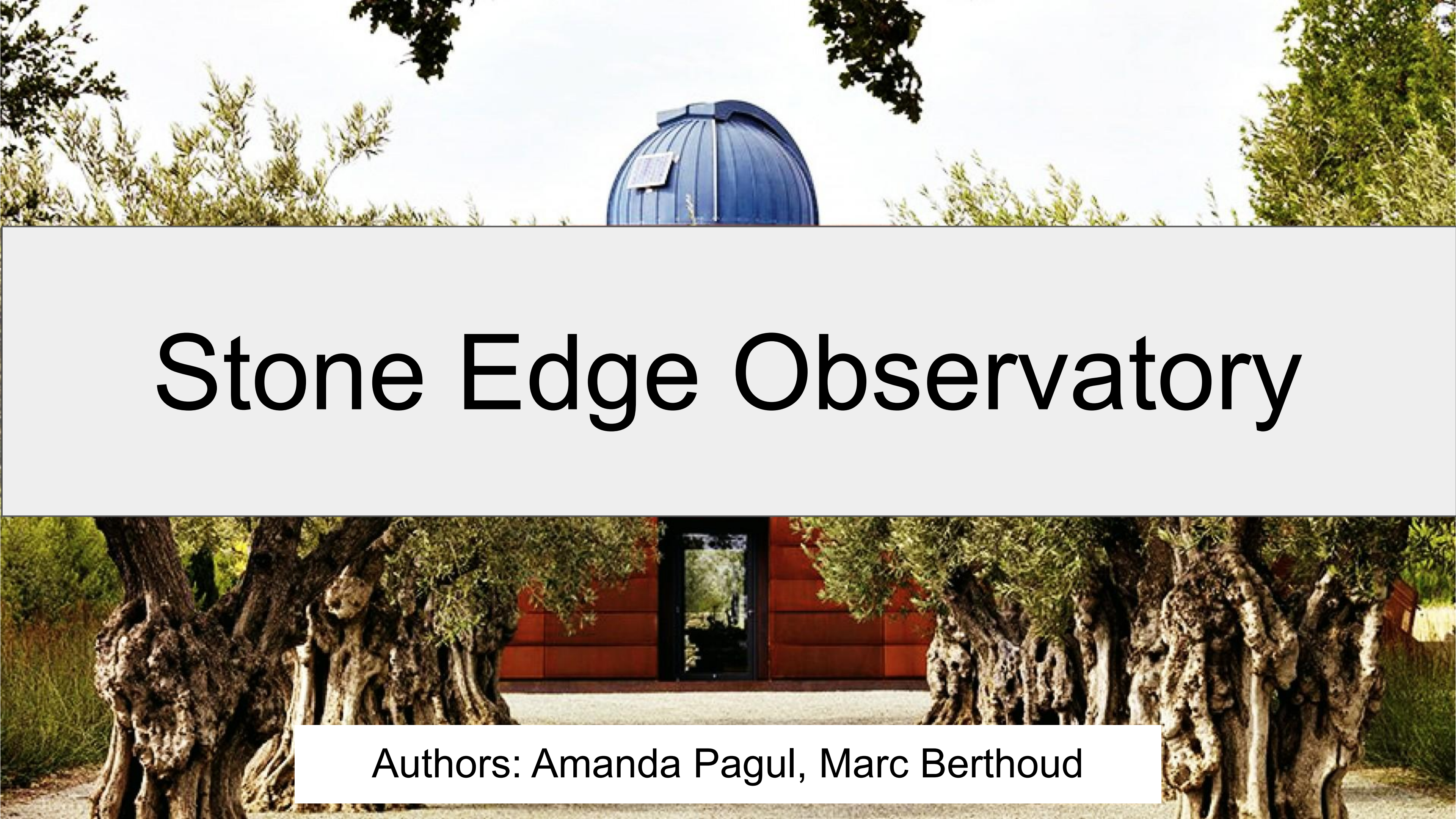

GLT
NOEMA
30-M
SMT
Kitt Peak
JCMT
SMA
LMT
ALMA
APEX
SPT



Stone Edge Observatory

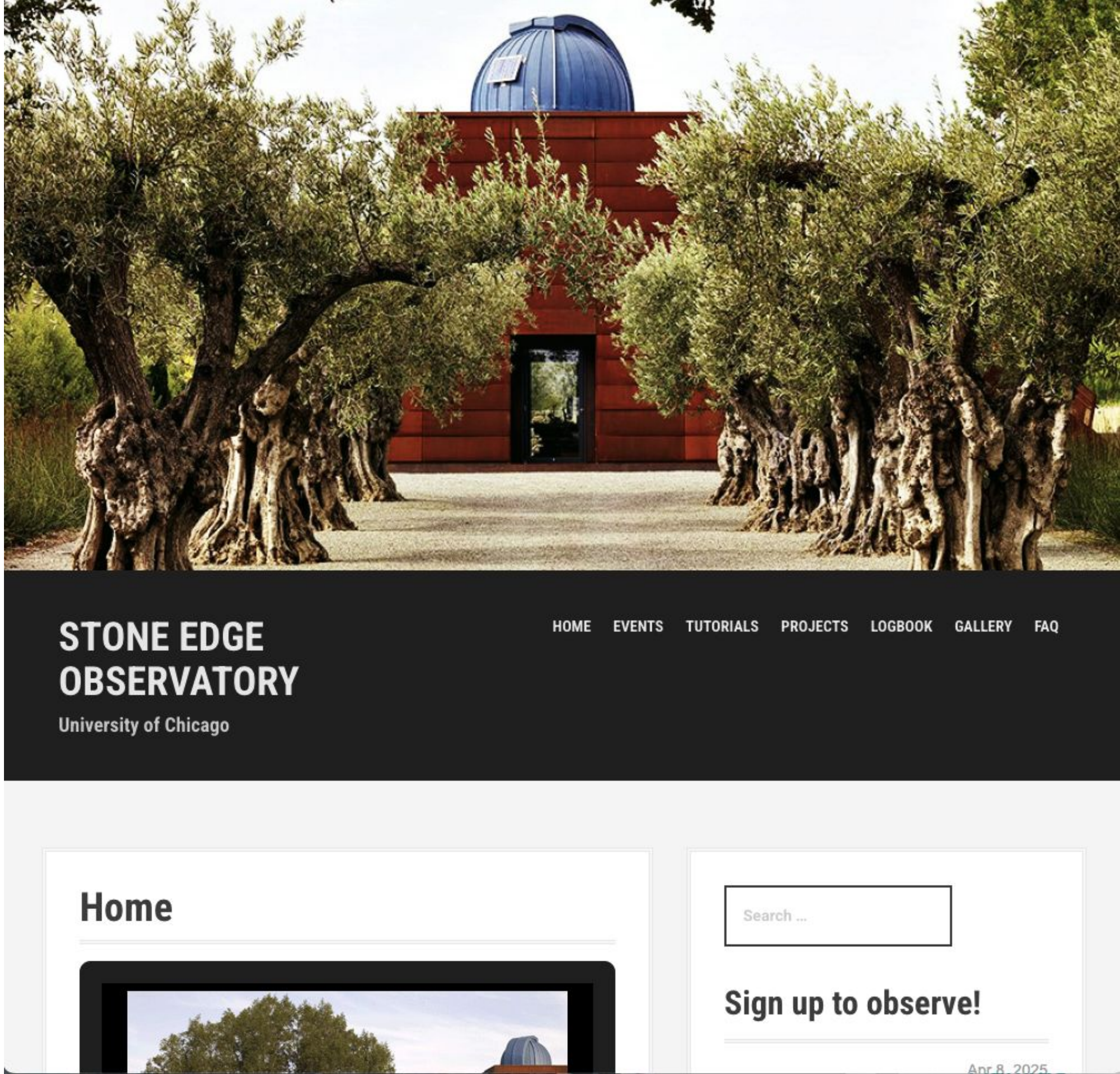
Authors: Amanda Pagul, Marc Berthoud

Recap

- Telescope in California, 0.5m mirror
- Camera 2048x2048pix, 26’x26’ FOV
- Filters: g’, r’, i’, Halpha, SII, OIII
- Gateway: stars.uchicago.edu
- #itzamna @ Slack to observe
- Make sure the skies are clear, check at:
    - NOAA Sonoma Weather
    - Airport reports for KAPC KDVO KO69
    - No Observing if Humidity > 90%, chance of
    - rain > 10% or sky cover > 25% at any of these

SEO Public Page

- FAQ
- Tutorials:
  - Hitchhiker's Guide to Observing
  - Stellar Magnitudes
- Sign up to observe



