EFOSC: Observing and data reduction

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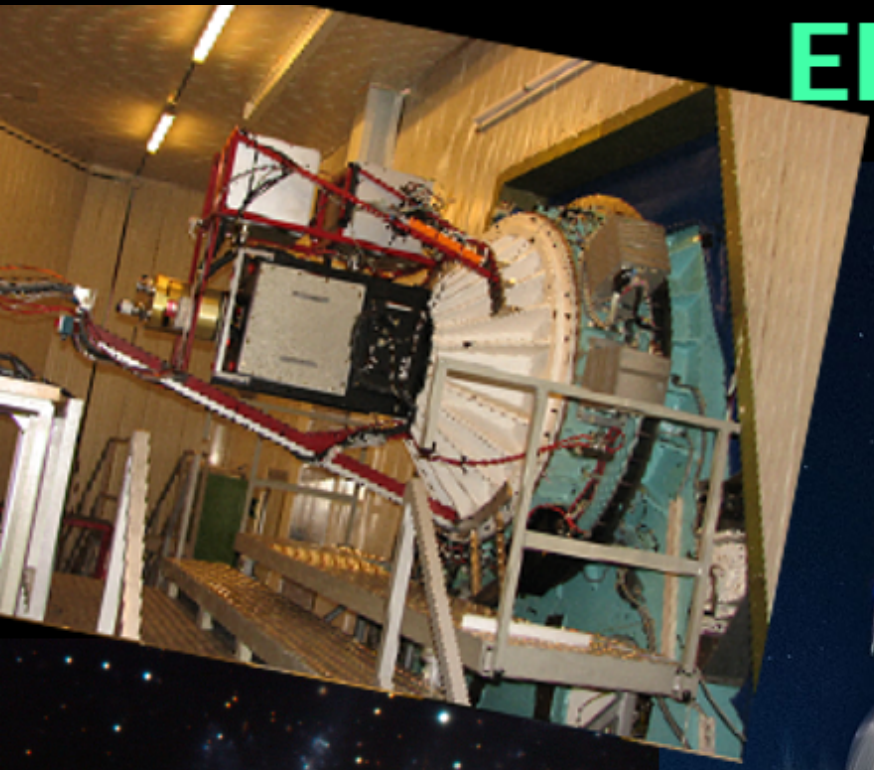
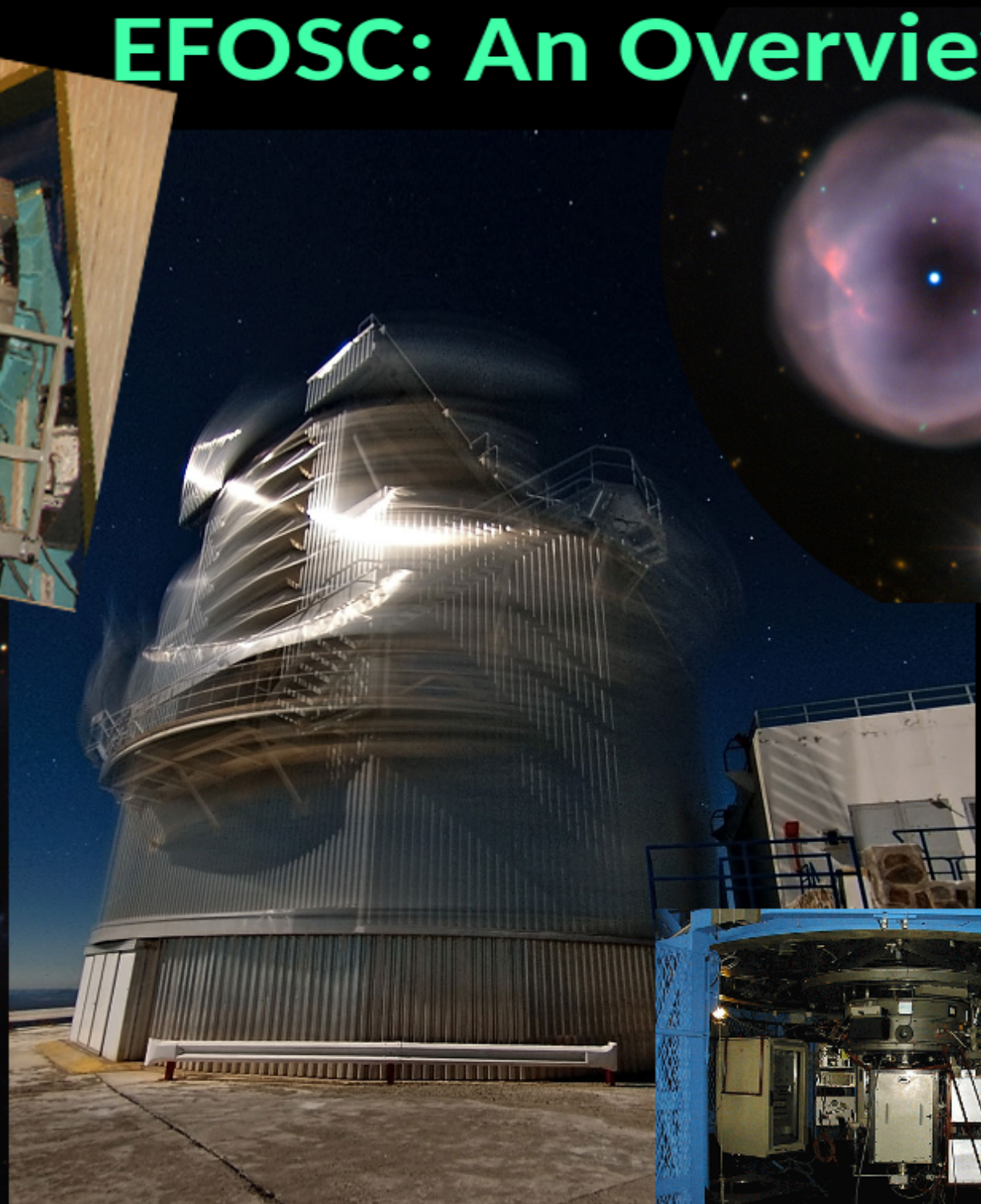
European Southern Observatory, Chile

La Silla Observing School 12th- 23rd February 2024

EFOSC: An Overview



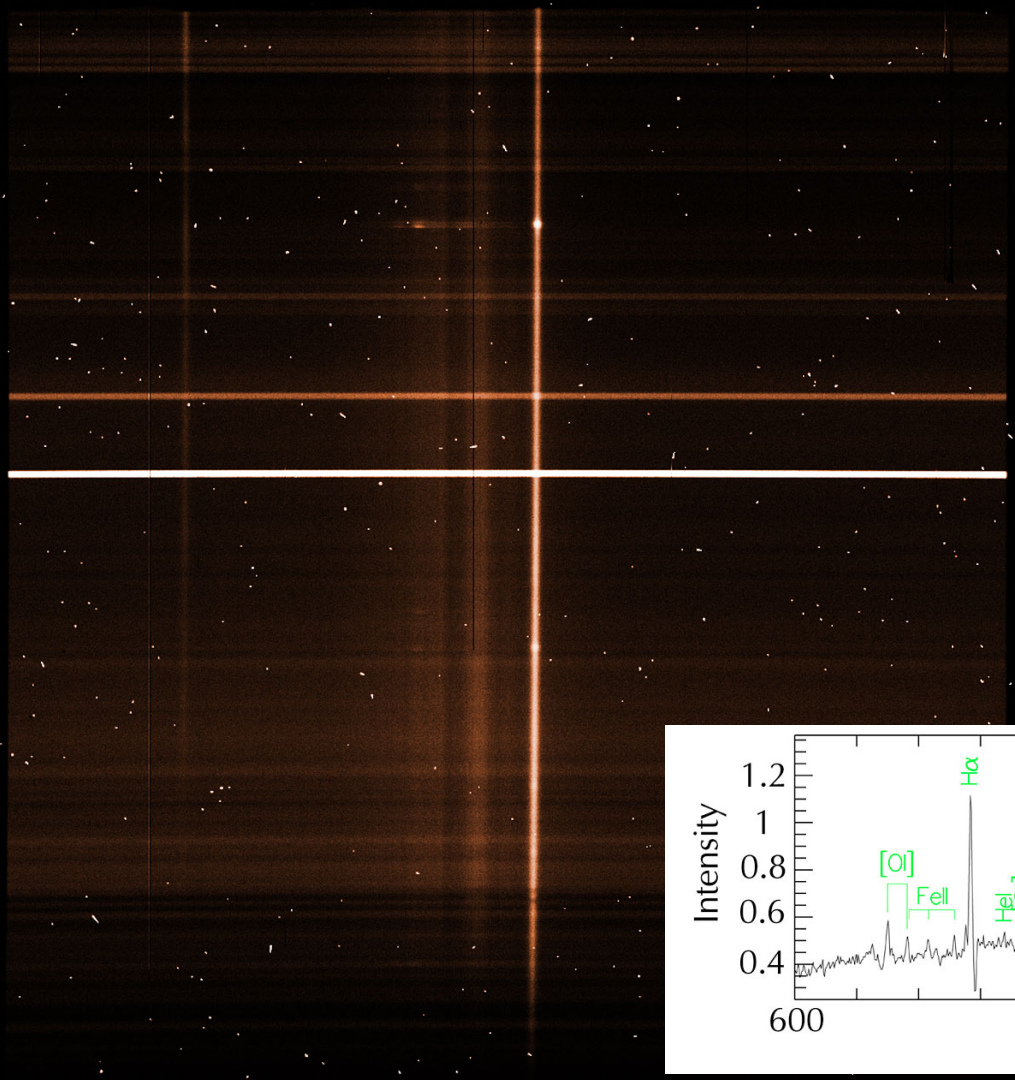


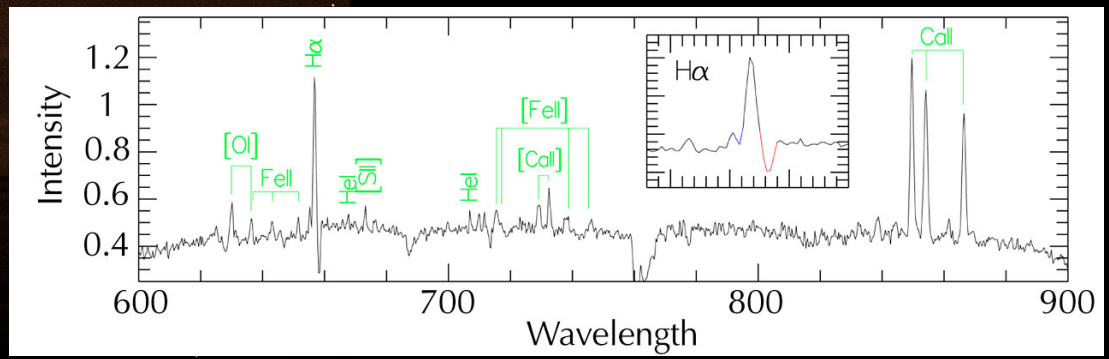
EFOSC: An Overview

	EFOSC2 observing modes
IMA	imaging
LSS	longslit spectroscopy
MOS	multi-object spectroscopy (masks)
IPOL	imaging polarimetry
SPOL	spectropolarimetry
COR	coronography

