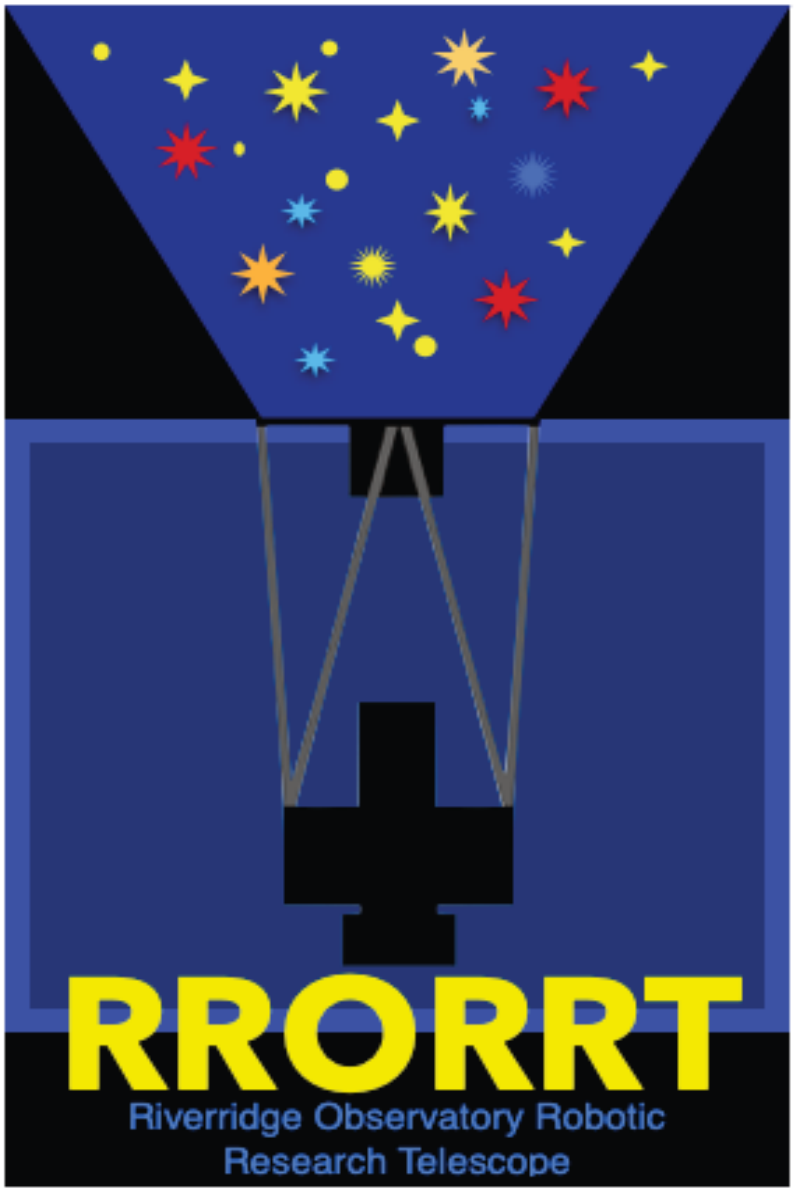

Observing Plan Tutorial

Presented by the Central Arkansas Astronomical Society and Arkansas Tech University

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Welcome to the RRORRT

The River Ridge Observatory Robotic Research Telescope (RRORRT) is a AG Optical Systems 14.5“ Dall Kirkham telescope fitted with an SBIG Aluma 2020BSI CMOS camera, rotator and filter wheel, making it suitable for gathering a wide range of scientifically useful data and astrophotography. Controlled by a suite of software and connected to the observatory weather and sky condition sensors, the system can run a large number of observing plans autonomously.

ACP Expert Software

The RRORRT uses ACP Expert to automate observatory functions and schedule observing sessions. Users create Observing Planbs that specify where an object is located, exposure time, number of exposures and other parameters. ACP chooses which observing plans to plans to run based on the parameters for each plan. ACP signals for the roof to open, points to an object, gathers the images and sends them to a folder, then moves to the next object or plan. After the night’s session is done, the telescope parks and the roof closes.