SEO Queue

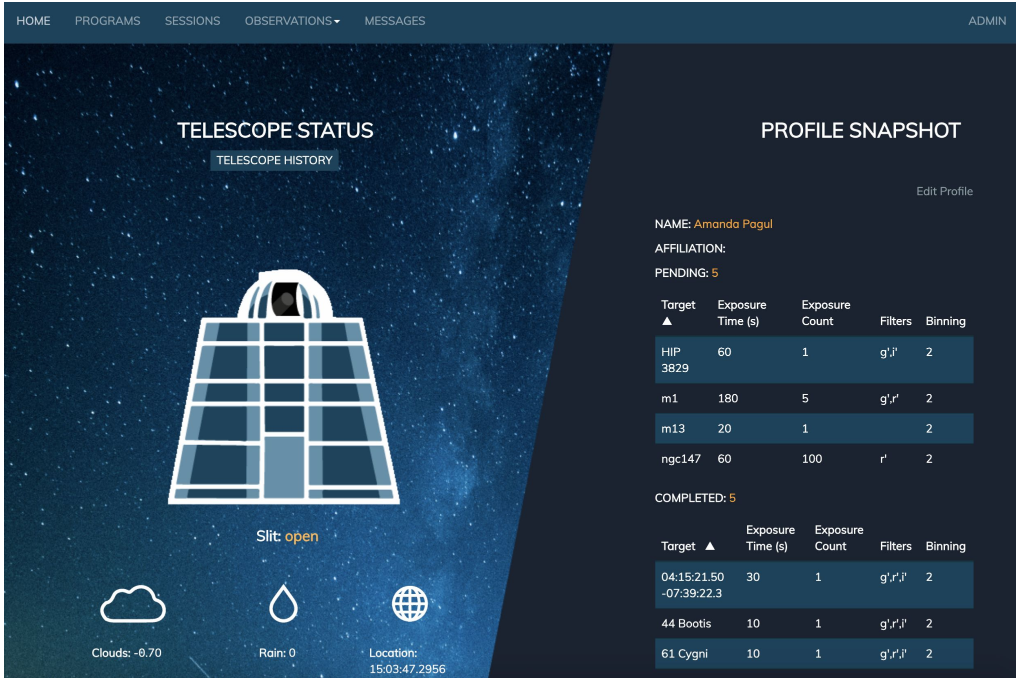
Submit observations to be taken at an “ideal” time, accounting for object altitude, user-specified advanced options (lunar avoidance, max airmass, etc.), and user priority.

Queue was upgraded last year.

New features we are working on:

- Exposure time suggestions
- User-specified session
- User-specified observing program
- Upgrade UI

Access here:
queue.stoneedgeobservatory.com/home



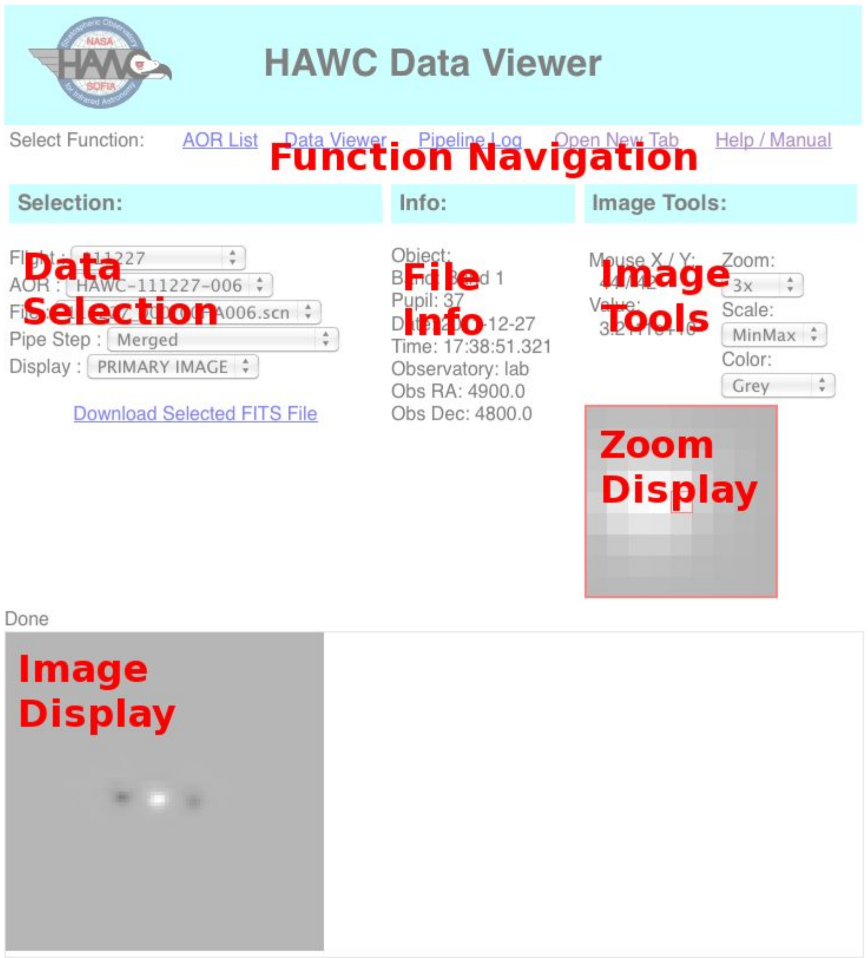
Ask Seth / Marc for an account to observe!

If you’d like to help develop additional features, contact marcberthoud@uchicago.edu

Getting SEO Images

Use Data Viewer on STARS to view and analyze data and to download images.

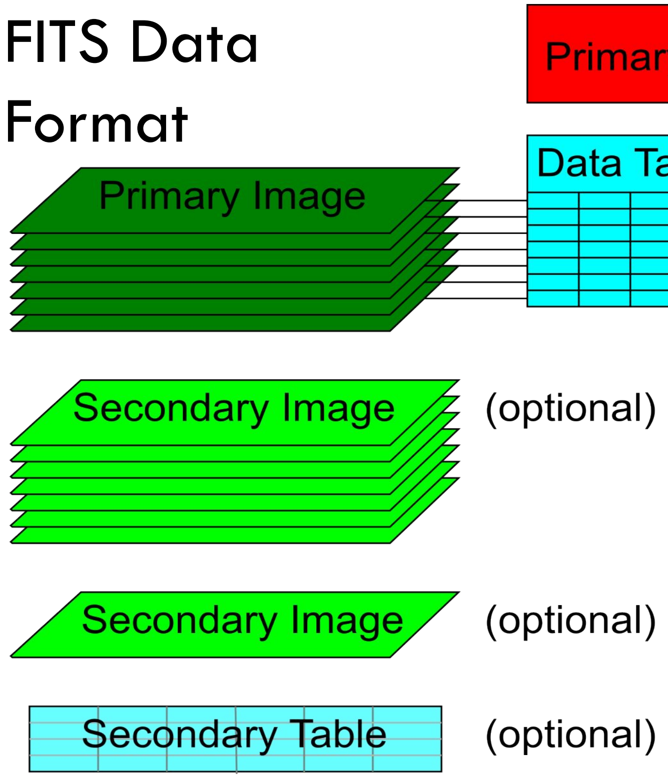
- Several viewers on stars:
  - stars.uchicago.edu/fitsview25
    for 2025 data
  - stars.uchicago.edu/queue
    for queue and class support data
- Several views:
  - List view: allows you to select observations
  - Data view: to look at and analyze data.
  - Pipeline log: current log of reduction pipeline
- Details on data access on the class wiki at github.com/bradfordbenson/ASTR21200_2025/wiki/Stone-Edge-Observatory



Data Reduction Pipeline

- Automates several processes which, for large data sets, can be time consuming to run on personal machines (or difficult to set up)
  - At a minimum, files are Bias/Dark/Flat corrected and hot pixels are removed
  - Process will typically work for images with many background stars. Otherwise color images will need to be created manually
  - Assuming all steps work, a color image preview will be generated
- Runs daily on the STARS to reduce queue and Itzamna data
- Generally good for creating images using g/r/i (broad-band) filters automatically, but not for other (narrow-band) filters like H-alpha, OIII, SII