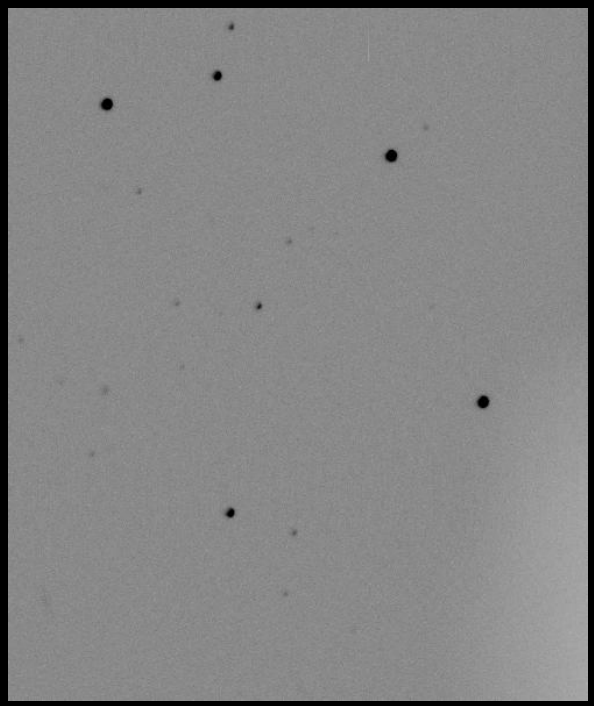
EFOSC2 observing modes: Imaging

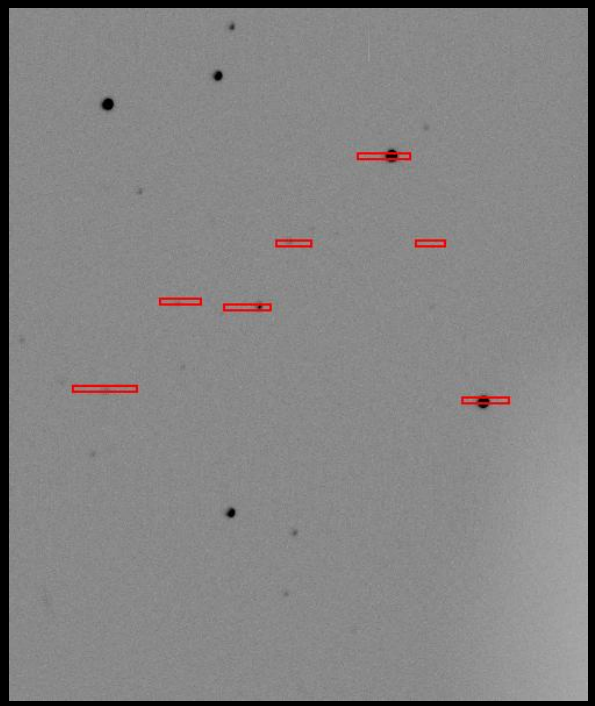
EFOSC2 observing modes: Spectroscopy

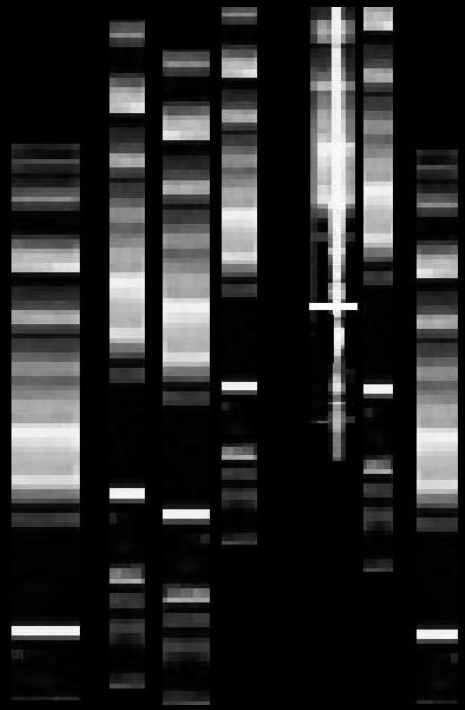




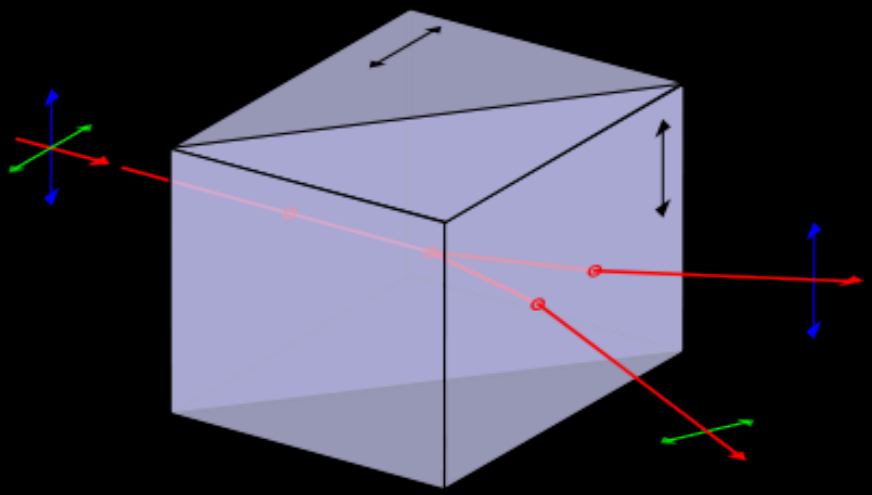
EFOSC2 observing modes: MOS





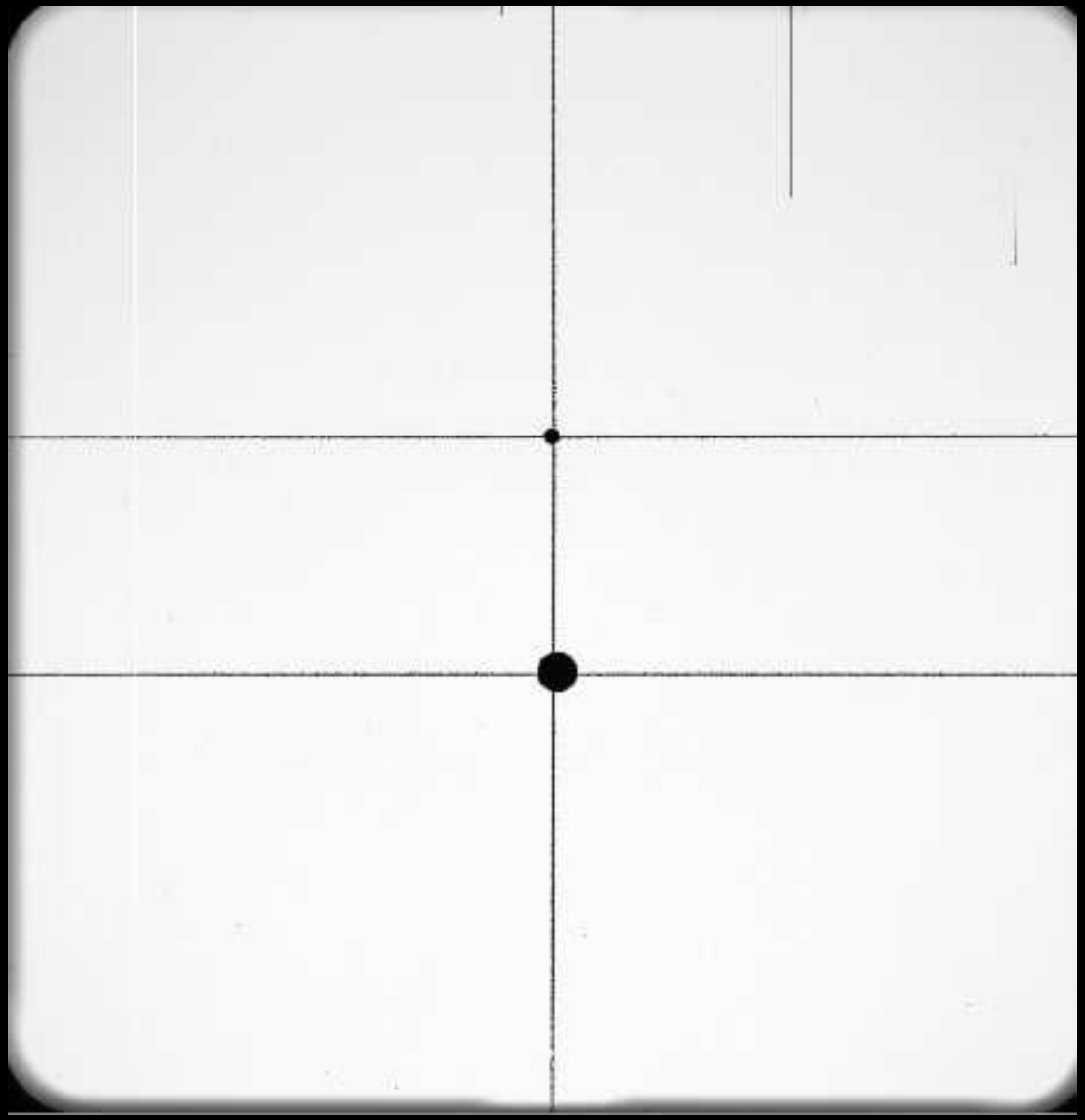


EFOSC2 observing modes: Polarimetry (IPOL and SPOL)

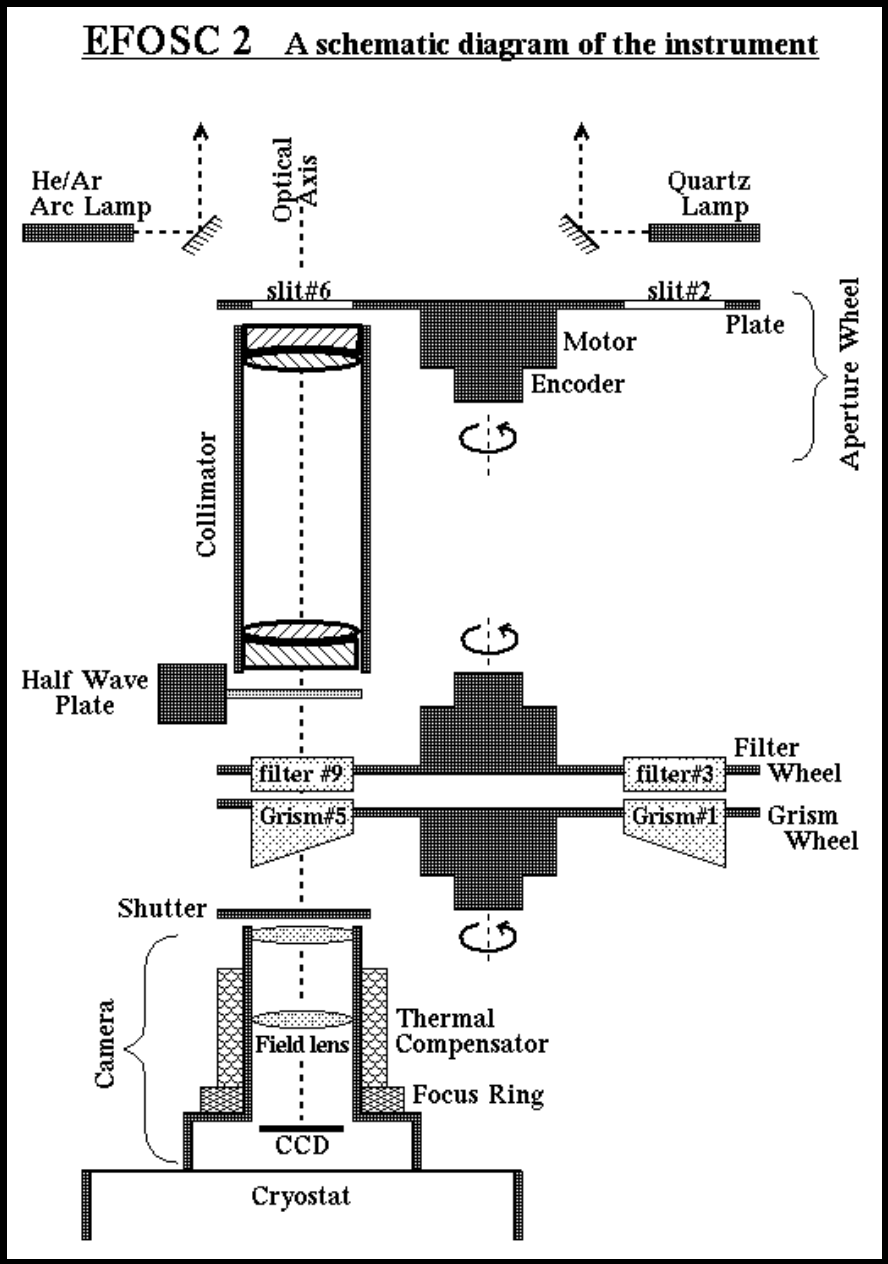


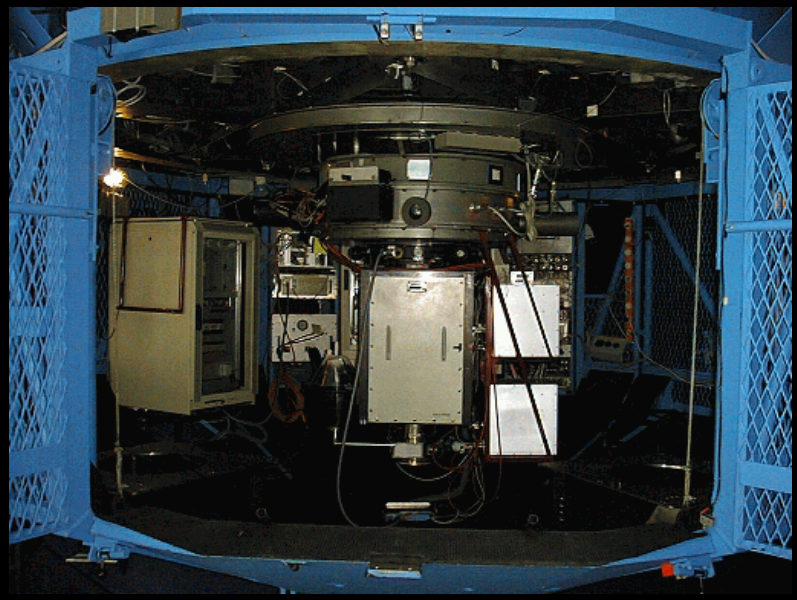
CHANL: 0 START: 1.0,1.0
FRAME: EFOSC_ImaPol066_0020.fi END: 489.0,275.0
CUTS: 106.0,1083.18225 MIN,MAX: 106.0,1083.18225

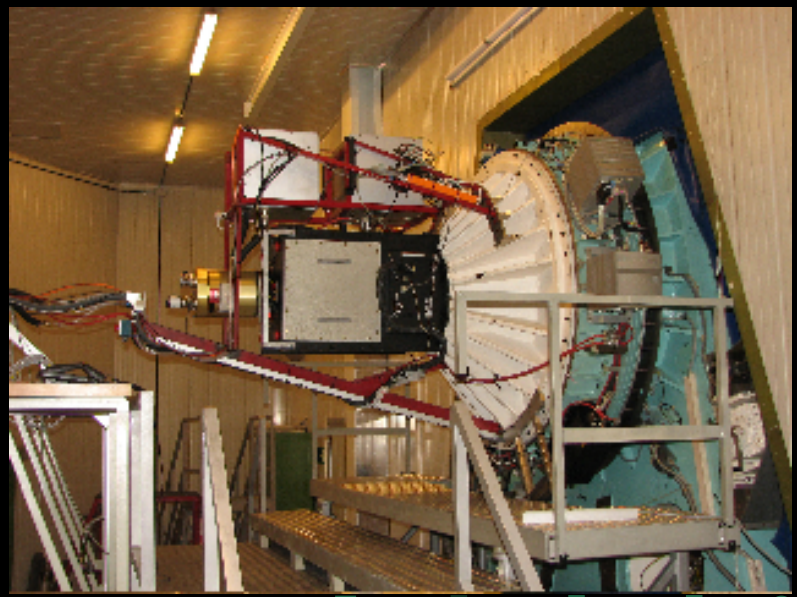
EFOSC2 observing modes: Coronography



EFOSC: An Overview







Observing with EFOSC: Preparation

Web www.eso.org/sci/facilities/lasilla/instruments/efosc.html

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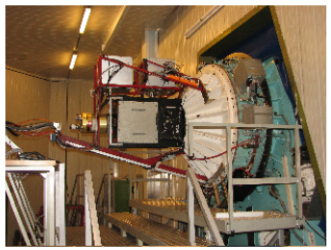
EFOSC2 : ESO Faint Object Spectrograph and Camera

Summary

EFOSC2, or the ESO Faint Object Spectrograph and Camera (v.2) to give its full name, is a very versatile instrument for low resolution spectroscopy and imaging. The instrument has multi mode capability including normal/polarimetric imaging/spectroscopy (several submodes in each), multi-object spectroscopy and coronography. One can easily switch between most modes, even during a single night, with little loss of observing time; this flexibility and the ease of operation make for a very efficient instrument capable of handling most observing programmes in an efficient manner.



Despite its multi mode capability the real forte of EFOSC2 is low resolution spectroscopy - it is a very efficient instrument in terms of both photons and time. A second feature of this instrument is the sensitivity of its CCD to UV photons.

Note that as of April 2008 EFOSC2 is mounted at the Nasmyth B focus of the NTT. These web pages give information about the characteristics of the instrument at the NTT. The old EFOSC2 at ESO 3.6m information is still available for reference. For a general description of the changes due to the change of telescope, see Snodgrass et al. 2008, ESO Messenger 132, 18.

Publications based on data obtained with the EFOSC2 instrument should reference the following paper: Buzzoni et al. 1984, ESO Messenger 38, 9 .

Contact Information

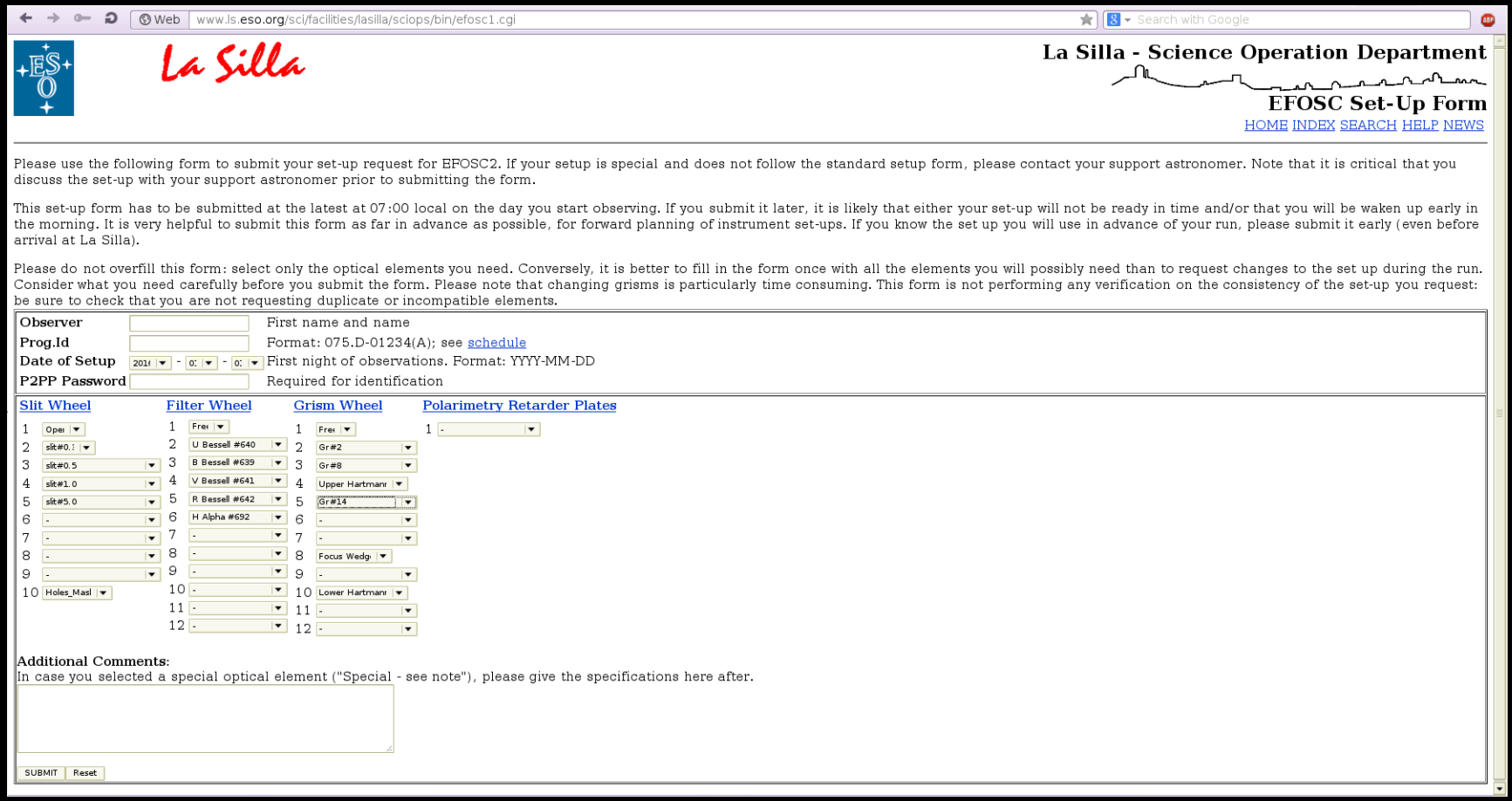
- All questions related to observations and proposal preparation should be addressed to the La Silla Science Operations.
- Please send us your comments, suggestions and report errors and inaccurate statements in the web pages and manuals.