The Web Interface

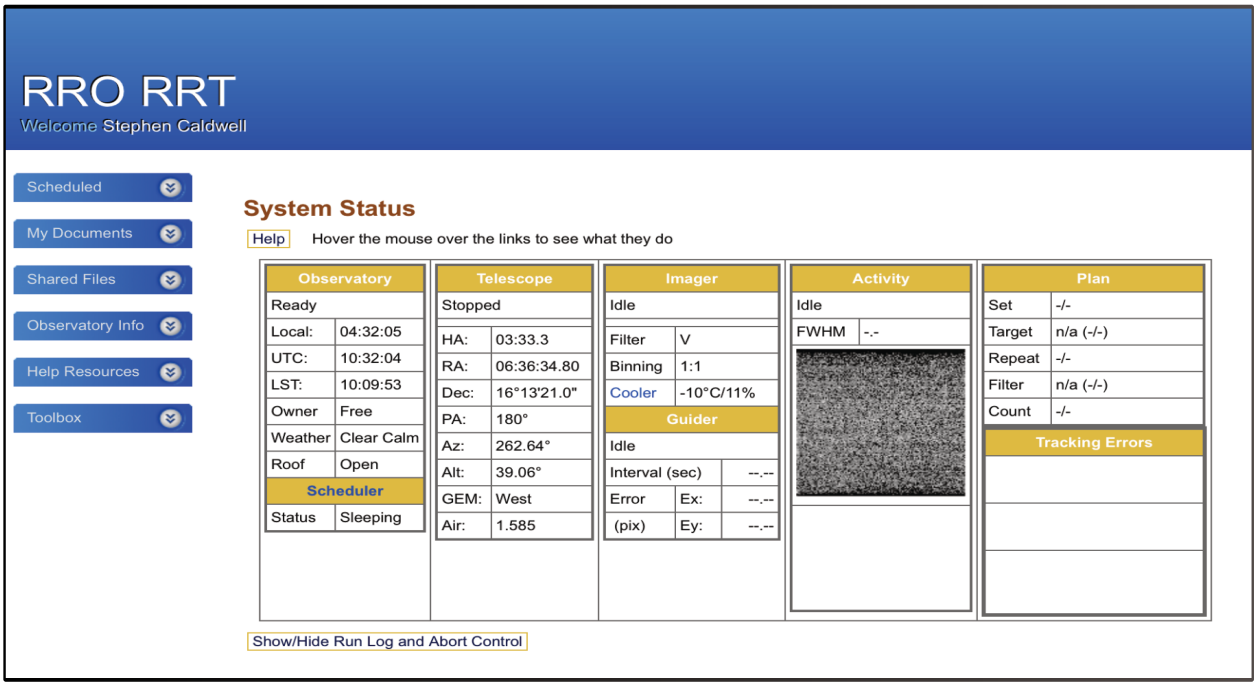
Users create observing plans by going to the RRORRT web interface:

acp.rrt.rrobs.org and log in with their username and password.