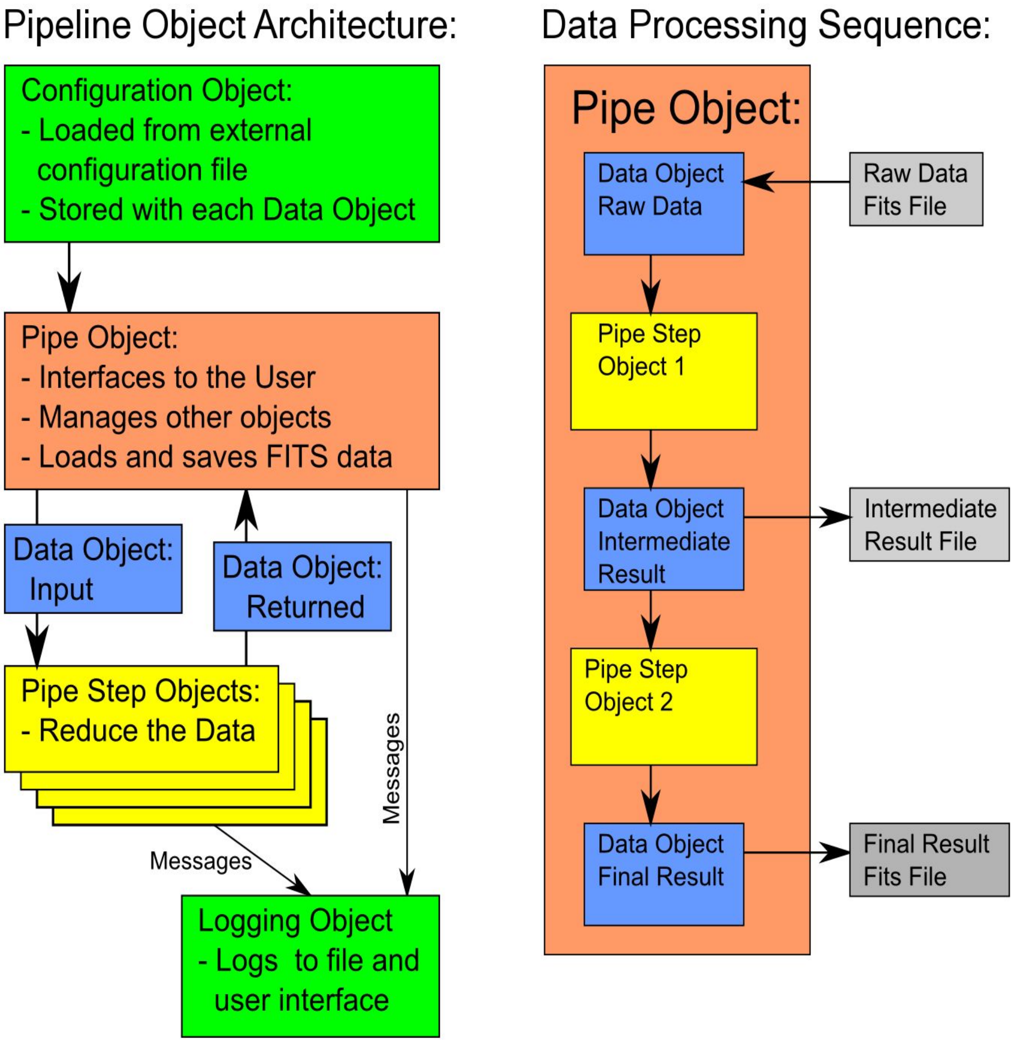
Flexible Image Transport System (FITS)



Main data format used by astronomers.

- Each image contains HDU(s) - header data unit
- Primary Header: Information about File and (optional) first data set
- Secondary Headers:
    - Tables
    - Additional Images (Error image, Bad Pixel Mask . . .)
- Images can have 2, 3 or more dimensions, same for table columns.

DarePype Structure



DarePype Configuration

- Each pipeline needs a configuration file (it will not run without it)
  - Config files has different sections: [general], [data] one for each mode, one for each step
- Pipe MODE says how the data is reduced.
  - Modes allow different ways to run the pipeline or reduce different types of data
  - STARS uses `mode_seo_server_ccd`
    Users should use `mode_seo_user_ccd`
- Make your own config file
- Config file Toolkit
  - Header overwrite
  - Hierarchical / delta config files
  - Modes can have extra parameters for steps

```
# General Section: configuration of the pipeline
[general]
    # list of packages to look for pipe step modules (order matters)
    steppacks = stonesteps, darepype.drp
    # list of steps for unknown instrument mode
    stepslist = load, StepRGB


# Data Section: information on data objects and file names
[data]
    dataobjects = DataFits, DataText #, DataCsv

### Pipelines Section: configuration for individual pipeline modes
# Stoneedge Mode Configuration
[mode_stoneedge]
# List of keyword=values required in file header to select this pipeline mode
    #   Format is: Keyword=Value|Keyword=Value|Keyword=Value
    datakeys = "OBSERVAT=StoneEdge"
    # list of steps
    stepslist = load, StepAddKeys, StepBiasDarkFlat, save, StepHotpix, StepRGB


### Pipe Step Section
# BiasDarkFlat step configuration
[biasdarkflat]
    # filename that overrules the fit keys
    biasfile = /data/images/StoneEdge/0.5meter/2018/*/bias/bias*.fits
    darkfile = /data/images/StoneEdge/0.5meter/2018/*/dark/dark*.fits
    flatfile = /data/images/StoneEdge/0.5meter/2018/*/flat/flat*.fits
    daterange = 0.5
    # list of keys that need to match bias and data file
    #fitkeys = 'list','of','FIT Keywords','for Bias/Dark/Flat' # StoneEdge
    biasfitkeys = XBIN, DATE-OBS
    darkfitkeys = XBIN, DATE-OBS, EXPTIME
    flatfitkeys = XBIN, FILTER, DATE-OBS
    # list of input file datasets to flatten
    # - Expects None or a list of image HDU
    #datalist = R array, T array


# RGB step configuration
[makergb]
    # percentile value for miniumum scaling (in decimal form)
    minpercent = 0.5
    # percentile value for maximum scaling
```

SEO Pipeline CCD

- The Pipeline runs automatically on all queue data and the data taken by #Itzamna or #Ixchel.
- You can look at the reduced data on STARS
  - Look at “Fits Data” → “SEO Queue” for the queue data
  - Look at “Fits Data” → “SEO 2025” for itzanma data
  - Look at “Fits Data” → “Data Folders” to have listing of raw files.
- The pipeline usually is able to fully reduce good r/g/i/clear data but not narrow-band (H-alpha, OIII, SII) or bad data.
  - At a minimum BDF/HDR corrected and hot pixel removed files are produced.
  - Calibration process will usually work well for images clear and bright foreground stars.

- Pipe Steps and Files:
  - Raw File: from telescope
  - StepAddKeys: Adds missing header information
  - StepBiasDarkFlat: Does BDF correction
  - StepHotpix: Removes bad pixels
  - HPX File: is BDF and hotpix corrected
  - StepAstrometry: Uses a star catalog to find precise RA/Dec coordinates
  - WCS File: Has updated coordinates
  - StepFluxCalSex: Uses sextractor to extract sources and callibrate the image using guide star catalog
  - FCAL File: Flux calibrated (also make fit plot .png)
  - StepRGB: makes JPEG rgb image
  - .JPG File: a JPEG image preview

Running the Pipeline in Colab / Jupyter Notebook

- Run through the the jupyter notebook under SEO UChicago/PipeLine/SEO_PipeColabV6.0.ipynb at https://drive.google.com/drive/folders/1O4HBbrZMIDb1l7XCH5ewJ8AVubsyh6rr?usp=share_link
- You can select which images to download. They should be RAW images of the same object taken with different filters.
- This folder also contains colab notebooks to
    - Coadd images: Coadd_DemoColabV2.1
    - Make an RGB image with the pipeline: MakeRGB_withPipeline
    - Run webastrometry: WebAstrometry_Colab_V2.1
    - DataDownload: To download large datasets from STARS

PipeRuns

- DarePypeRun.py is a support tool to help reduce data using darepype packages.
- Needs a PipeRun.txt file which specifies all run parameters

Example Piperun File:

```
# Daily Reduction PipeRun file
# This is a COMMENT
pythonpath = /data/scripts/pipeline/source
pipeconf = /data/scripts/pipeline/config/pipeconf_SEO.txt
/data/scripts/pipeline/config/dconf_stars.txt
pipemode = postbdf
loglevel = DEBUG
logfile = /data/scripts/pipeline/PipeLineLog.txt
inputfiles = /data/images/StoneEdge/0.5meter/2022/2022-01-12/reduced/*_HDR.fits
outputfolder = /data/images/StoneEdge/0.5meter/2022/2022-01-12/reduced
```