Content of these pages

The following items are available on all the EFOSC pages, using the bar on the left.

- Overview: a short description of the instrument
- News: list of changes affecting the instrument and/or its pages.
- Instrument Description: all the important parameters of the instrument

Observing with EFOSC: Preparation



Web www.ls.eso.org/sci/facilities/lasilla/sciops/bin/efosc1.cgi

Search with Google

La Silla

La Silla - Science Operation Department

EFOSC Set-Up Form

HOME INDEX SEARCH HELP NEWS

Please use the following form to submit your set-up request for EFOSC2. If your setup is special and does not follow the standard setup form, please contact your support astronomer. Note that it is critical that you discuss the set-up with your support astronomer prior to submitting the form.

This set-up form has to be submitted at the latest at 07:00 local on the day you start observing. If you submit it later, it is likely that either your set-up will not be ready in time and/or that you will be waken up early in the morning. It is very helpful to submit this form as far in advance as possible, for forward planning of instrument set-ups. If you know the set up you will use in advance of your run, please submit it early (even before arrival at La Silla).

Please do not overfill this form: select only the optical elements you need. Conversely, it is better to fill in the form once with all the elements you will possibly need than to request changes to the set up during the run. Consider what you need carefully before you submit the form. Please note that changing grisms is particularly time consuming. This form is not performing any verification on the consistency of the set-up you request: be sure to check that you are not requesting duplicate or incompatible elements.

Observer		First name and name
Prog.Id		Format: 075.D-01234(A); see schedule
Date of Setup	2014 - 0: - 0:	First night of observations. Format: YYYY-MM-DD
P2PP Password		Required for identification

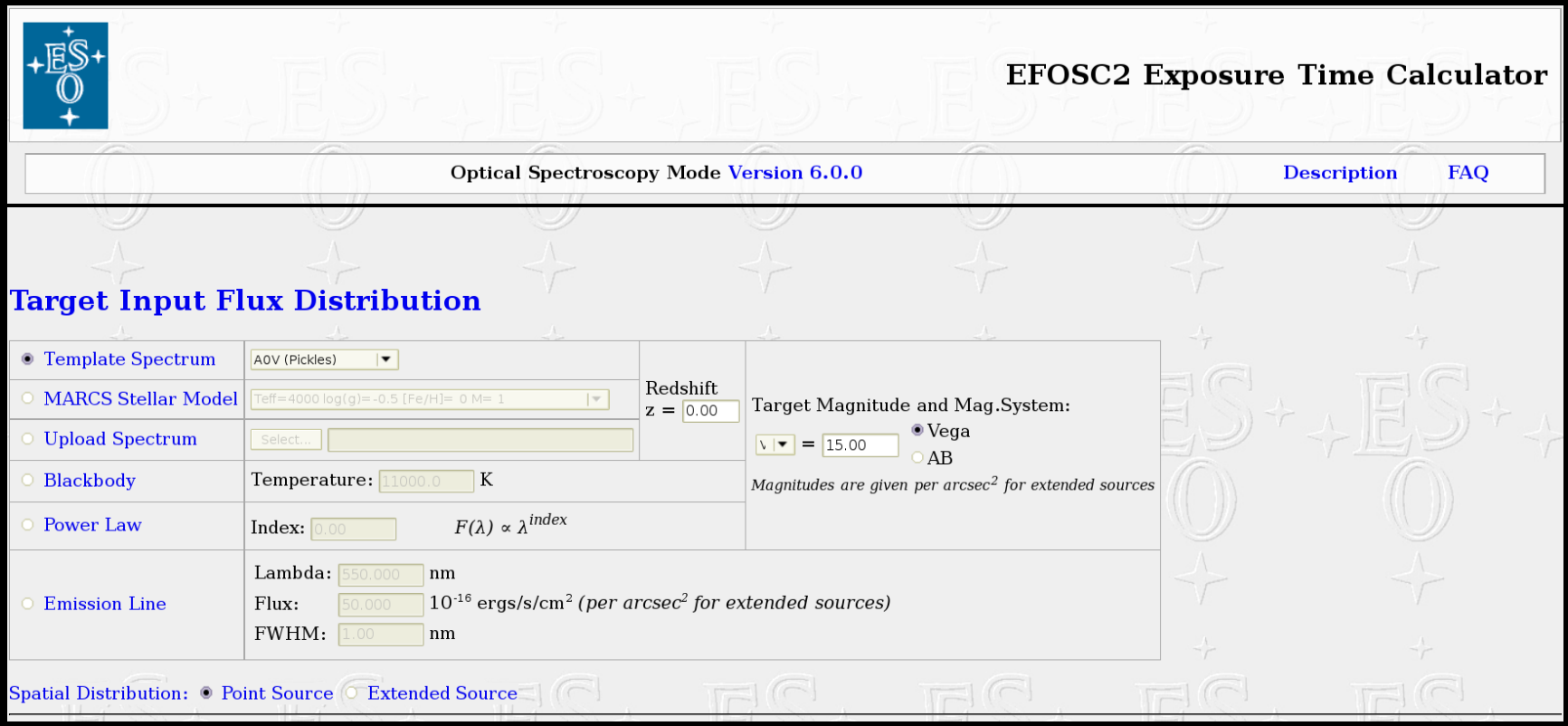
	Slit Wheel	Filter Wheel	Grism Wheel	Polarimetry Retarder Plates
1	Open	Free	Free	-
2	slit#0.3	U Bessell #640	Gr#2	
3	slit#0.5	B Bessell #639	Gr#8	
4	slit#1.0	V Bessell #641	Upper Hartmann	
5	slit#5.0	R Bessell #642	Gr#14	
6	-	H Alpha #692	-	
7	-	-	-	
8	-	-	Focus Wedge	
9	-	-	-	
10	Holes_Masl	-	Lower Hartmann	
11		-	-	
12		-	-	

Additional Comments:

In case you selected a special optical element ("Special - see note"), please give the specifications here after.

SUBMIT Reset

Observing with EFOSC: Preparation



EFOSC2 Exposure Time Calculator

Optical Spectroscopy Mode Version 6.0.0 — Description — FAQ

Target Input Flux Distribution

◉ Template Spectrum	A0V (Pickles)	Redshift z = 0.00	Target Magnitude and Mag.System: V = 15.00 ◉ Vega ○ AB
○ MARCS Stellar Model	Teff=4000 log(g)=-0.5 [Fe/H]= 0 M= 1		
○ Upload Spectrum	Select...		
○ Blackbody	Temperature: 11000.0 K		*Magnitudes are given per arcsec² for extended sources*
○ Power Law	Index: 0.00 $F(\lambda) \propto \lambda^{index}$		
○ Emission Line	Lambda: 550.000 nm Flux: 50.000 10^{-16} ergs/s/cm² *(per arcsec² for extended sources)* FWHM: 1.00 nm		

Spatial Distribution: ◉ Point Source ○ Extended Source

Observing with EFOSC: Preparation

EFOSC2 Exposure Time Calculator

Optical Spectroscopy Mode Version 6.0.0 — Description — FAQ

Sky Conditions

Moon phase: 3 days *from new Moon*

Airmass: 1.20

Seeing/Image Quality:

For point sources, the resulting Image Quality FWHM is modeled by the ETC considering the transfer functions of the atmosphere, telescope and instrument. See the helpfile for details.

- (•) Seeing: 0.80 arcsec *FWHM in V-band at zenith* ***(use this value in the proposal)***

  Probability ***50%*** *of realising the seeing ≤ 0.8 arcsec*

- ( ) IQ: 0.80 arcsec ***(to be used for the OB constraint set)***

Instrumental Setup

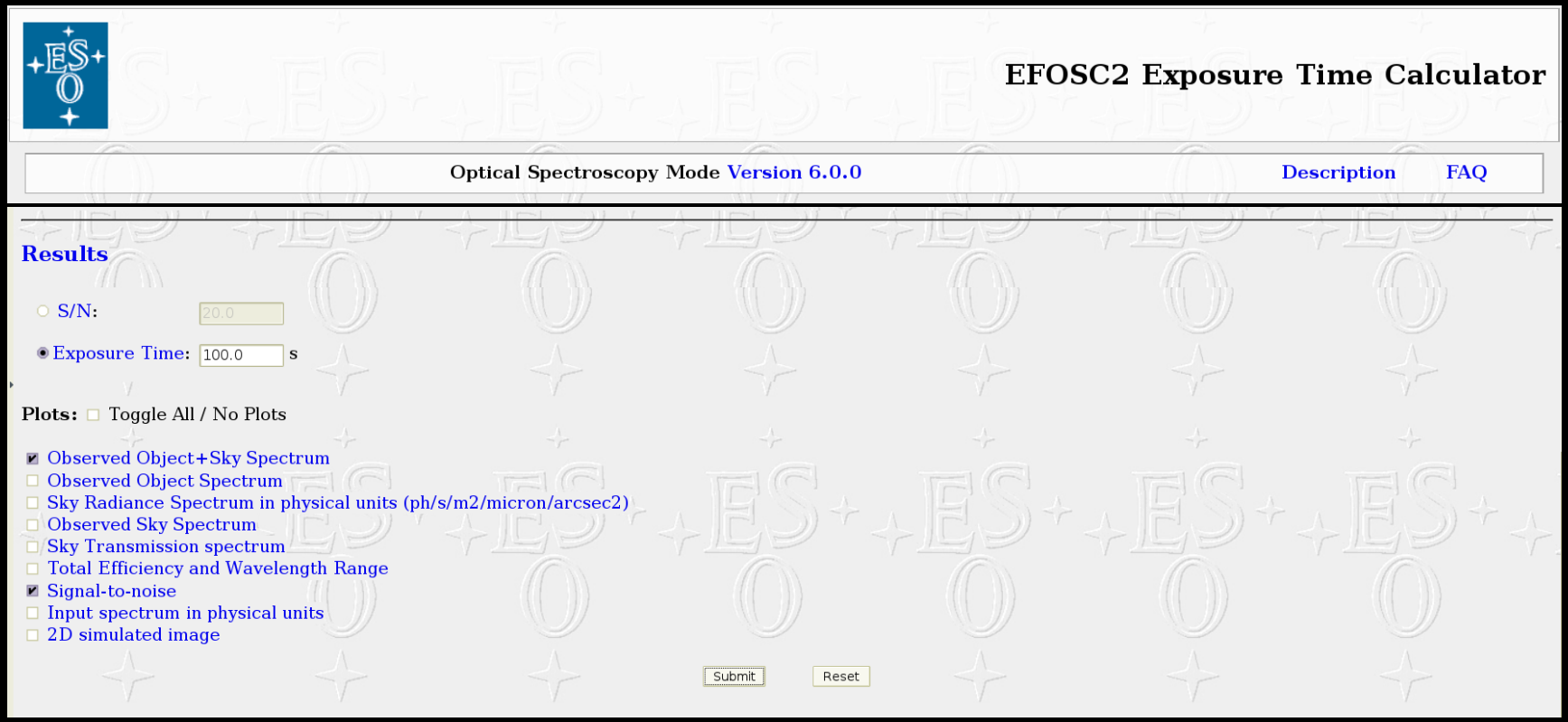
Slit width: 1.0

Grism: Grism 2

Detector: CCD#40 Readout mode: norma Binning: 2x2 (spectral)×(spatial)