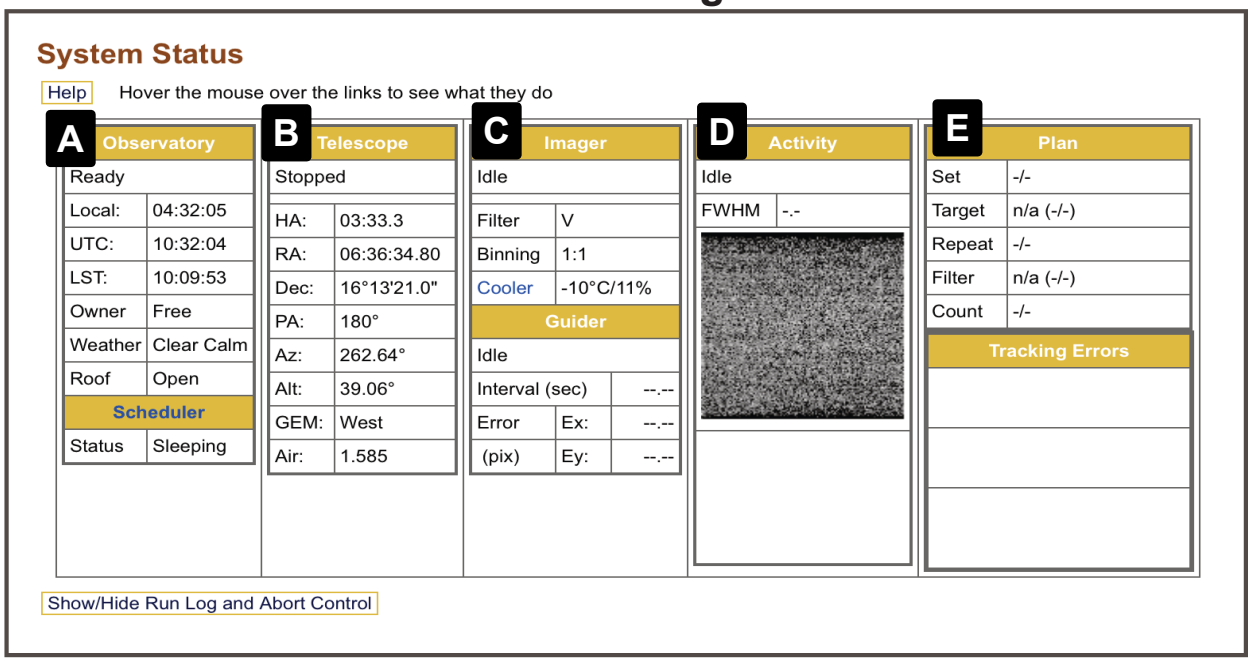
The system status page is shown below. Here the user will see the current status of the RRORRT and access scheduling form and scheduling browser to create their observing plans.

Tutorial

A simple tutorial showing how to create an observing plan is presented on the following pages.



1.0 Elements of the ACP Status Page



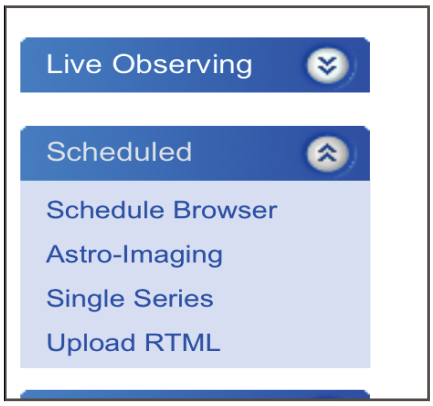
A **Observatory/Scheduler:** shows observatory status, time, weather conditions and roof status.

B **Telescope:** shows status of telescope (tracking, slewing, etc.) and it's position.

C **Imager:** shows the status of the CMOS camera, filter in use, binning and temperature of the camera. Also shows the Guider status.

D **Activity:** shows the status of the imager (observing, idle, etc.) and may show a picture of the current object being imaged.

E **Plan:** shows the active observing plan, plan name and observing set, image set, observation repeat and image count. Tracking Error may show if guider and imager experience tracking issues.



Menu Sidebar

To the left of System Status is the menu sidebar.

For the purposes of this tutorial, we will focus on two items under the Scheduled heading:

Single Imaging

Schedule Browser

These two items are what you will use to create observing plans.

2.0 Tutorial: Creating an Observing Plan

Schedule Image Series Form

Click on “Single Image” under the Scheduled Menu. The form will appear below System Status. Each section and the relevant items are discussed below.

1. Scheduler Project

New Project: type in a name for your project. You also want to identify the project as yours, so for example “Caldwell-Planetary Nebula”.