PipeRuns (continued)

- To run a darepyperun download and edit user_piperun.txt and user_dconf.txt files from stars.uchicago.edu/images/Temp/Users/berthoud
- Edit those files to point to your installation of the SEO pipeline and the RAW data you want to be reduced.
- Run piperun with the following command in the command line

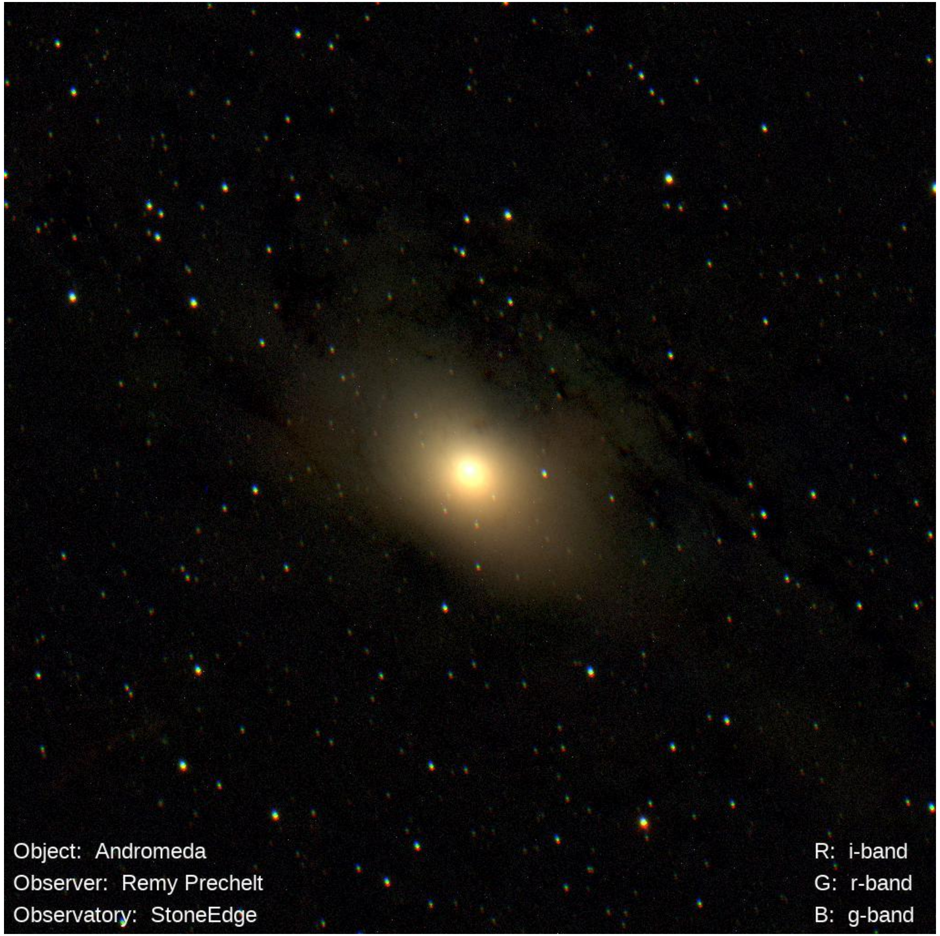
```
darepyperun.py /path/to/your_piperun.txt
```

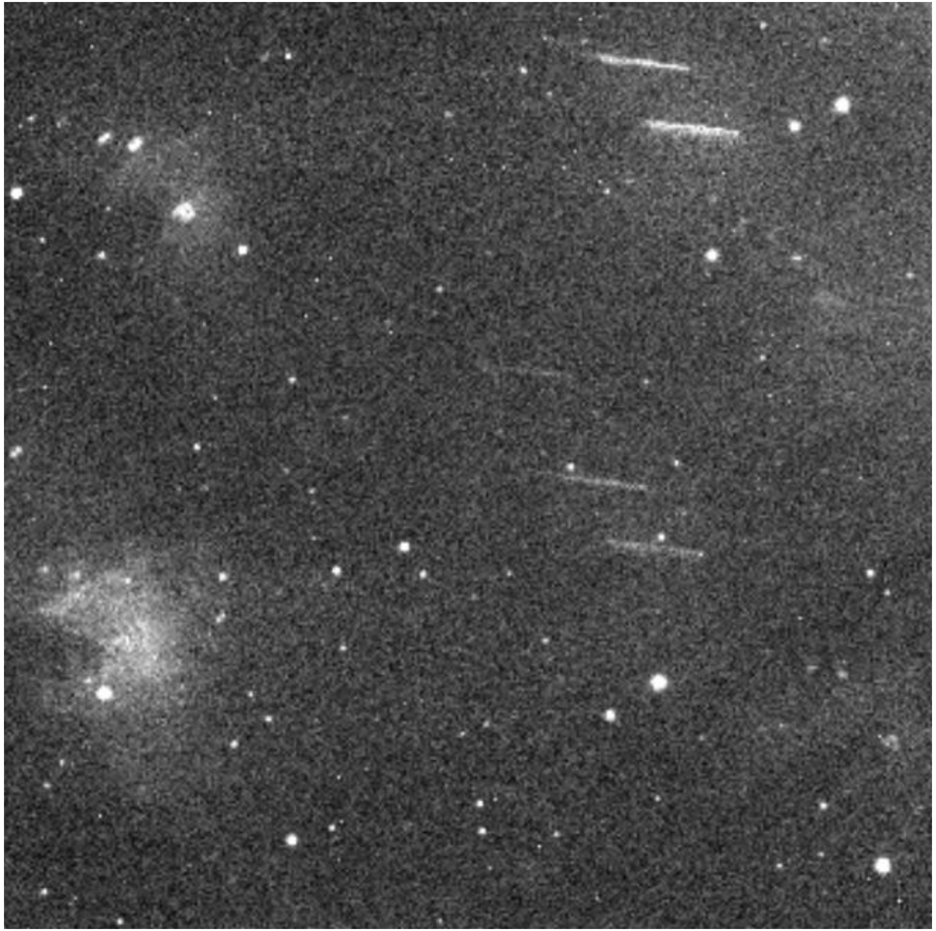
  - You might have to set PATH or list full path for darepyperun

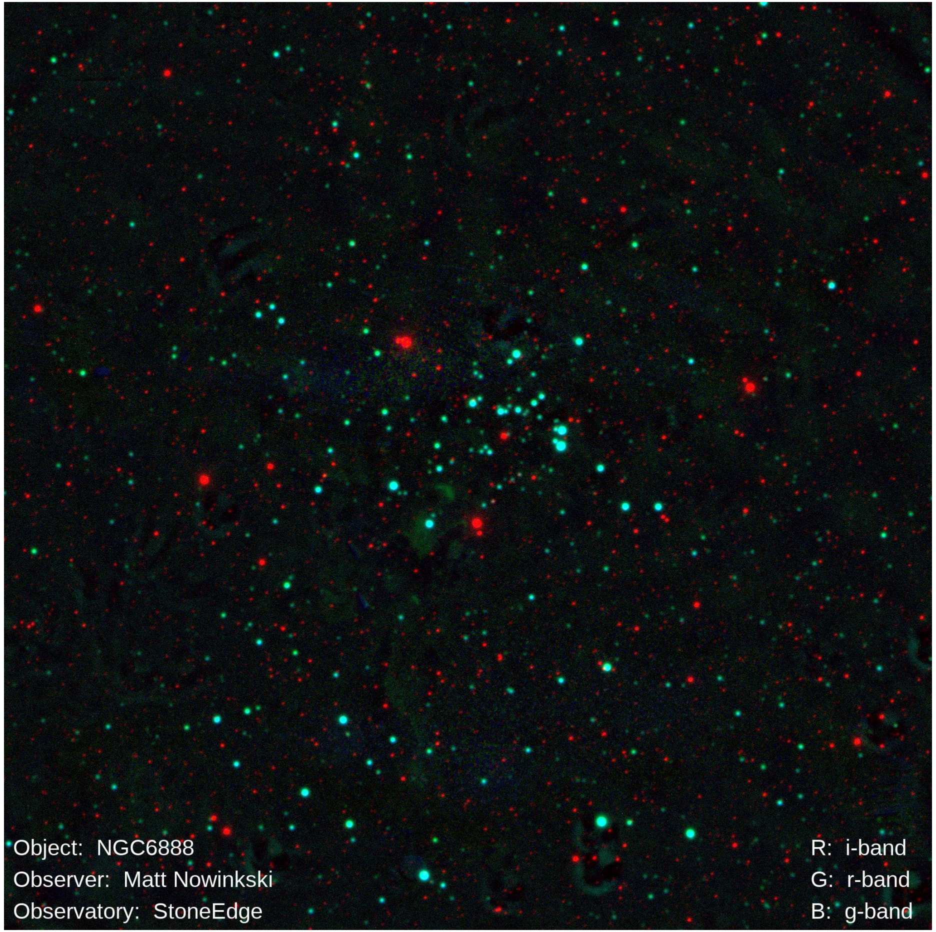
- That’s all Folks!