Polarimetry Mode: (•) No polarimetry ( ) Linear polarisation

Observing with EFOSC: Preparation



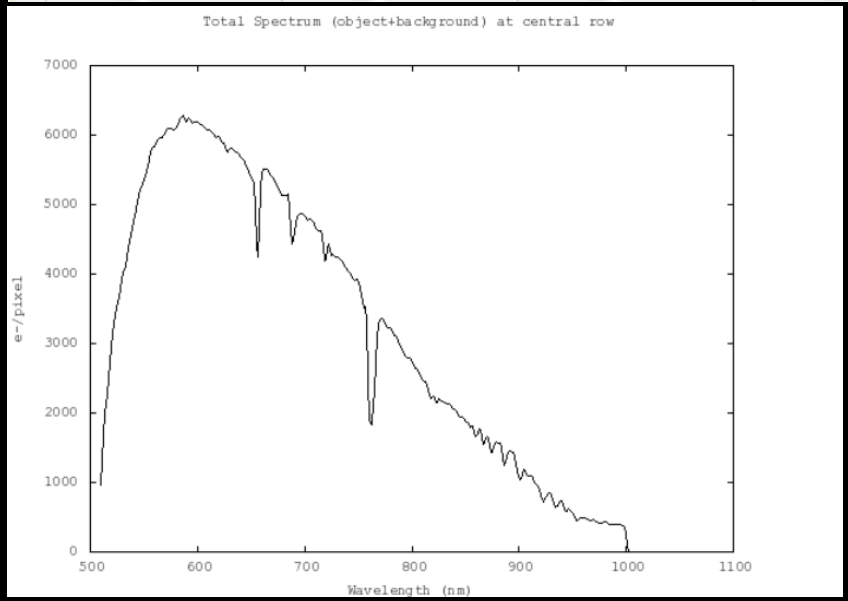
Observing with EFOSC: Preparation

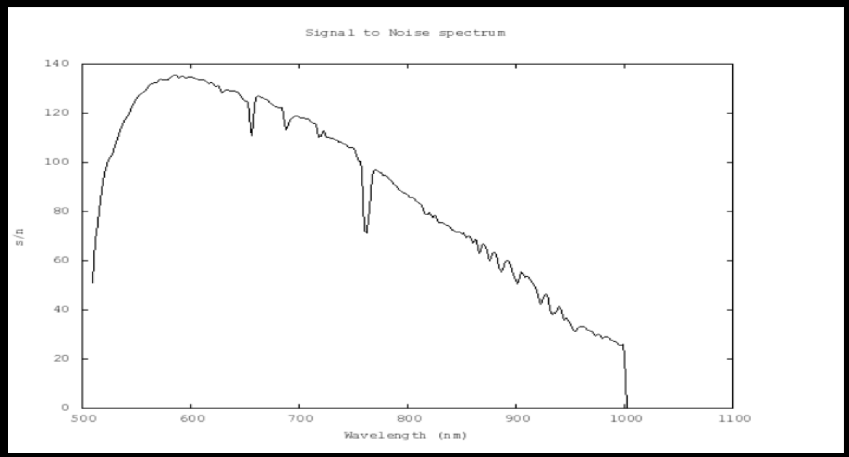
EFOSC2 Exposure Time Calculator

Optical Spectroscopy Mode Version 6.0.0 — Description — FAQ

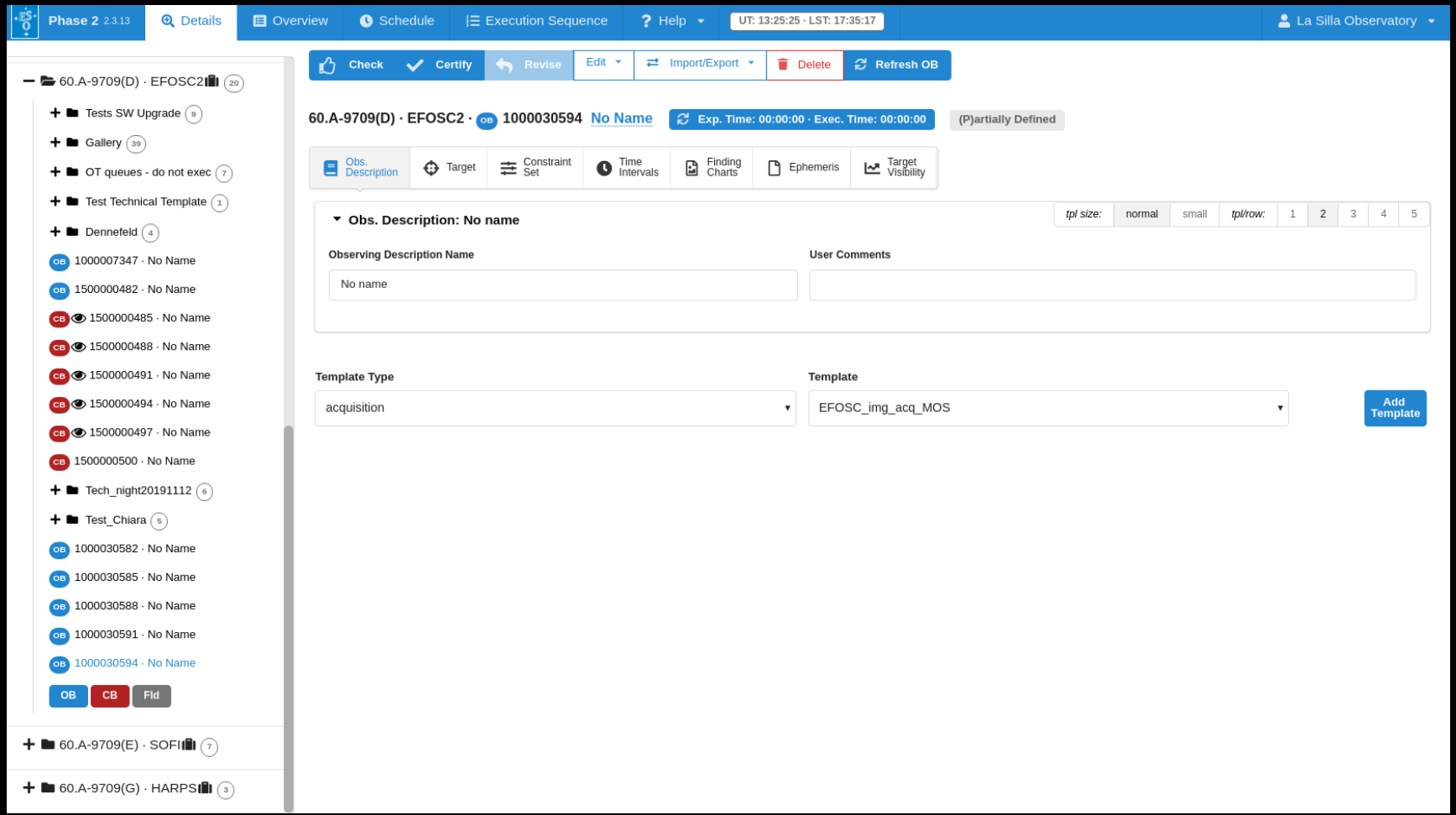
Wavelength Range	: **510.000 - 1100.000**	nm
Central Wavelength	: **670.000**	nm
Dispersion	: **1.320**	nm/pixel
Plate scale	: **0.260**	"/pixel
Image Quality FWHM	: **2.745**	pixels ***(to be used for OB constraint set)***
Efficiency at central wavelength (with extinction)	: **22.195**	%
Efficiency at central wavelength (no extinction)	: **24.021**	%
Total object counts at central wavelength	: **16175.530**	e-
Sky background level at central wavelength	: **15.674**	e /pixel
Max. intensity at central wavelength (object+sky)	: **5387.187**	e-
AD converter saturation	: **85196**	e-
Detector read-out noise level	: **8.500**	e-/pixel
Detector dark current	: **1.000**	e-/pixel/hour
PSF extension	: **5**	pixels
Signal to Noise (*) at central wavelength	: **125.489**	
Exposure Time (1 exposure)	: **100.000**	seconds

(*) The signal to noise is calculated over 1 pixel along the dispersion and the nearest integer of 2*fwhm(image quality)/plate_scale = 5 pixels along the slit.

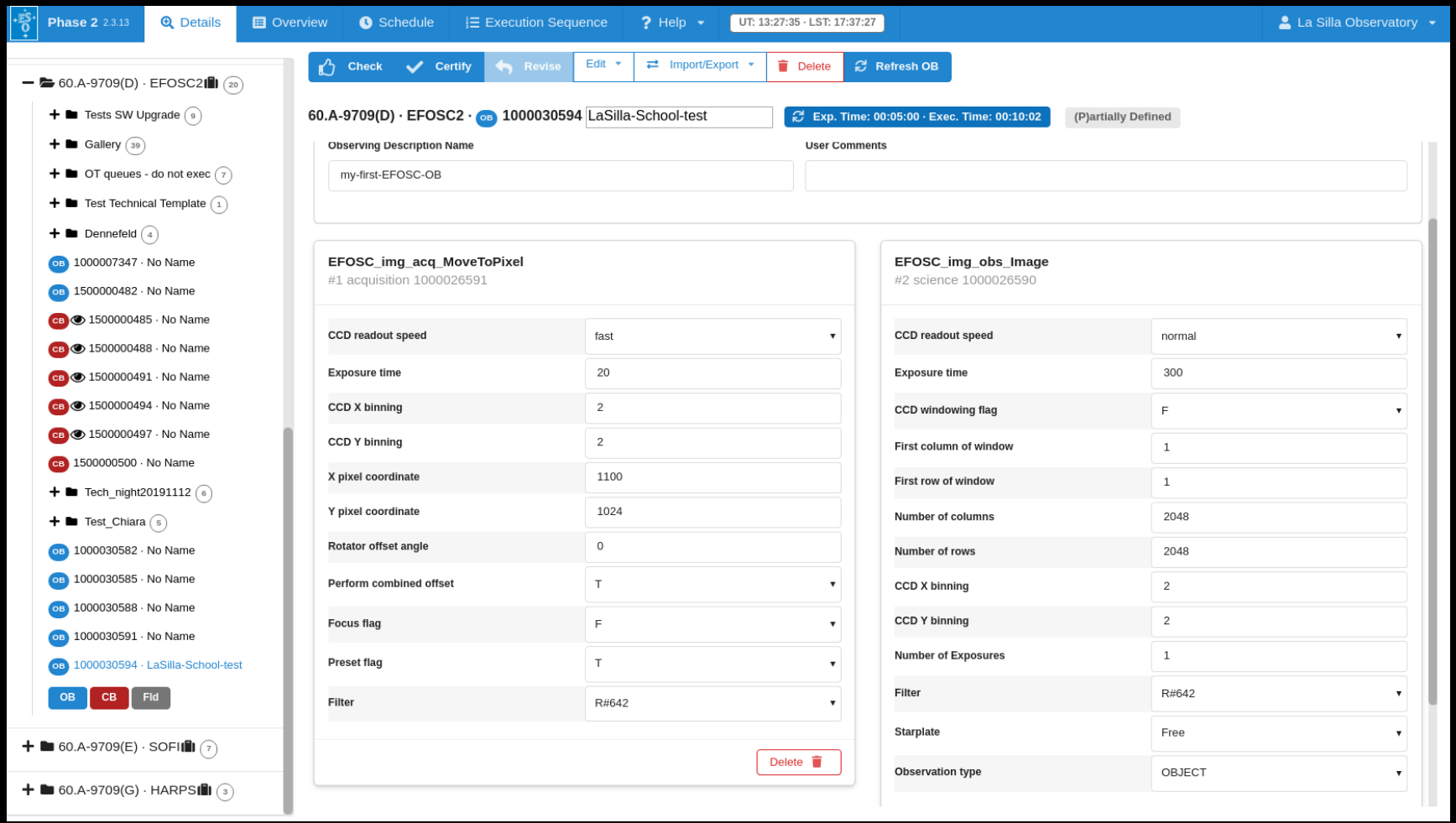




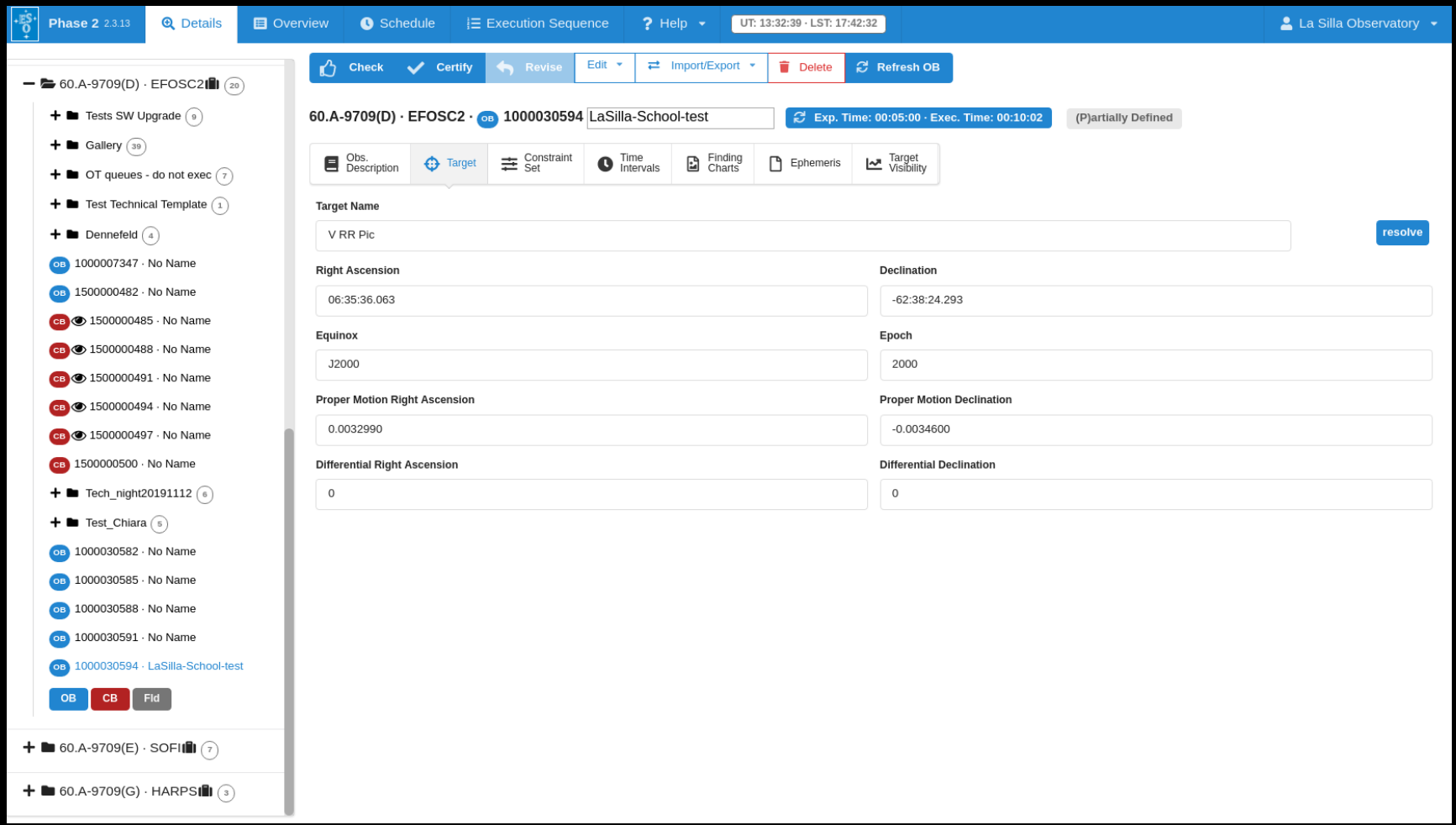
Observing with EFOSC



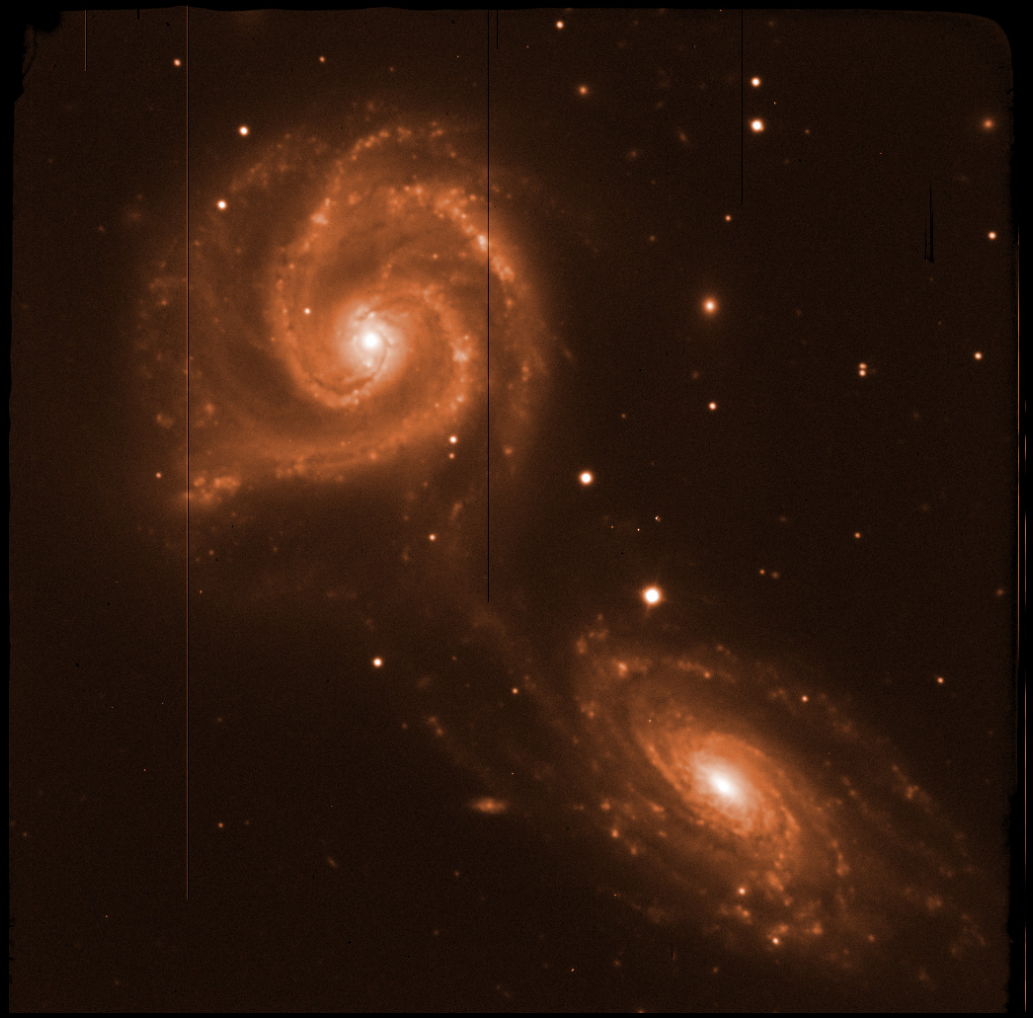
Observing with EFOSC



Observing with EFOSC

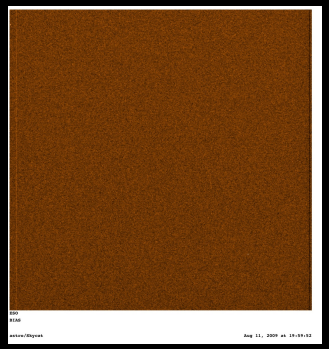
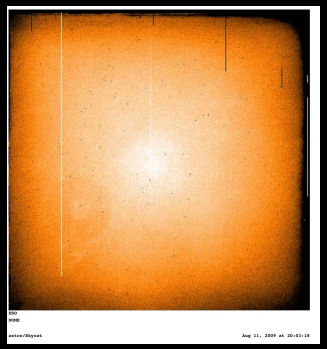
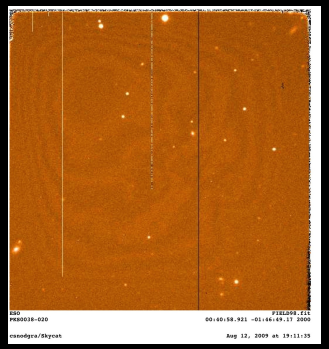