2. Object and Coordinates

Target Name: type in the name of your target: “M57 Ring Nebula”.
Right Asc. (hrs): type in the RA using this format: 18:54:11.1.
Declination (deg.): type in the DEC using this format: +33:03:23.2.
Pos. Angle (deg.): type in the Pos. Angle using this format: 20.0. If you are not using a guide star, type in 0 . For more about Position Angles, see the *RRORRT Position Angle using Aladin* or *FOVI Tutorial for The Sky X.*

3. Images and Processing

In this section, you designate the number of images, the filter and duration (exposure time).
Use: place a checkmark for each row you want to use.
Count: number, how many time you want to image using the specific filter.
Filter: click in this box and choose which filter you want to use(click ”More” to add additional filters. The RRORRT has the following filters—

Photometric		Astrophotography	Narrowband	
B	B-Band Bessell	Luminance	Ha	Hydrogen Alpha (Red)
V	V-Band Bessell	Red	O III	Oxygen III (Green)
R	R-Band Bessell	Green	S II	Sulfer II
I	I-Band Bessell	Blue		

Duration: number, exposure time in seconds. Examples—

60 seconds= 1 minute
120 seconds= 2 minutes
180 seconds= 3 minutes
300 seconds= 5 minutes

You may also specify exposure times like so—

1.25 seconds, 1.50 seconds, 1.75 seconds

Dithering: default is 0.0
Auto Focus: default is unchecked

Schedule Image Series

Help

1. Scheduler Project

Select Project:	(select existing project, or...) Refresh Project List
New Project:	(...create new project with this name)

2. Object and Coordinates

Target Name:		Get Coordinates or Ephemeris
Right Asc. (hrs):		Deep Sky Catalog Search
Declination (deg):		*(coordinates in J2000)*
Pos. Angle (deg):		*(true/sky PA, required)*

3. Images and Processing

Use	Count	Filter	Duration	Binning
☐		Luminance		1
☐		Luminance		1
☐		Luminance		1
More				
Dithering:	0.0	*(main imager pixels, -1.0 for auto)*		
Auto Focus:	☐	*Autofocus before each block of images*		

4. Constraints

Horizon:	35	*(degrees, must be above this altitude)*
Hour Angle:		*(Hours E, W, -east, must be within HA range)*
Air Mass Range:		*(max, min - relative air mass must be within this range)*
Moon Avoid:		*(distance degrees, width days Moon Avoid Help)*
Moon Down:	☐	*(Moon must be below horizon, ignore Moon Avoid)*
Sky Condition:	Good	*(Sky must be at least this good)*

5. Priority and Series

Priority:	0	*(each observer has own priority scale)*
Repeat Series:	1	*(repeat entire image set this many times)*

6. Timing and Monitor Mode

Note: The values and options in this section are cleared when this form is closed.

Monitor Interval:	0	*(days, requeue every 'n' days forever or until "Must Run Before")*
Must Run After:		*(UTC, ex: 2018/11/30 03:12:44)*
Must Run Before:		*(UTC, ex: 2018/11/30 03:12:44)*
Fixed Time:	☐	*(override dispatcher use with caution!)*
Run Now:	☐	*(start immediately if constraints met)*

☐ Enable requests immediately

Submit Request

4. Constraints

Items such as Hour Angle, Air Mass Range and Moon Avoid can be left blank.
Horizon: number, degree object must be above for plan to run. Default is 35o.
Moon Down: check this if you want the plan to run when the Moon is below the horizon.
Sky Condition: you can specify a sky condition—good, fair or excellent. “good” is default.

5. Priority and Series

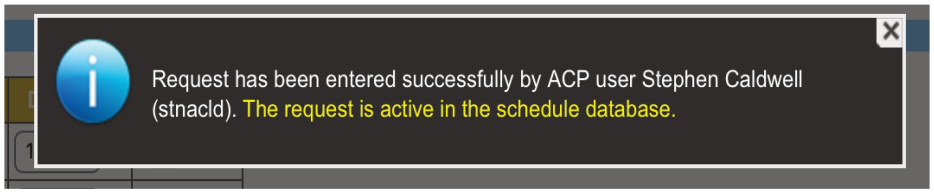
Priority: plans with higher priority numbers will run before others. Default is “0”. Leave this a “0” unless you have permission from the Program Manager.
Repeat Series: number of times you want plan to repeat in a single night”s session.