Installing the Pipeline

- Requires python (version 3.6 or later)
  - Also requires the following python packages
    - numpy
    - astropy
    - logging
    - darepype
    - drizzle (for creating mosaics)
    - ccdproc (for BDF corrections)
- Git repo is located at github.com/yerkesobservatory/pipeline
- More documentation and instructions for running the pipeline locally can be found on the projects page at sites.google.com/a/starsatyerkes.net/yerkesprojects/projects/image-pipeline/pipe-development






Object: NGC6888
Observer: Matt Nowinkski
Observatory: StoneEdge
R: i-band
G: r-band
B: g-band

StarDrive & StarBase

StarDrive

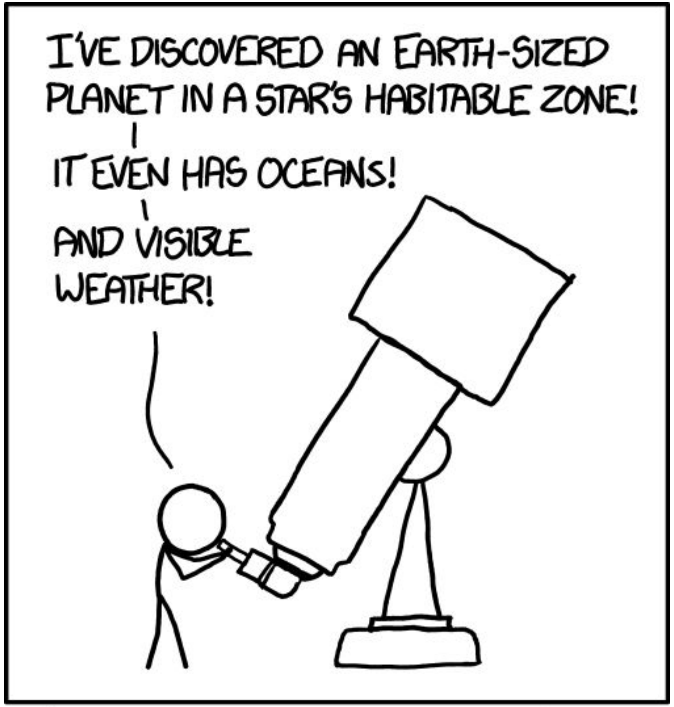
- 24TB NAS with Raid 5
- Archives all past SEO data
- Temporary user folder (up to 1TB)
- Can also support other projects.

Starbase

- Raspberry Pi 4 8GB with 1TB SSD
- Mounted access to StarDrive
- Pipeline installed (incl. astrometry.net)
- Temporary or permanent student accounts possible.
- Ask Marc for an account on Starbase

Additional Comments

- Caleb, Rohan, Seth and Marc and are usually on Slack and willing to help!
- The SEO community is awesome and will help out if you ask a question and they happen to be on Slack
- Please reach out if you would like to observe, do a mini SEO project, or help in the development – any level of engagement is welcome! :)
- The software can always be improved, suggestions, bug reports and help is appreciated.

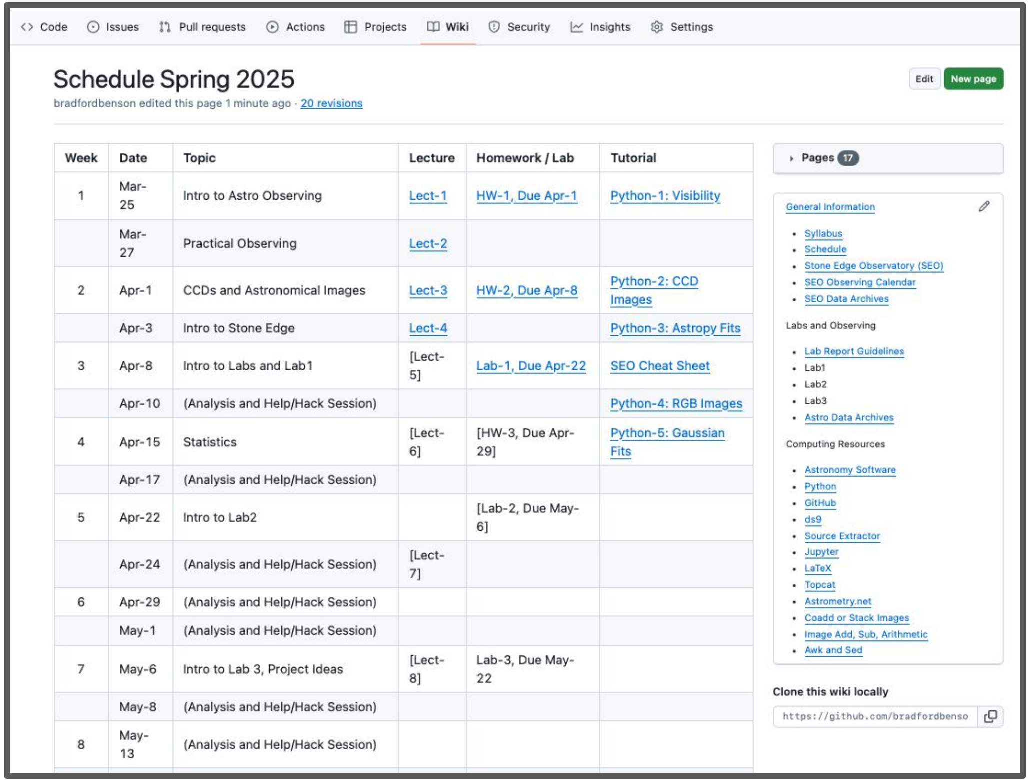


TO MESS WITH AN ASTRONOMER, PUT A MIRROR IN THE PATH OF THEIR TELESCOPE.

Horsehead Nebula
Lorenzo et al. 2022

Lab-1: CCDs and Astronomical Images

- Lab is posted on the GitHub and Canvas
- Two phases to the lab:
  1) Analyzing “archival” SEO data
  2) Scheduling and analyzing SEO data of your own
     - Make sure you are on itzamna channel in Slack
     - Try to pick objects and schedule time on SEO as soon as you can!



Code Issues Pull requests Actions Projects Wiki Security Insights Settings

Schedule Spring 2025

Edit New page

bradfordbenson edited this page 1 minute ago · 20 revisions

Week	Date	Topic	Lecture	Homework / Lab	Tutorial
1	Mar-25	Intro to Astro Observing	Lect-1	HW-1, Due Apr-1	Python-1: Visibility
	Mar-27	Practical Observing	Lect-2		
2	Apr-1	CCDs and Astronomical Images	Lect-3	HW-2, Due Apr-8	Python-2: CCD Images
	Apr-3	Intro to Stone Edge	Lect-4		Python-3: Astropy Fits
3	Apr-8	Intro to Labs and Lab1	[Lect-5]	Lab-1, Due Apr-22	SEO Cheat Sheet
	Apr-10	(Analysis and Help/Hack Session)			Python-4: RGB Images
4	Apr-15	Statistics	[Lect-6]	[HW-3, Due Apr-29]	Python-5: Gaussian Fits
	Apr-17	(Analysis and Help/Hack Session)			
5	Apr-22	Intro to Lab2		[Lab-2, Due May-6]	
	Apr-24	(Analysis and Help/Hack Session)	[Lect-7]		
6	Apr-29	(Analysis and Help/Hack Session)			
	May-1	(Analysis and Help/Hack Session)			
7	May-6	Intro to Lab 3, Project Ideas	[Lect-8]	Lab-3, Due May-22	
	May-8	(Analysis and Help/Hack Session)			
8	May-13	(Analysis and Help/Hack Session)			

Pages 17

General Information

- Syllabus
- Schedule
- Stone Edge Observatory (SEO)
- SEO Observing Calendar
- SEO Data Archives