Observing with EFOSC: Imaging



- FoV: $4.1' \times 4.1'$
- 4 Bessel filters
- 4 Gunn filters
- 18 Narrow Band filters

Observing with EFOSC: Imaging

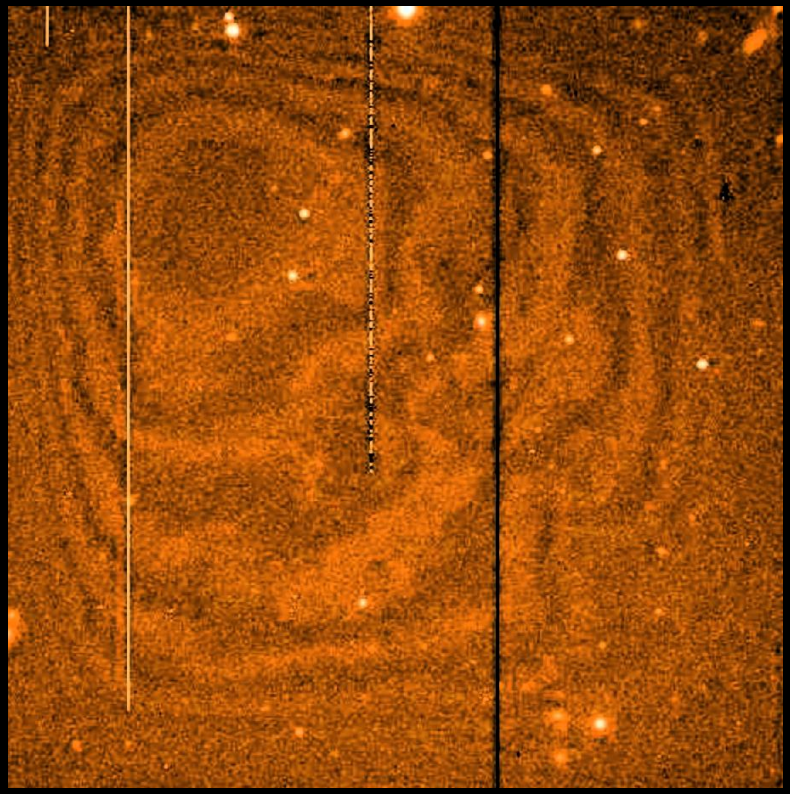




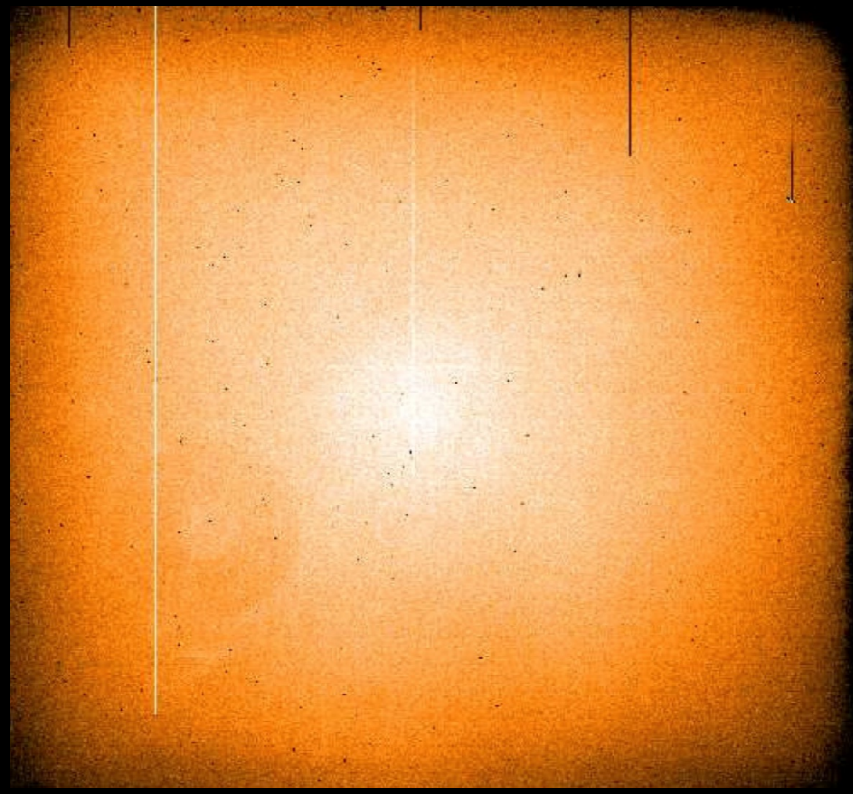
To calibrate, we might need:

- bias (day)
- flats (twilight)
- super-flat for fringes or sky-concentration (night)
- photometric standard stars (night)
- astrometric field (night)

Observing with EFOSC: Imaging

How to correct for fringing or sky concentration?





Observing with EFOSC: Imaging

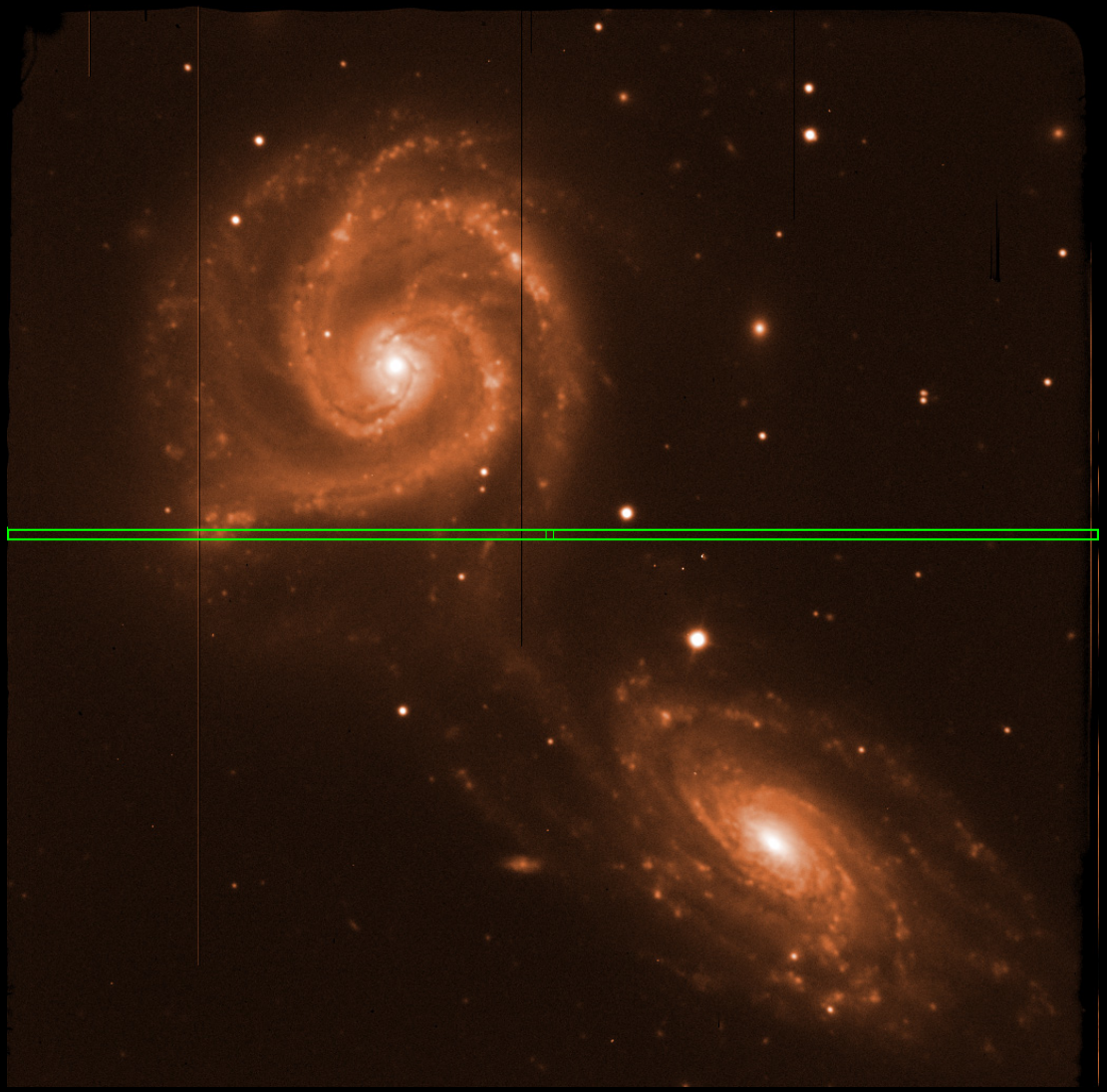
How to correct for fringing or sky concentration?

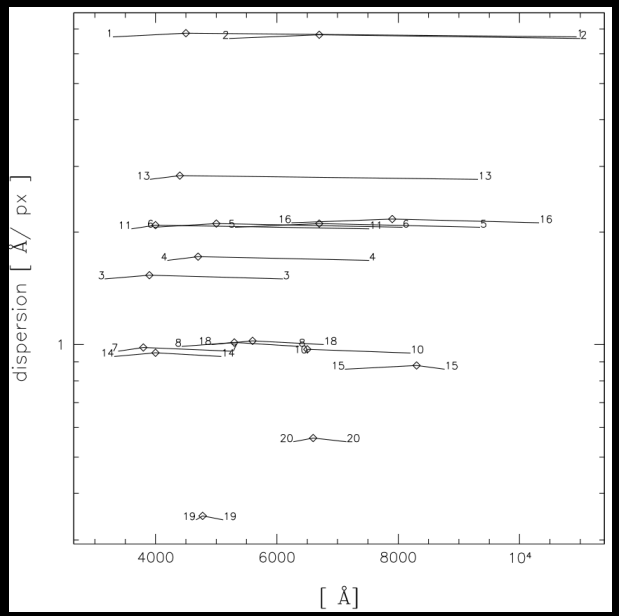
Fringing and sky concentration are additive patterns as they result from light getting scattered in the camera. They have to be subtracted from the images after the pattern has been scaled to the actual value in the image.

Note that also the flats show these features, so for proper flat-fielding, the structure has to be subtracted from the flat-image before dividing by the flat. $\rightarrow$ iteration

A fringe pattern is available on EFOSC page, it seems to be stable in shape. No analysis is done for sky concentration.