6. Timing and Monitor Mode

All items expect Monitor Interval should be left blank.
Monitor Interval: number, specify number of days before the plan will requeue to run again. If left at “0”, plan will run once; if at “1”, plan will requeue everyday; if “2”, plan will requeue every two days, and so forth. Note: requeuing does not guarantee the plan will run.

Check **“Enable requests immediately”**.

Click **“Submit Request”** to send your plan the the Scheduler. You will see a box pop up like the one below:



Schedule Image Series

Help

1. Scheduler Project

Select Project:	(select existing project, or...) Refresh Project List
New Project:	(...create new project with this name)

2. Object and Coordinates

Target Name:		Get Coordinates or Ephemeris
Right Asc. (hrs):		Deep Sky Catalog Search
Declination (deg):		*(coordinates in J2000)*
Pos. Angle (deg):		*(true/sky PA, required)*

3. Images and Processing

Use	Count	Filter	Duration	Binning
☐		Luminance		1
☐		Luminance		1
☐		Luminance		1

More

Dithering:	0.0	*(main imager pixels, -1.0 for auto)*
Auto Focus:	☐	*Autofocus before each block of images*

4. Constraints

Horizon:	35	*(degrees, must be above this altitude)*
Hour Angle:		*(Hours E, W, -east, must be within HA range)*
Air Mass Range:		*(max, min - relative air mass must be within this range)*
Moon Avoid:		*(distance degrees, width days Moon Avoid Help)*
Moon Down:	☐	*(Moon must be below horizon, ignore Moon Avoid)*
Sky Condition:	Good	*(Sky must be at least this good)*

5. Priority and Series

Priority:	0	*(each observer has own priority scale)*
Repeat Series:	1	*(repeat entire image set this many times)*

6. Timing and Monitor Mode

Note: The values and options in this section are cleared when this form is closed.

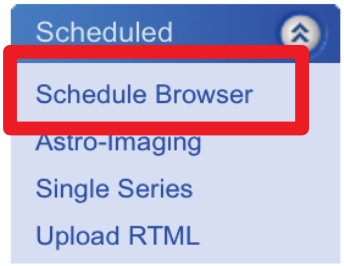
Monitor Interval:	0	*(days, requeue every 'n' days forever or until "Must Run Before")*
Must Run After:		*(UTC, ex: 2018/11/30 03:12:44)*
Must Run Before:		*(UTC, ex: 2018/11/30 03:12:44)*
Fixed Time:	☐	*(override dispatcher use with caution!)*
Run Now:	☐	*(start immediately if constraints met)*

☐ Enable requests immediately

Submit Request

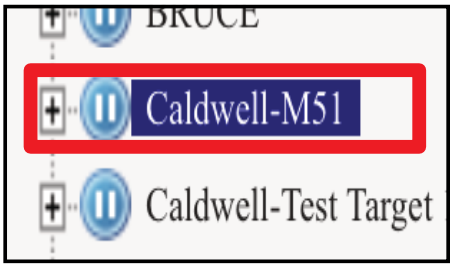
2.1 Enabling Your Observing Plan in Schedule Browser

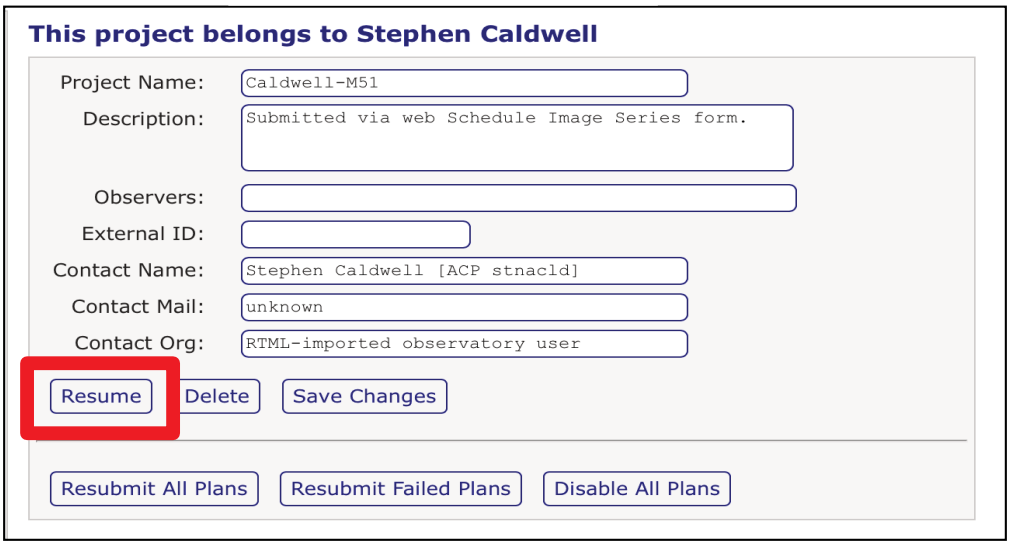
If you forget to check *"Enable requests immediately"*, you will see the above message. You can go into the Schedule Browser and enable your request.