Labs and Observing

- Lab Report Guidelines
- Lab1
- Lab2
- Lab3
- Astro Data Archives

Computing Resources

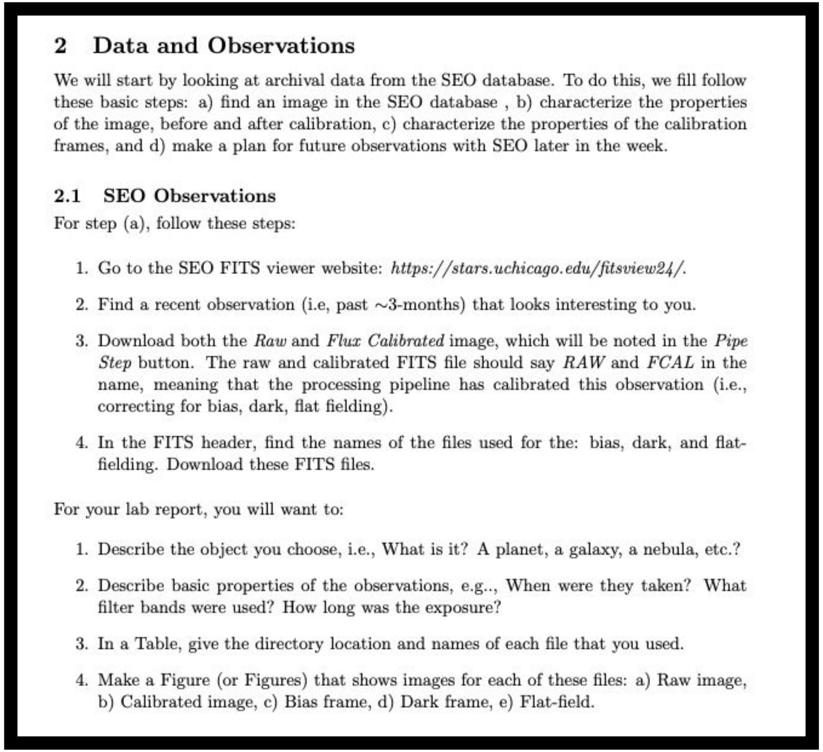
- Astronomy Software
- Python
- GitHub
- ds9
- Source Extractor
- Jupyter
- LaTeX
- Topcat
- Astrometry.net
- Coadd or Stack Images
- Image Add, Sub, Arithmetic
- Awk and Sed

Clone this wiki locally

https://github.com/bradfordbenso

Lab-1: Overview

Use SEO FITS archive to find data



2 Data and Observations

We will start by looking at archival data from the SEO database. To do this, we fill follow these basic steps: a) find an image in the SEO database , b) characterize the properties of the image, before and after calibration, c) characterize the properties of the calibration frames, and d) make a plan for future observations with SEO later in the week.

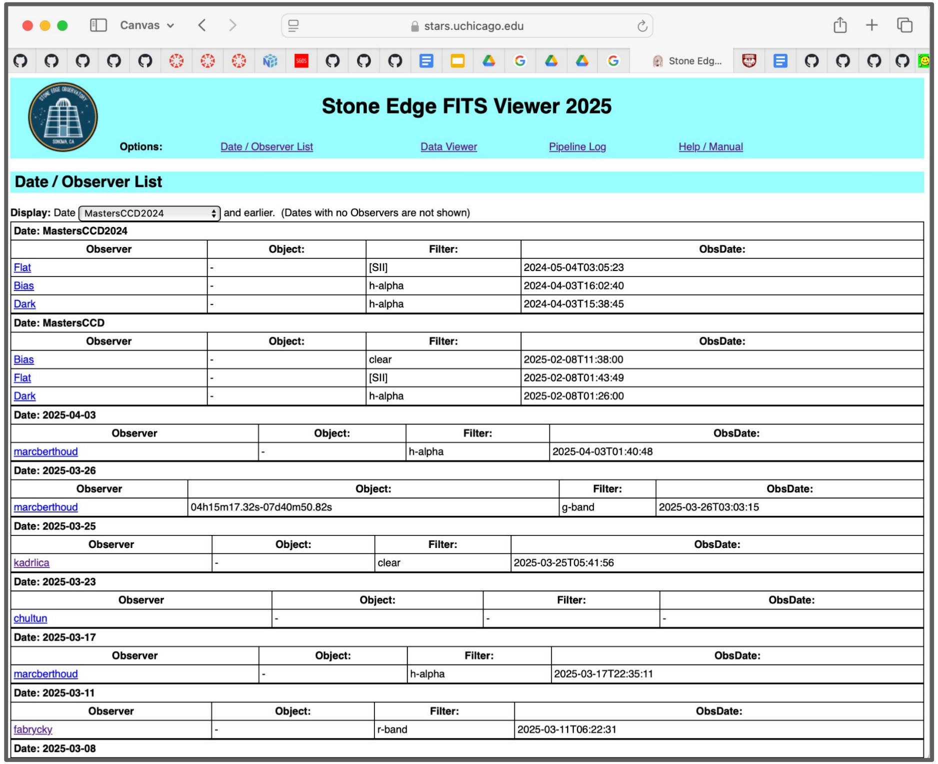
2.1 SEO Observations

For step (a), follow these steps:

1. Go to the SEO FITS viewer website: *https://stars.uchicago.edu/fitsview24/*.
2. Find a recent observation (i.e, past ~3-months) that looks interesting to you.
3. Download both the *Raw* and *Flux Calibrated* image, which will be noted in the *Pipe Step* button. The raw and calibrated FITS file should say *RAW* and *FCAL* in the name, meaning that the processing pipeline has calibrated this observation (i.e., correcting for bias, dark, flat fielding).
4. In the FITS header, find the names of the files used for the: bias, dark, and flat-fielding. Download these FITS files.

For your lab report, you will want to:

1. Describe the object you choose, i.e., What is it? A planet, a galaxy, a nebula, etc.?
2. Describe basic properties of the observations, e.g.., When were they taken? What filter bands were used? How long was the exposure?
3. In a Table, give the directory location and names of each file that you used.
4. Make a Figure (or Figures) that shows images for each of these files: a) Raw image, b) Calibrated image, c) Bias frame, d) Dark frame, e) Flat-field.



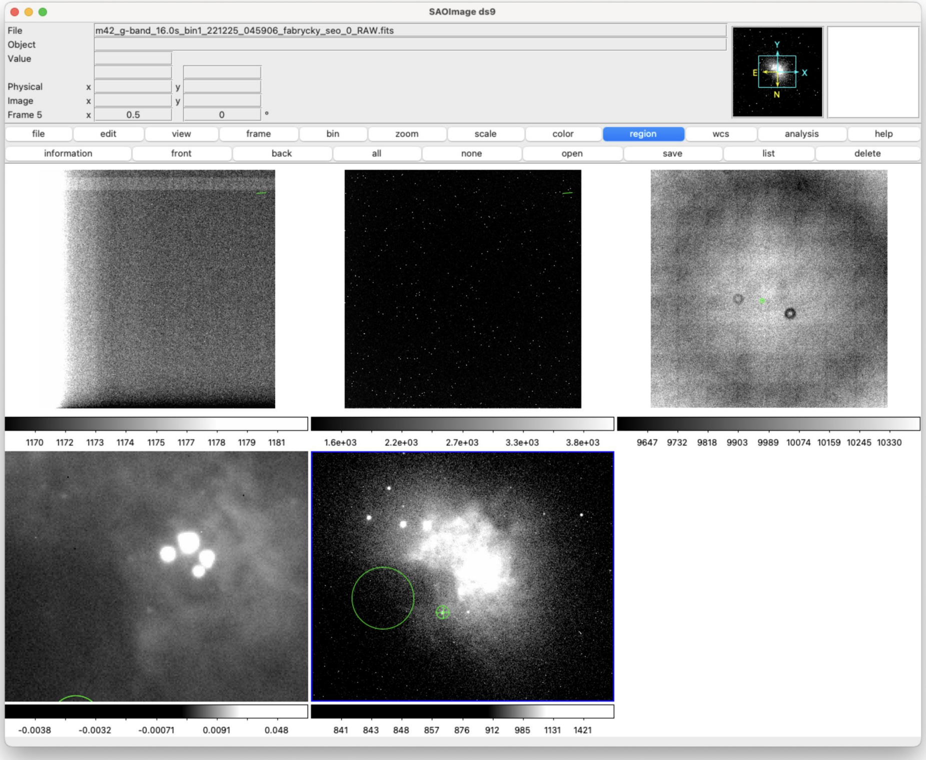
Lab-1: Overview

To plot and analyze data, most likely use ds9, python (see tutorial on wiki), or other programs of your choice