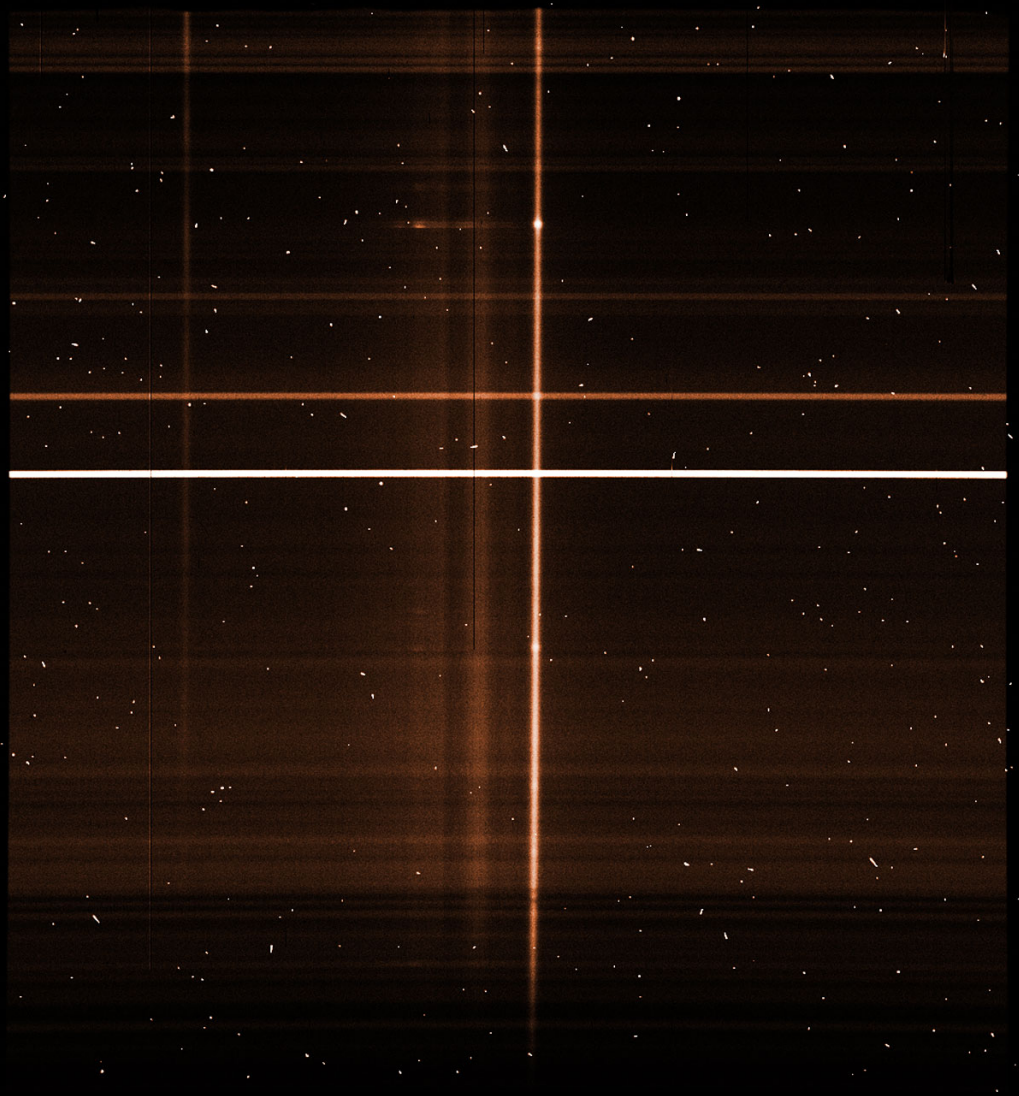
Observing with EFOSC: Spectroscopy



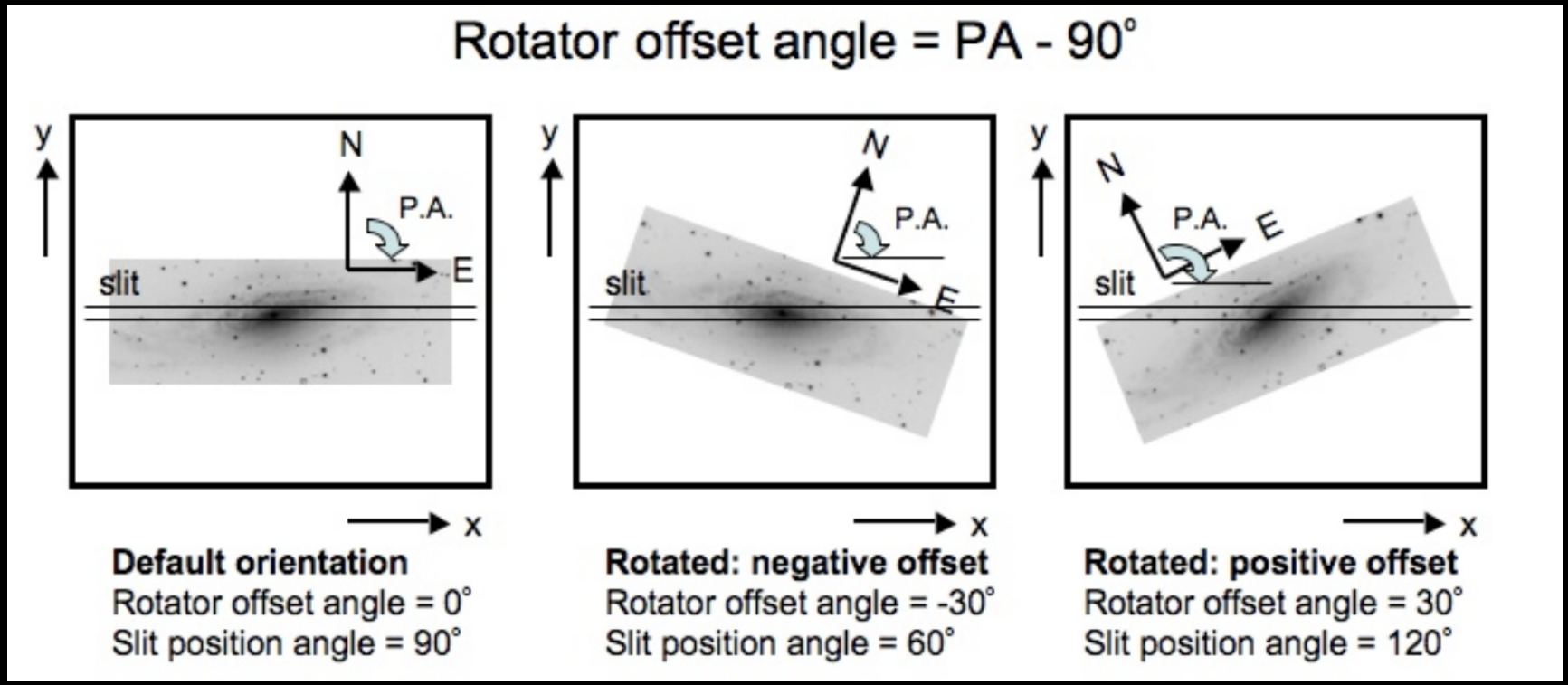


- 17 grisms
- 9 slit witdh
- all slits also with offsets to change the wavelength range

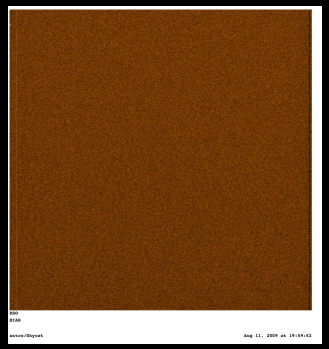
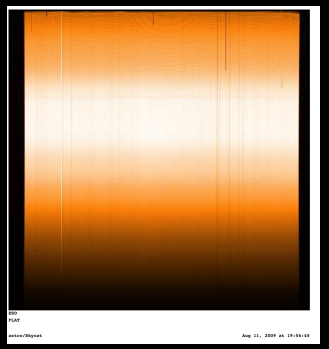
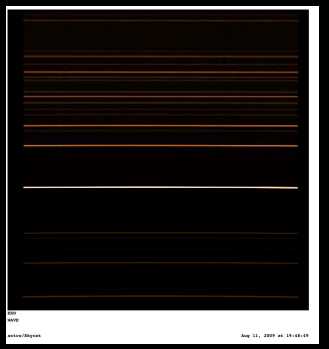
Observing with EFOSC: Spectroscopy



Observing with EFOSC: Spectroscopy



Observing with EFOSC: Spectroscopy

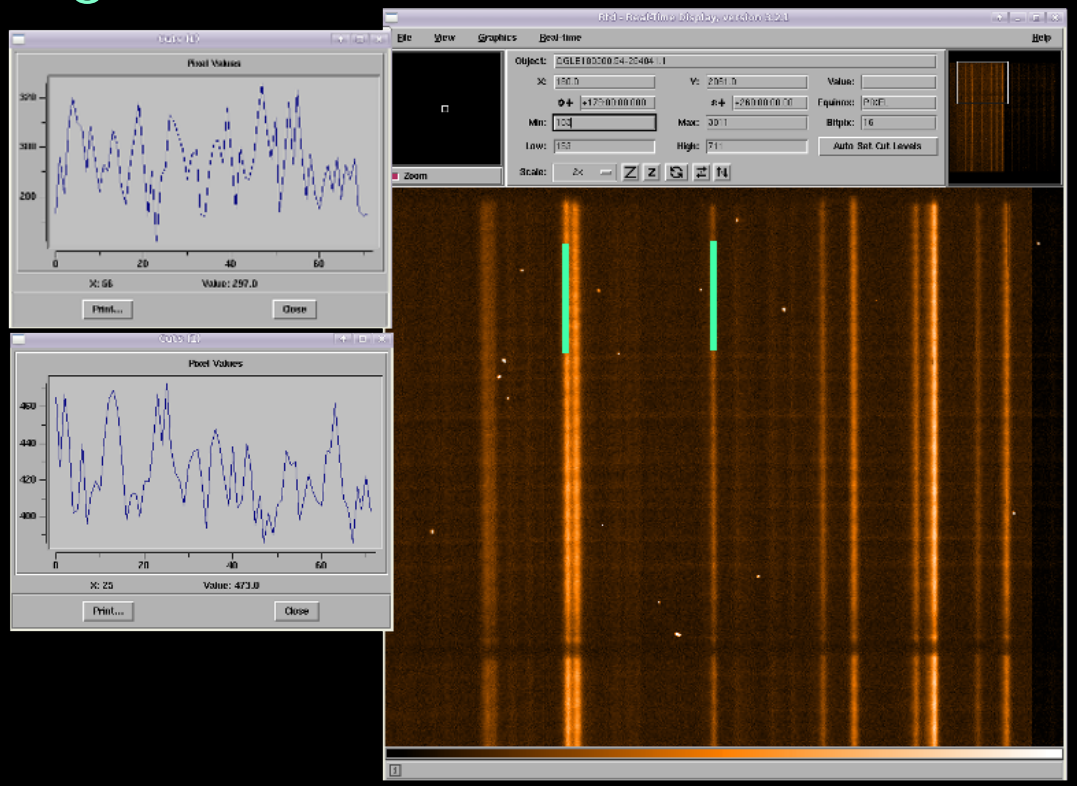




To calibrate, we might need:

- bias (day)
- flats (day)
- arcs lamps (day)
- flat for fringes (night)
- spectro-photometric standard stars (night)

Observing with EFOSC: Spectroscopy

Fringes:

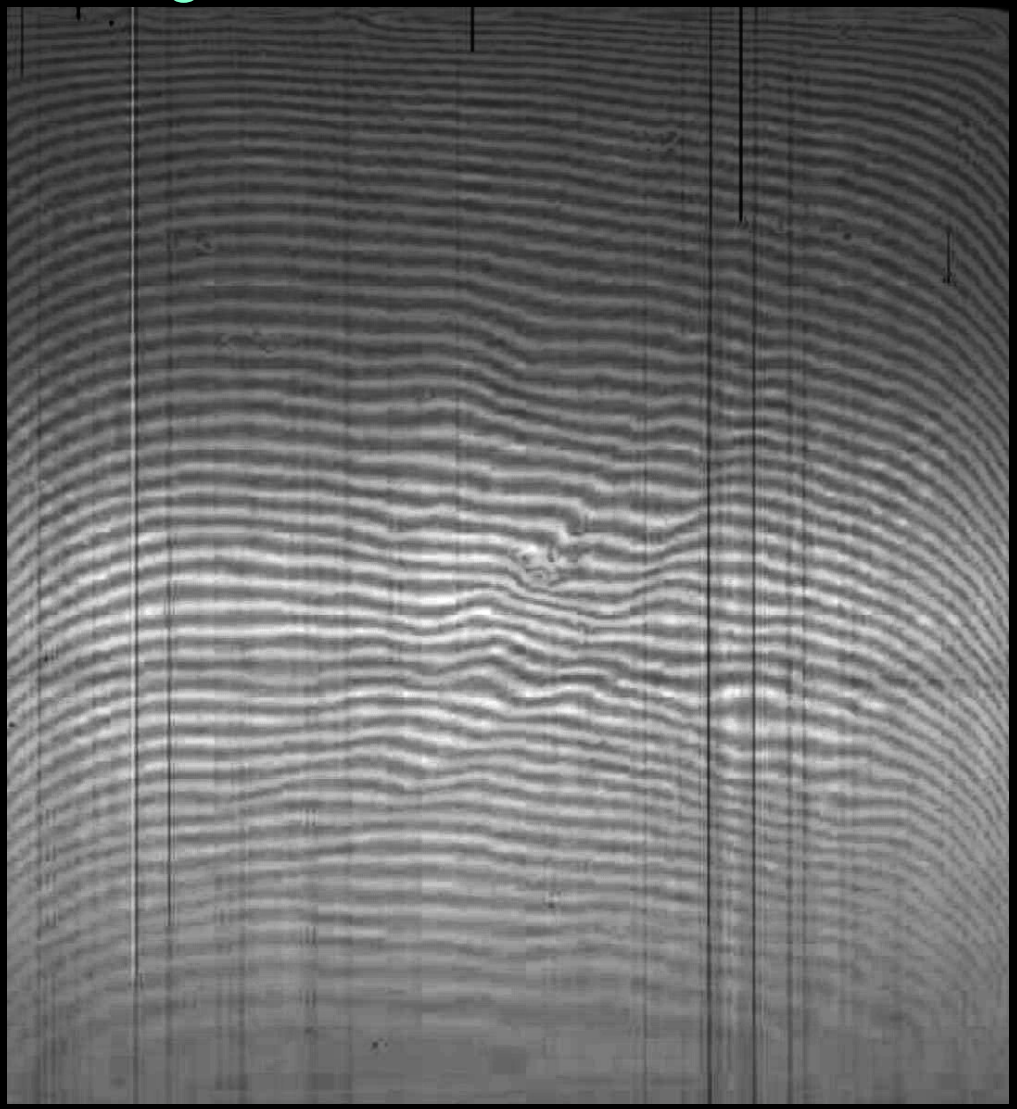


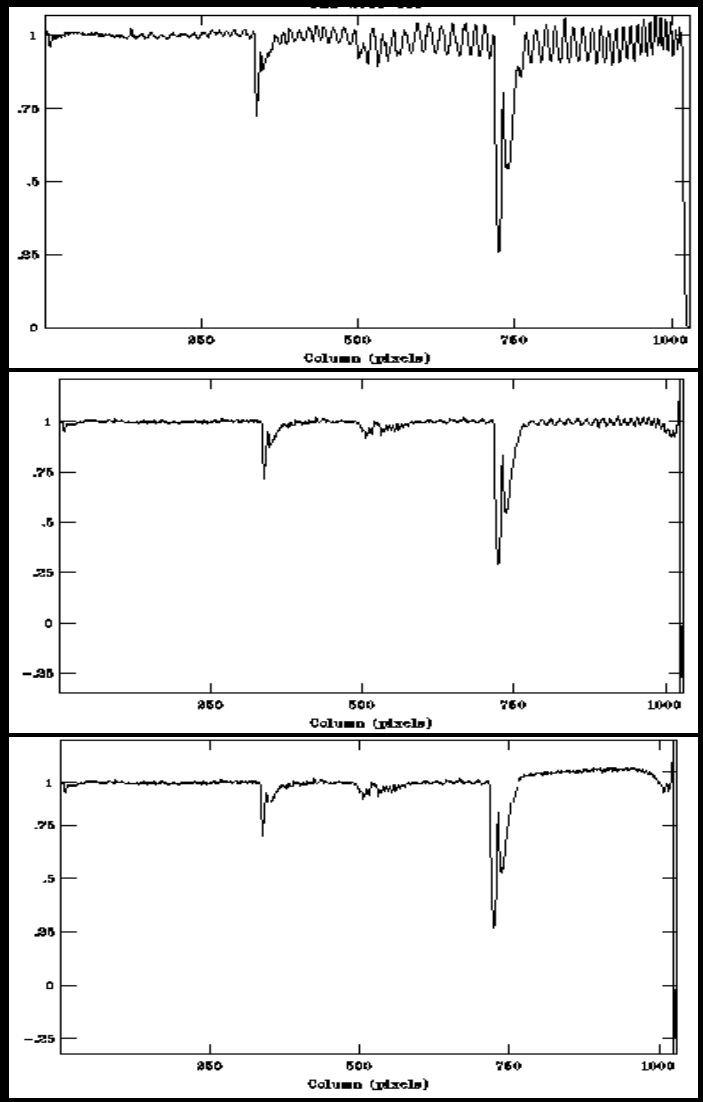
For optimal fringe correction, the flat should be taken close in time and at the same rotator angle as the observations.

Spectroscopic fringes are multiplicative and thus part of the flat-field correction.

Observing with EFOSC: Spectroscopy

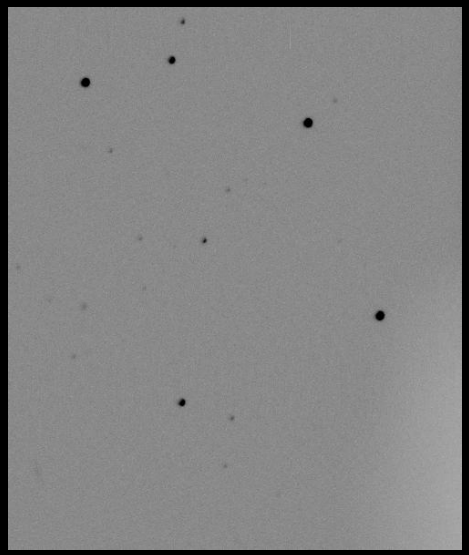
Fringes:



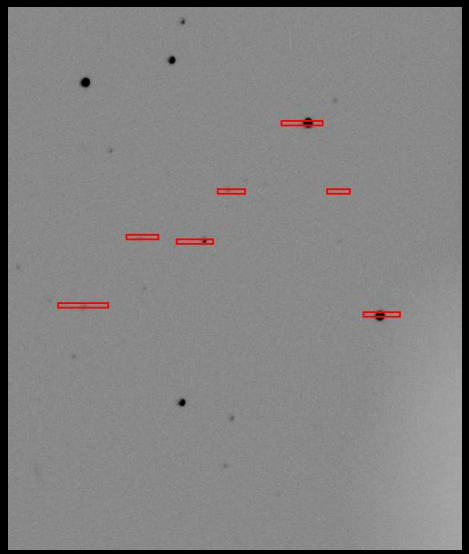


Observing with EFOSC: MOS

First, a pre-image has to be taken:



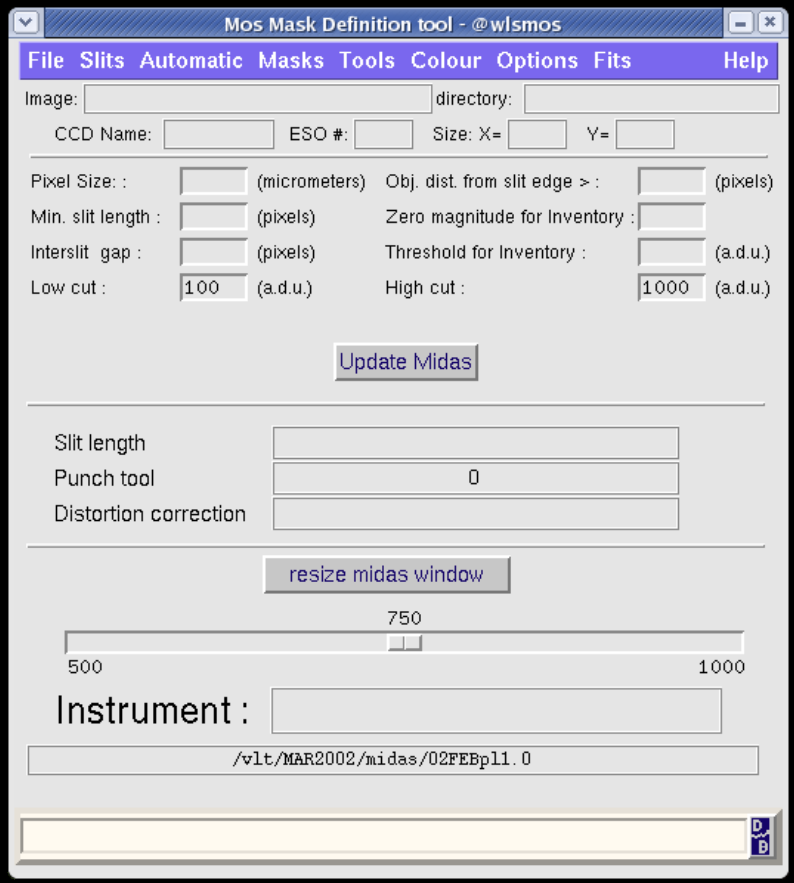
And slits for the observations defined:



Three slit options:	
1.02" x 8.6"	(punch #5)
1.34" x 8.6"	(punch #7)
1.87" x 8.5"	(punch #3)

Observing with EFOSC: MOS

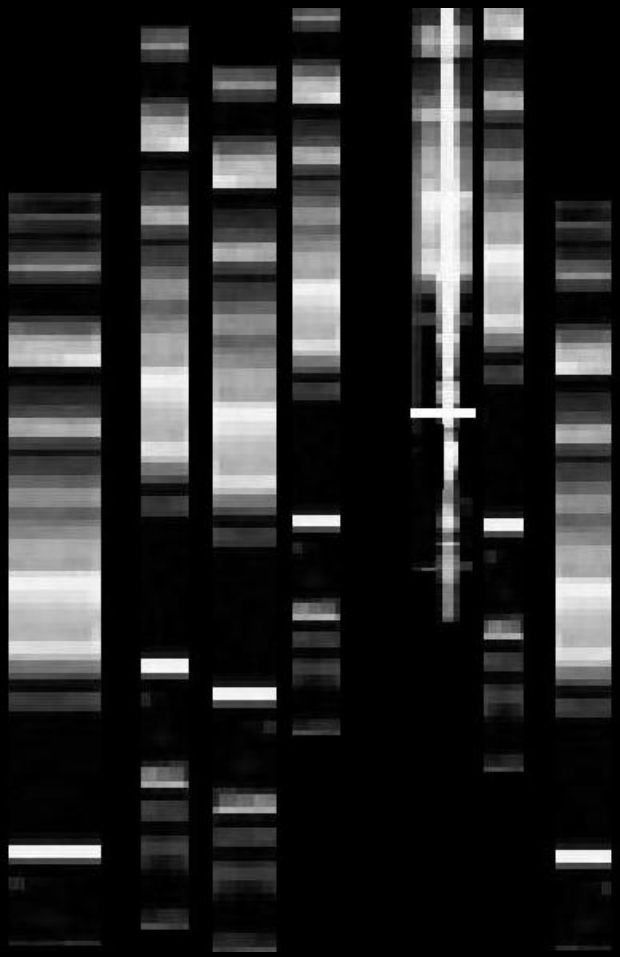
To define the mask with the slits at the right position, a MOS-table needs to be created using a special software on La Silla:

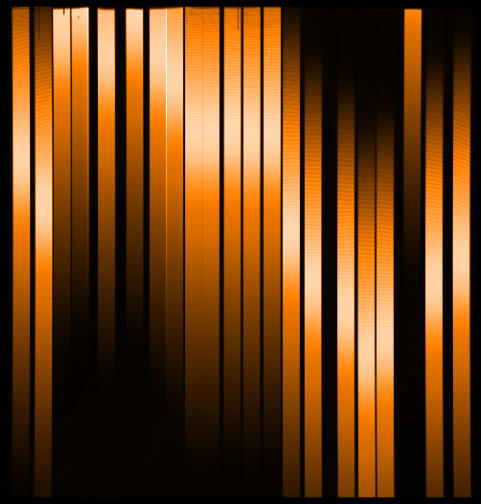


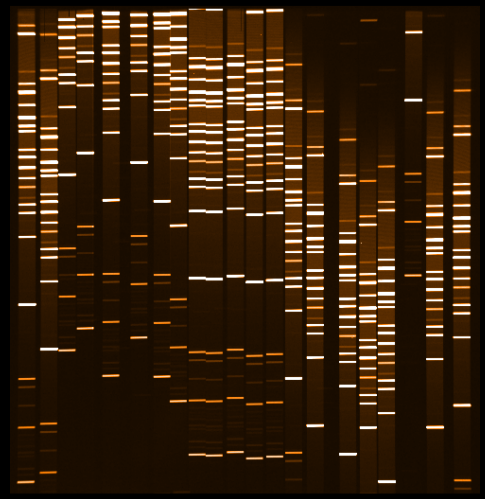
Then, using this table, the mask needs to be punched and then inserted in the Slit-Wheel of EFOSC (during the day).

The acquisition template for the MOS mode allows to align the mask with objects on sky (rotation and translation).

Observing with EFOSC: MOS



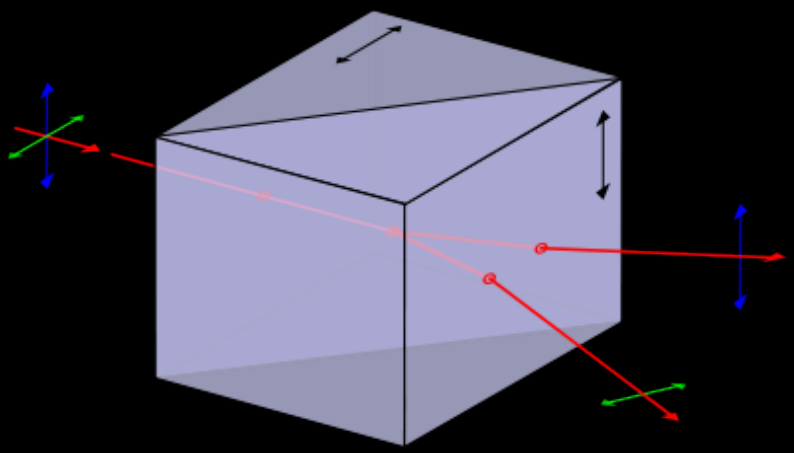


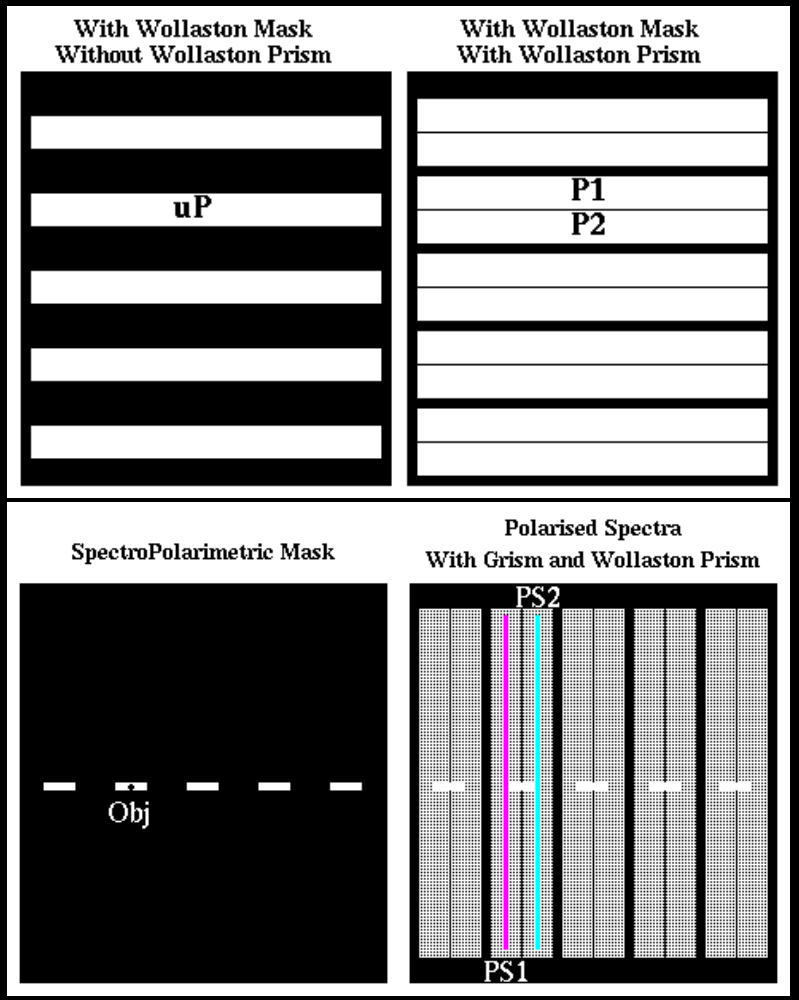


For calibration, we might need:

- bias
- flats
- arc lamps
- flat for fringes
- spectro-photometric standard star

Observing with EFOSC: Polarimetry





Wollaston prism
Wollaston mask
$\lambda/4$-plate for circular polarisation
$\lambda/2$-plate for linear polarisation

Observing with EFOSC: Polarimetry

To calibrate IPOL data, we might need:

- bias, flats, photometric standard stars
- polarimetric standard stars (night)

To calibrate SPOL data, we might need:

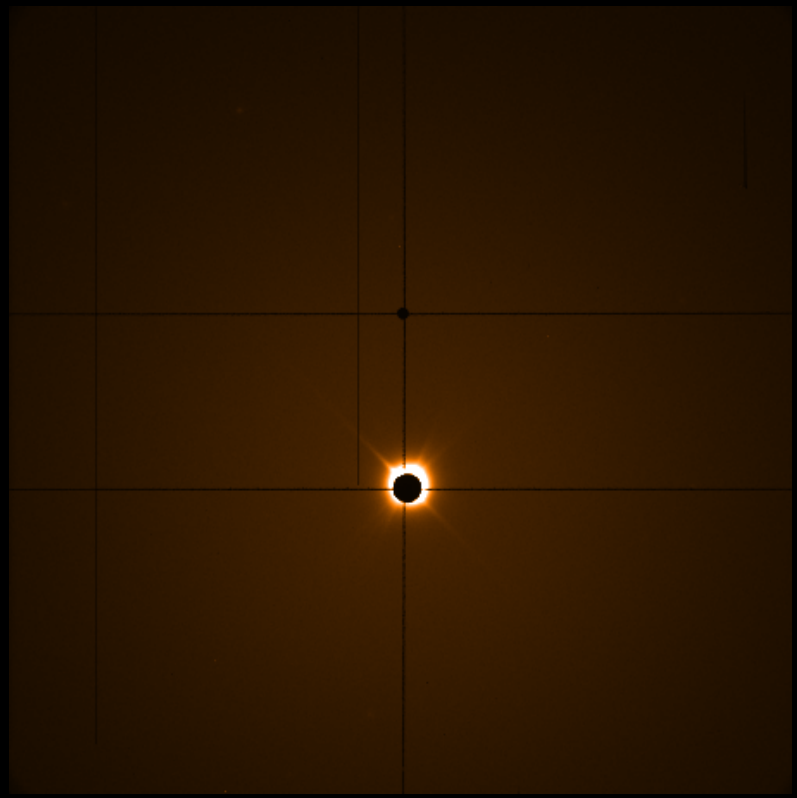
- bias, flats, arc lamps, flat for fringes, spectro-photometric standard stars
- spectro-polarimetric standard star (night)

In Cassegrain focus:	low and stable contribution to the polarisation by telescope
In Nasmyth focus:	higher contribution and changing with rotator angle

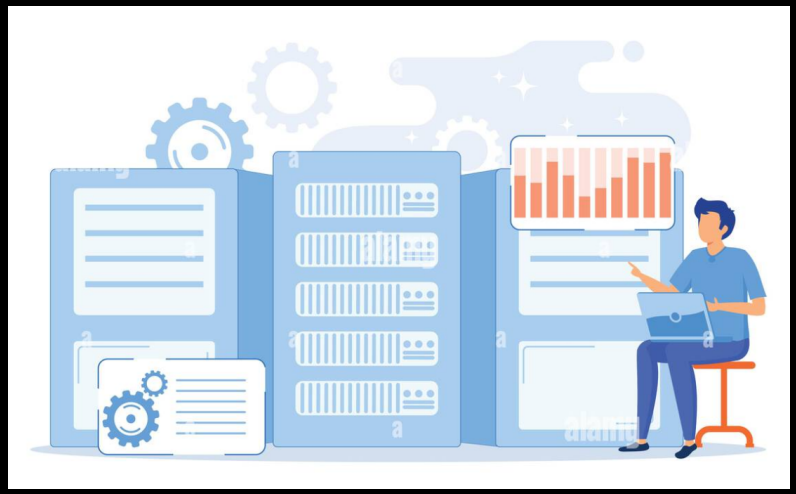
Observing with EFOSC: Coronography

The Coronographic mode is very similar to simple imaging:

- target to be put on right position for the mask
- final adjustment on sky
- same calibrations needed as for imaging



What comes after...



Data Reduction

Pipelines, EsoRex

EsoReflex

file:/usr/share/reflex/workflows/efosc-2.3.8/efosc_imaging.xml (on chapman2.sc.eso.org)

File Edit View Workflow Tools Window Help

Components Data Outline

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All Ontologies and Folders

- Components
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- Dataone
- Directors
- Esoreflex
- Job
- Opendap
- Outreach
- R

0 results found.

DDF Director

EFOSC Workflow For IMG Data (v. 2.3.8)

This is a basic workflow to help with data organisation and execution of the pipeline. The workflow was generated without a review of the quality of the science products.

Workflow Instructions

To run this workflow on the demo data:

- Turn on highlighting. Choose "Tools"-> "Animate at Runtime" from top menu and set it to "1".
- Press the "Run" button OR cntrl-R to start the workflow.

To run on a different data set:

- Click on RAW_DATA_DIR and set as appropriate. All subdirectories of RAW_DATA_DIR will be searched for data.
- If desired, change END_PRODUCTS_DIR. IMPORTANT: END_PRODUCTS_DIR should not be a subdirectory of the RAW_DATA_DIR, otherwise it will be searched for raw data!
- Press the "Run" button OR cntrl-R to start the workflow.

The general concepts of Reflex are described in Astron. Astrophys., 559, A96. Please credit this paper in publications on research that used Reflex.