Click on Schedule Browser.

In Schedule Browser, look in the list on the left-hand side to find your Project. In this example, it is "Caldwell-M51". Notice the plan button is "paused". Click on the plan.





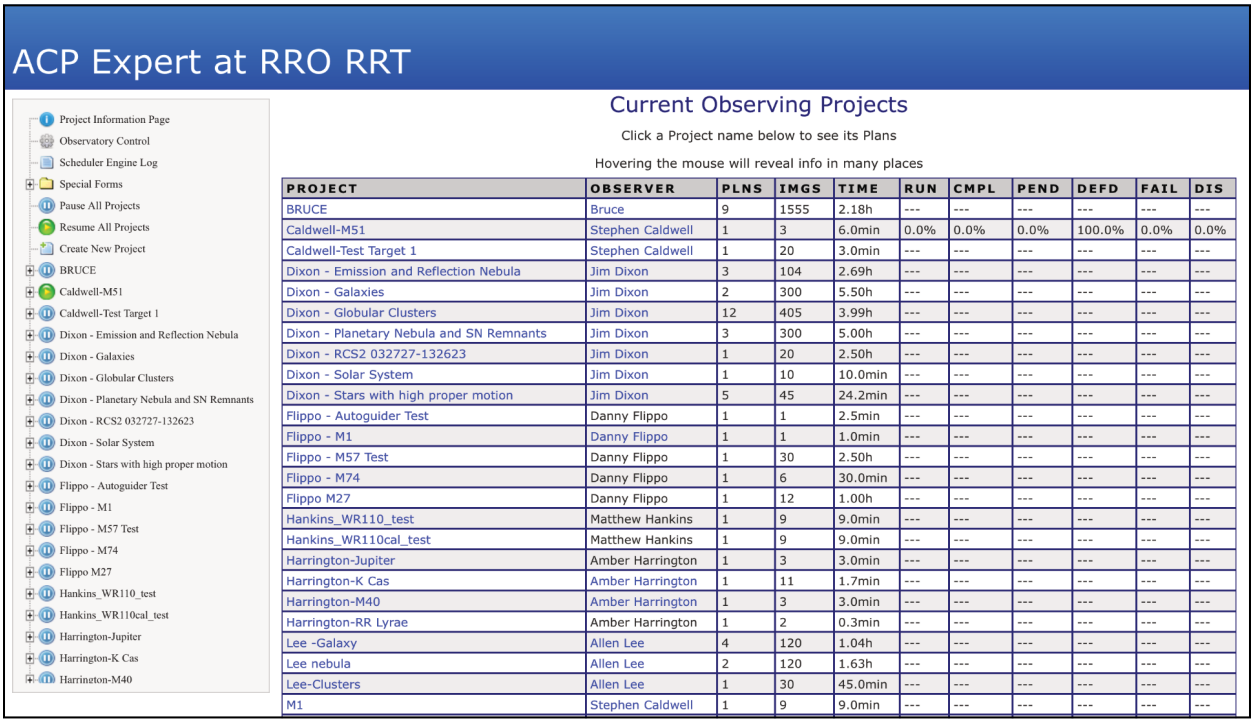
To enable your plan, click **"Resume"**.