3 Data Analysis

For each of the observations above, characterize the basic statistical properties of the images and include the below information in your lab report:

1. For each image, measure the mean, median, standard deviation, maximum, and minimum value of the images. Put these values in a table, and describe the basic properties of each, i.e., why they do (or don't) make sense given the nature of each (e.g., why are the calibrated units different than the raw image? How do the mean and standard deviation of the bias compare to the other images?
2. **Bias frame:** The standard deviation of the bias frame is a measure of the read noise in units of counts. Does the standard deviation match the width of the distribution in the histogram? Why doesn't it? What might be a better way to estimate the read noise (i.e., rather than a straight standard deviation)?
3. **Dark frame:** Plot a histogram of the counts. Can you identify any hot pixels? From the histogram, what cut would you use to reject them? And what fraction of pixels gets rejected?
4. **Dark frame:** What is the dark current in electrons per pixel per second? What temperature was your dark frame taken at? Was the bias frame taken at the same temperature, and how would that affect this measurement?
5. **Flat field:** Plot a histogram of counts in the flat field? Describe its statistical properties, and relate features in the image to what you see? What does the flat field have to say quantitatively about the variation of sensitivity or efficiency across the raw image?
6. **Calibrated Image:** Choose a region of the image where there are one (or several) obvious astronomical objects. Can you fit a Gaussian to the point spread function (PSF) and measure the full-width at half-maximum (FWHM)? What is your measured FWHM in pixels? and arcseconds?



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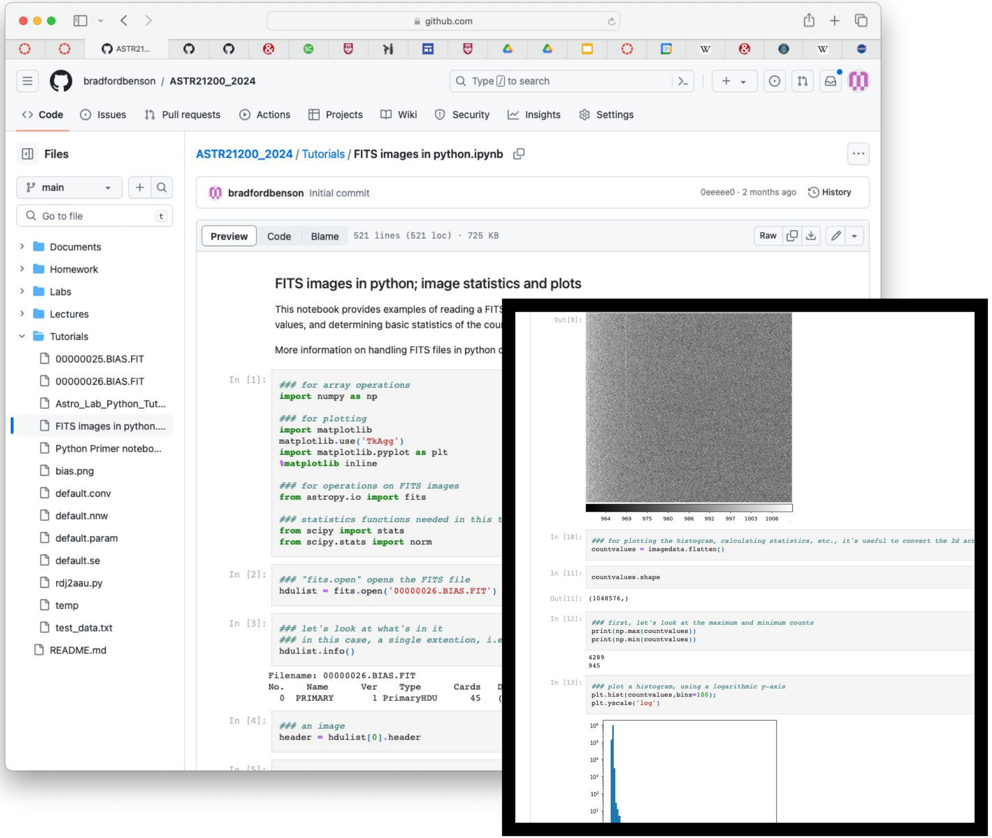


Lab-1: Overview

Take an observation with SEO and make an RGB image

4 New SEO Observations

To gain experience with real-time observations with SEO, you are going to take an image of an object from the *Messier catalog*. The Messier catalog includes some of the most visually impressive objects in the sky. There were originally selected in the 18th century as a set of relatively bright, extended, non-stellar objects. There are 110 Messier objects in total, and includes 39 galaxies, 29 globular clusters, 27 open clusters, 6 diffuse nebulae, 4 planetary nebulae, and 1 supernova remanent. You can find a full list of Messier objects at *https://en.wikipedia.org/wiki/Messier_object*.

Preparing for your SEO observations:

1. *Join Itzamna:* Make sure you are in join the **itzamna** channel on the SEO Slack. Ask your TAs, Brad, or Marc to be invited.
2. *Pick an object:* Look through the list of Messier objects, and find one that is interesting to you and observable from SEO in the next week. Feel free to use itzamna channel to find objects and plot their visibility.
3. *Schedule a time:* Make sure to check out the SEO calendar [1]. Pick a date and time that would be convenient for your group to observe your targets and reserve time on the calendar. Ideally, you would schedule a zoom session amongst your lab group to jointly participate and follow along with remote observing.
4. *Itzamna observing instructions:* For detailed observing instructions, review and follow the steps in the *SEO Cheat Sheet* [2]
5. *Take SEO images:* Take *gri* filter measurements of your object (i.e., one observation per filter, three observations total). You will likely want to take 30 or 120 second exposures, though it will depend on the object's magnitude. You might want to take an initial short exposure (e.g., 10 or 30-sec), to see how it looks before deciding.
6. *Download your data:* You will likely have to wait 1-day for your images to be processed. You can check on the processing state and eventually download your data

Lab-1: Lab Report

- Lab-1 instructions include guidance about what format we want for the Lab Report.
    - Expecting the first report to be in Jupyter notebook form, with outline mirroring the Lab instructions (i.e., Intro, Data/Observations, Data Analysis, Future Work) (similar to a paper)
- ***Each person should submit their own Lab report!***
    - Common analyses / code / images can be used by the lab group, but each individual should write their own lab report, with descriptions and text of their own (note the name of your lab partners)

5 Lab Report

Prepare a *jupyter* notebook that documents your entire analysis for the lab. Make sure to explain your steps and conclusions; imagine writing a tutorial for another astronomy student, who is not taking the class. Use *markdown* boxes (which can also parse $\LaTeX$). Note that you can also include figures (i.e., in png, jpg, etc. form) that are produced outside of the notebook (e.g. with ds9).

The explanations in the *jupyter* notebook will be what we read, but we might look at your code if we think you did something wrong. Make sure that the report is logical; each section should have a short introduction, then code with results and plots, then a conclusion. Make sure the section numbering follows this manual (e.g., Introduction, Data, Data Analysis, Conclusions). Once your notebook is finished, make sure to restart it and re-run all cells. Then save the notebook in pdf format, e.g., through the print menu.

1 Lab Report 2

1.0.0.1 Jason Wu, with Elena Jochum, Dillion Bass, and Joseph Yeung

In the 1929, Edwin Hubble laid the groundwork for modern cosmology by observationally confirm the notion of an expanding universe, a theory implicitly suggested by Einstein's theory of General Reletivity. This discovery was an

Lab-1: Lab Groups

- You will do the labs in “groups”
  - We have 31 people in the course, so next week, we will need to break into 7x groups of 4-5 people per group at next week’s class
  - Feel free to choose your group, and we will help match anyone needing a group.
- Any questions?

5 Lab Report

Prepare a *jupyter* notebook that documents your entire analysis for the lab. Make sure to explain your steps and conclusions; imagine writing a tutorial for another astronomy student, who is not taking the class. Use *markdown* boxes (which can also parse $\LaTeX$). Note that you can also include figures (i.e., in png, jpg, etc. form) that are produced outside of the notebook (e.g. with ds9).

The explanations in the *jupyter* notebook will be what we read, but we might look at your code if we think you did something wrong. Make sure that the report is logical; each section should have a short introduction, then code with results and plots, then a conclusion. Make sure the section numbering follows this manual (e.g., Introduction, Data, Data Analysis, Conclusions). Once your notebook is finished, make sure to restart it and re-run all cells. Then save the notebook in pdf format, e.g., through the print menu.