Workflow tutorial and Fors pipeline manual can be found here: http://www.eso.org/sci/software/pipelines/index.html#pipelines_table

Setup Directories

Input:

- ROOT_DATA_DIR: $HOME/reflex_data/
- RAW_DATA_DIR: /usr/share/esopipes/datademo/efosc/

Only change CALIB_DATA_DIR if you do NOT want to use the calibration data delivered with the pipeline:

- CALIB_DATA_DIR: /usr/share/esopipes/datastatic/efosc-2.3.8/

Output:

- END_PRODUCTS_DIR: $ROOT_DATA_DIR/reflex_end_products

Working Directories:

- BOOKKEEPING_DIR: $ROOT_DATA_DIR/reflex_book_keeping/efosc_imaging
- LOGS_DIR: $ROOT_DATA_DIR/reflex_logs/efosc_imaging
- TMP_PRODUCTS_DIR: $ROOT_DATA_DIR/reflex_tmp_products/efosc_imaging
- BOOKKEEPING_DB: $BOOKKEEPING_DIR/bookkeeping.db

Global Parameters

= actor with interactive option

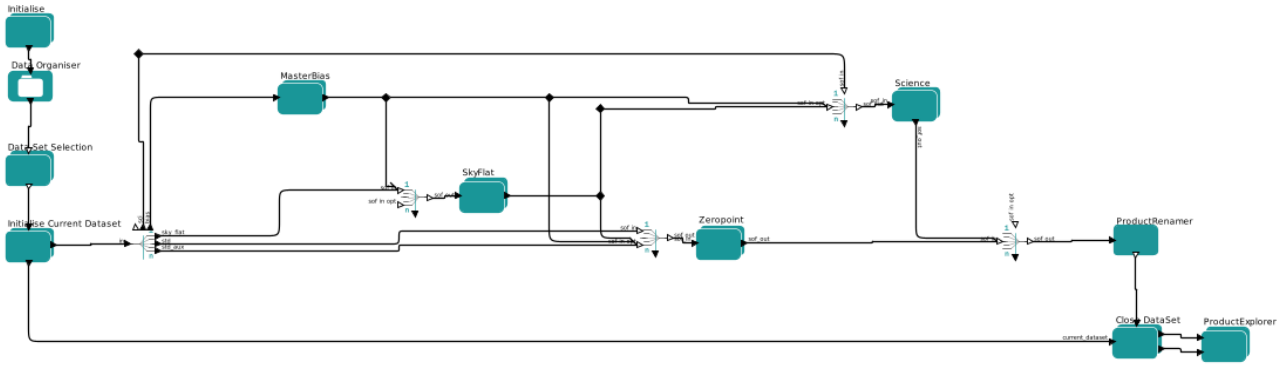
- RecipeFailureMode: Ask — Global parameter for the behaviour when a recipe fails. 'Ask' means that each time a recipe fails, the choice to continue or stop wil be presented. 'Continue' means that the workflow will ignore errors and continue. 'Stop' means the workflow will stop.
- EraseDirs: false — Change "EraseDirs" to 'true' to erase BOOKKEEPING_DIR, TMP_PRODUCTS_DIR and LOGS_DIR each time the workflow is run (Lazy Mode will not work anymore)
- FITS_VIEWER: fv — Program to use for the inspection of input/output products. Use full path name if it is not in the standard path.
- GlobalPlotInteractivity: false — Set to "false" to disable interactive GUIs for the whole workflow. Each interactive actor can specify its own setting, which overwrites the choice given here. This workflow has no interactive actors
- SelectDatasetMethod: Interactive — Specify how datasets for processing are selected ("All", "New" = never tried before, "Reduced" = successfully run before. "Failed"=unsuccessfully run before), or set to "Interactive" for interactive selection.
- ProductExplorerMode: Triggered — Specify when you want to see the ProductExplorer GUI. "Triggered" = show it after all data sets have been reduced. "Enabled" = show it after each dataset. "Disabled" = never show it

Step 1: Data Organisation and Selection

Step 2: Creation of Master Calibration Files

Step 3: Science Reduction

Step 4: Output Organisation



file:/usr/share/reflex/workflows/efosc-2.3.8/efosc_spec.xml (on chapman2.sc.eso.org)

File Edit View Workflow Tools Window Help

Components | Data | Outline

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- Dataone
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- Esoreflex
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- Opendap
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- R

results found.

DDF Director

EFOSC Workflow For MOS Data (v. 2.3.8)

This is a basic workflow to help with data organisation and execution of the pipeline. The workflow was generated without a review of the quality of the science products.

Workflow Instructions

To run this workflow on the demo data:

- Turn on highlighting. Choose "Tools"-> "Animate at Runtime" from top menu and set it to "1".
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- CALIB_DATA_DIR: /usr/share/esopipes/datastatic/efosc-2.3.8/

Output:

- END_PRODUCTS_DIR: $ROOT_DATA_DIR/reflex_end_products

Working Directories:

- BOOKKEEPING_DIR: $ROOT_DATA_DIR/reflex_book_keeping/efosc_spec
- LOGS_DIR: $ROOT_DATA_DIR/reflex_logs/efosc_spec
- TMP_PRODUCTS_DIR: $ROOT_DATA_DIR/reflex_tmp_products/efosc_spec
- BOOKKEEPING_DB: $BOOKKEEPING_DIR/bookkeeping.db

Global Parameters

= actor with interactive option

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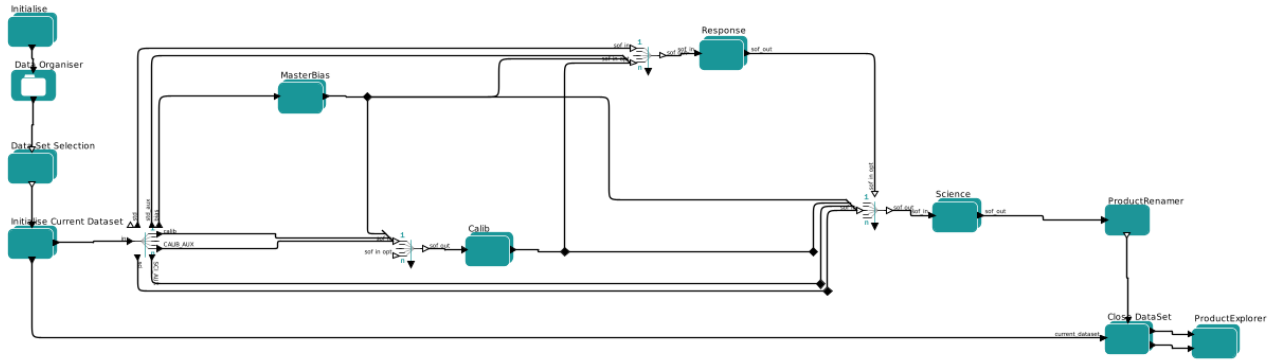
Step 1: Data Organisation and Selection

Step 2: Creation of Master Calibration Files

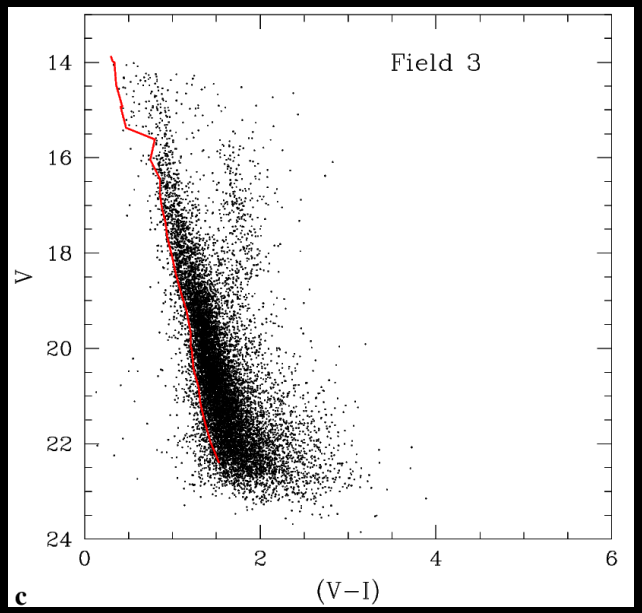
Step 3: Science Reduction

Step 4: Output Organisation

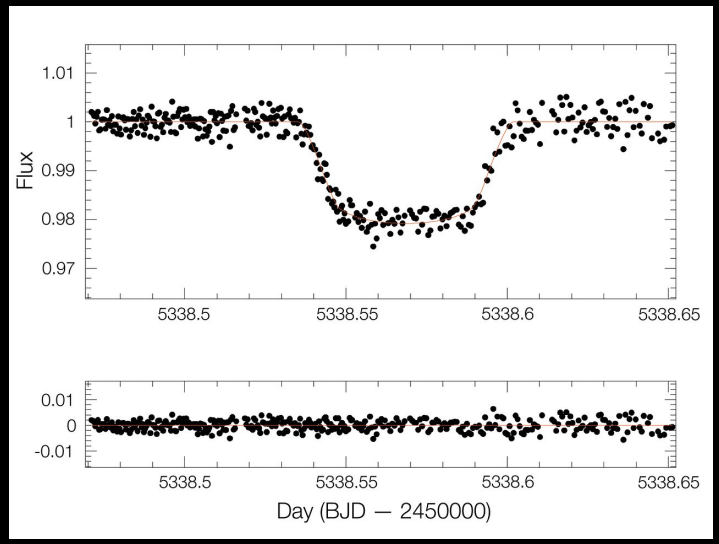


Auxilliary and debug parameters, please do not change: GLOBAL_TIMESTAMP: 2017-08-23T19:19:36 ESORexArgs: --suppress-prefix=TRUE END_PRODUCTS_SUBDIR: 2017-08-23T19:19:36/EFOSC.2011-01-20T08:17:54.055 toIN_SELECTED_DATASETS: 3

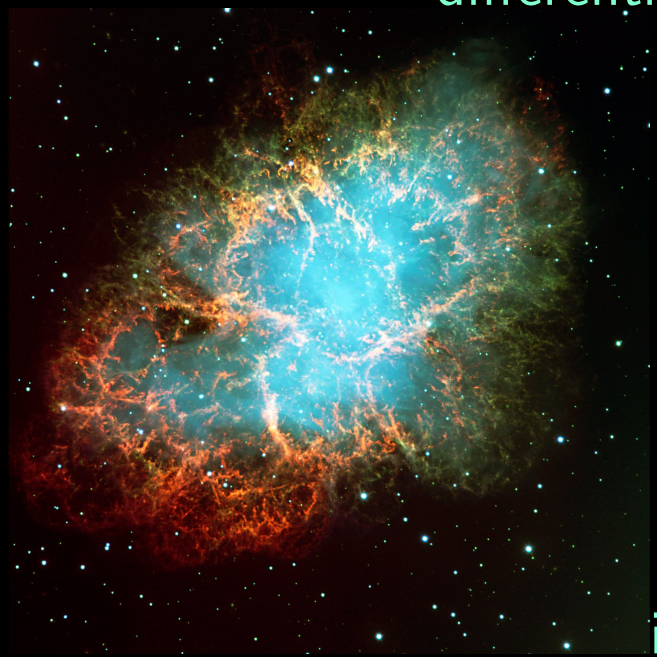
Imaging



photometry

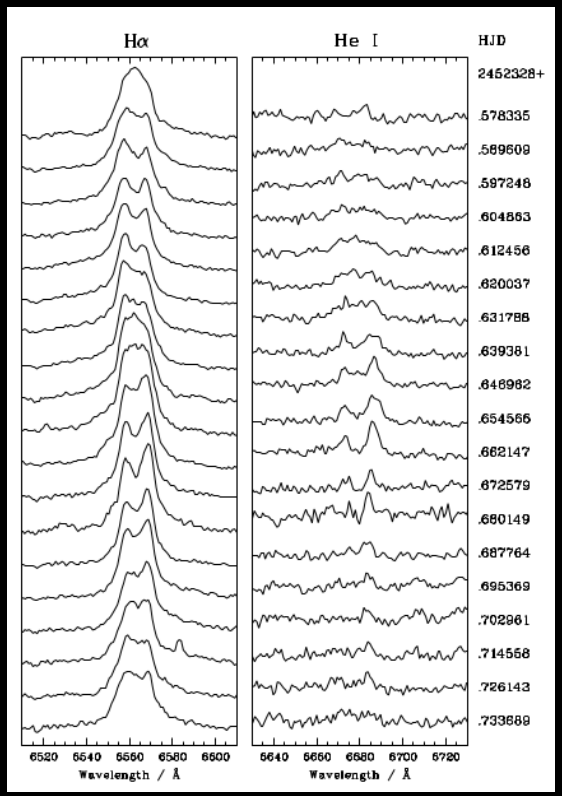


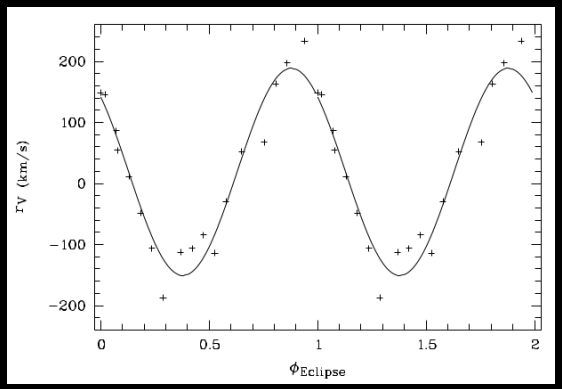
differential photometry



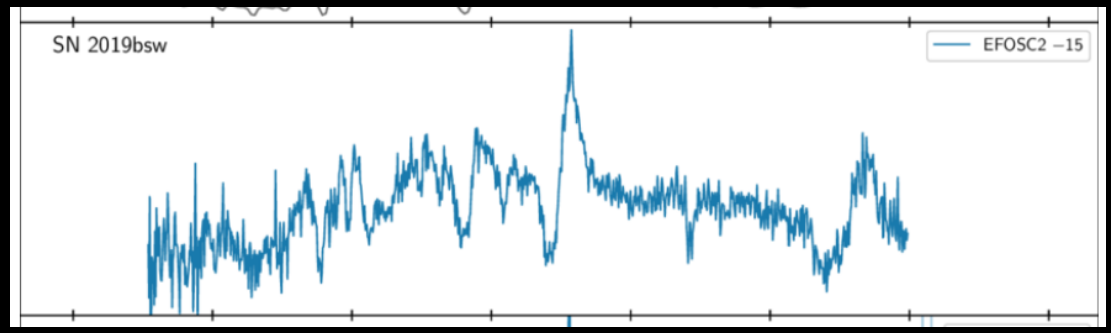
images

Spectroscopy

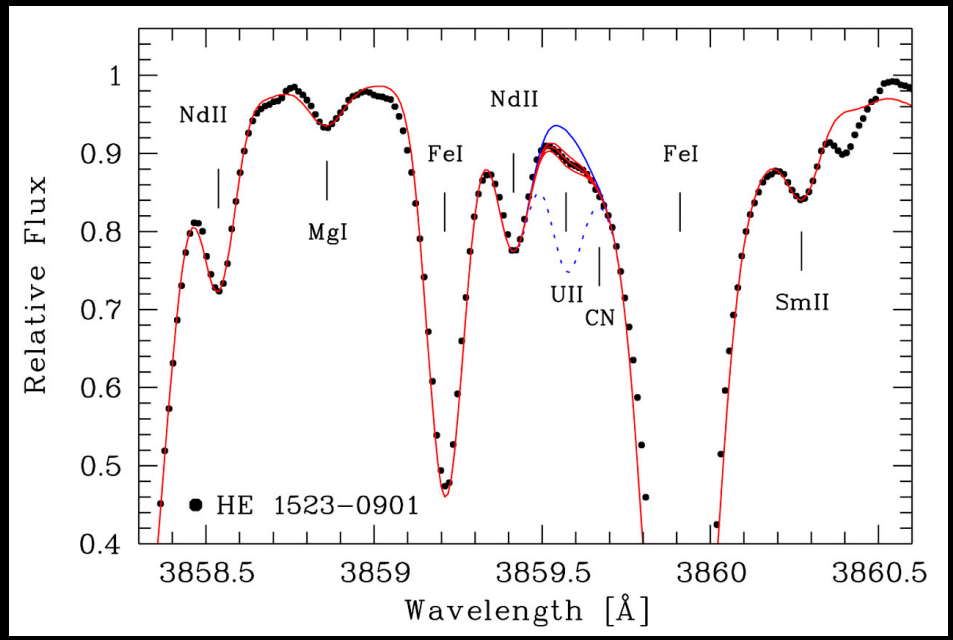




radial velocities



classification



abundances


Happy Observing!