Spare Slides / Notes

Outline

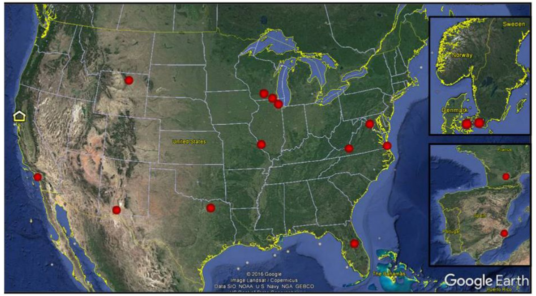
- Observatory
- Telescope
- Observing
  - Itzamna Slack interface
  - Queue
- Data visualization and download
- Data reduction pipeline
- Additional computing and storage resources


M8 by Lindsay


M42 by Emil

About

- SEO: located on Stone Edge Farm vineyards and winery in Sonoma, CA.
- University of Chicago is operating the telescope making it available to students and researchers.
- SEO is used by astronomers and students worldwide.



- SEO science examples: asteroid lightcurves, supernovae and comet observations and high precision photometry.

Who's Who

- John McQuown: Owner of Stone Edge Farm
- Rich Kron: Faculty advisor
- Al Harper: Scientific advisor
- Richard Treffers: Telescope Engineer
- Amanda Pagul: Facility Astronomer
- Matt Nowinski: Observation software engineer and student advisor
- Rohan Gupta: System integrator
- Seth Knights: Software engineer
- Caleb Krueger: Observation specialist
- Marc Berthoud: Data software engineer and database curator.

Rich, Al, Amanda and Marc are available for support anytime.

Your gateway to SEO: UChicago server at
https://stars.uchicago.edu

More about the Stone Edge Observatory

Some technical details:

- Ritchey-Chretien telescope with an aperture of 0.5m (20”)
- Field of view is 26’x26’ (2048 x 2048 pixels)
- Currently SDSS g’, r’, i’, H-alpha, SII, OIII, and clear filters (will soon include SDSS u’, z’)
- Current Camera: FLI Proline PL230 camera with an e2v CCD 230-42 chip
- Spare Camera: SBIG Aluma AC4040 CMOS

For general information, tutorials, and to request observing time, visit https://voices.uchicago.edu/stoneedgeobservatory.com/

Itzamna on Slack

Itzamna: Mayan sky god

Itzamna: Slack robot interacting with the SEO telescope. Takes commands on a Slack channel. Written by Matt Nowinski

To use Itzamna:

- Go to stars.uchicago.edu → Stone Edge → Slack
- Use your personal login or class account.

- Use the “itzamna” channel:
  - \help - to get command list
  - \clearsky - gives weather information
  - \lock - to lock the telescope so you can use it.
  - \crack - open the dome
  - \track on - start tracking
  - \find “object“- search the database
  - \pinpoint - point telescope to found object
  - \image “seconds” “bin” “filter” - take an image with given settings
  - \tostars - copies images to stars server
  - \squeeze - close the telescope dome
  - \unlock - release your lock on the telescope.
- Make sure the skies are clear, check at:
  - NOAA Sonoma Weather
  - Airport reports for KAPC KDVO KO69
  - **No Observing if** Humidity > 90%, chance of rain > 10% or sky cover > 25% at any of these

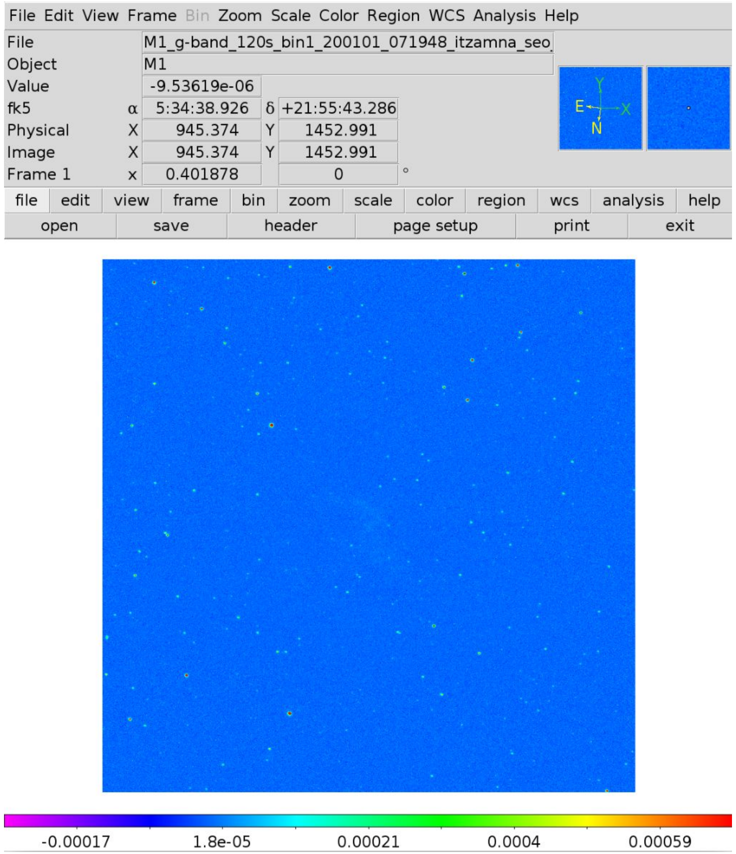
Student **T**eacher **A**stronomy **R**esource STAR Server

stars.uchicago.edu

- Education → Class Wiki
- Stone Edge → Queue, SEO Main page
- FITS Data → Fits View, Folders

DS9 — Image Analysis and making RGBs

- The pipeline sometimes fails before reaching completion, for a variety of reasons
- You can still make color images even when this happens though, using a tool called DS9
  - It can be found at http://ds9.si.edu/site/Home.html with versions for Mac, Windows, and Linux
- Also great for making quick color images while operating Itzamna
  - Also capable of more sophisticated scientific operations and measurements
  - Instructions for creating a color image can be found at http://ds9.si.edu/doc/user/rgb/index.html



SEO Raw Images for HDR mode (CMOS camera)

- The CMOS Camera has HDR (high dynamic range) mode and takes two images for each exposure.
    - One Low gain image - to get the flux of bright stars
        - Image stored in secondary header
    - One High gain image - to get the flux of dim stars and objects. This over-saturates bright stars.
        - Image stored in primary header
- The camera can still be operated single image mode.
    - In that case first HDU has the image.

SEO Pipeline HDR

- The Pipeline runs automatically on all queue data and the data taken by Itzamna / ixchel.
- You can look at the reduced data on the stars server at stars.uchicago.edu
  - Look at “Fits Data” → “SEO Queue” for the queue data
  - Look at “Fits Data” → “SEO 2022” for itzanma data
  - Look at “Fits Data” → “Data Folders” to have listing of raw files.
- The pipeline usually is able to fully reduce good r/g/i/clear data but not narrow-band (H-alpha, OIII, SII) or bad data.
  - At a minimum BDF/HDR corrected and hot pixel removed files are produced.
  - Calibration process will usually work well for images clear and bright foreground stars.

- Pipe Steps and Files:
  - Raw File: from telescope
  - StepAddKeys: Adds missing header information
  - StepHdr: Used instead of StepBiasDarkFlat to reduce and combine high dynamic range (HDR.fits) data
  - StepHotpix: Removes bad pixels
  - HPX File: is BDF and hotpix corrected StepSrcExtPy: Extracts point sources
  - SEP File: has table of extracted sources
  - StepAstrometry: Uses a star catalog to find precise RA/Dec coordinates
  - WCS File: Has updated coordinates
  - StepFluxCal: Uses extracted sources to calibrate the image using guide star catalog
  - FCAL File: Flux calibrated (also make fit plot .png)
  - StepRGB: makes JPEG rgb image
  - .JPG File: a nice JPEG

UChicago Makerspaces

You can learn to build your own projects and experiments on campus. There are several student labs available for you.

- MIELab: WERC 524
  - Sensing electronics: Radio to UV
  - IoT and embedded computers
  - In-situ and remote sensing equipment.
  - Data acquisition and automation
- POLSKY center Fab Lab: School of Business
  - Mechanical building, electronics polsky.uchicago.edu/fab-lab
- Mechanical Design + Fabrication Lab: PRC 307
  - 3D printers, CAD workstations, engineering support voices.uchicago.edu/mechanicallab
- Hack Arts Lab (HAL): MADD center, Crerar Library
  - 3D printers, laser cutters arts.uchicago.edu/hack-arts-lab-hal
  - MADD center also has Weston Game Lab

Marc’s Notes

- Nothing now