Your plan button will change from "paused" to "play".

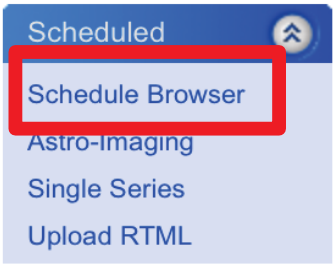
Note: When you are in Schedule Browser, only work with you projects. Changing another user's project is strictly prohibited.

2.2 Creating An Observing Plan in the Schedule Browser

You can create observing plans in the Schedule Browser. You can modify, pause and delete existing plans.

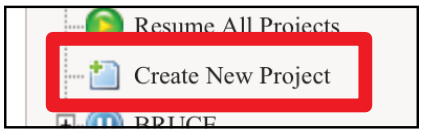


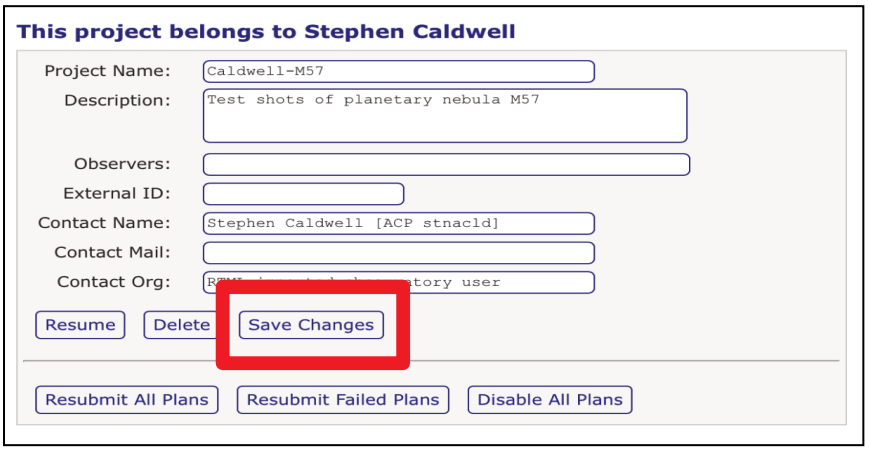
PROJECT	OBSERVER	PLNS	IMGS	TIME	RUN	CMPL	PEND	DEFD	FAIL	DIS
BRUCE	Bruce	9	1555	2.18h	---	---	---	---	---	---
Caldwell-M51	Stephen Caldwell	1	3	6.0min	0.0%	0.0%	0.0%	100.0%	0.0%	0.0%
Caldwell-Test Target 1	Stephen Caldwell	1	20	3.0min	---	---	---	---	---	---
Dixon - Emission and Reflection Nebula	Jim Dixon	3	104	2.69h	---	---	---	---	---	---
Dixon - Galaxies	Jim Dixon	2	300	5.50h	---	---	---	---	---	---
Dixon - Globular Clusters	Jim Dixon	12	405	3.99h	---	---	---	---	---	---
Dixon - Planetary Nebula and SN Remnants	Jim Dixon	3	300	5.00h	---	---	---	---	---	---
Dixon - RCS2 032727-132623	Jim Dixon	1	20	2.50h	---	---	---	---	---	---
Dixon - Solar System	Jim Dixon	1	10	10.0min	---	---	---	---	---	---
Dixon - Stars with high proper motion	Jim Dixon	5	45	24.2min	---	---	---	---	---	---
Flippo - Autoguider Test	Danny Flippo	1	1	2.5min	---	---	---	---	---	---
Flippo - M1	Danny Flippo	1	1	1.0min	---	---	---	---	---	---
Flippo - M57 Test	Danny Flippo	1	30	2.50h	---	---	---	---	---	---
Flippo - M74	Danny Flippo	1	6	30.0min	---	---	---	---	---	---
Flippo M27	Danny Flippo	1	12	1.00h	---	---	---	---	---	---
Hankins_WR110_test	Matthew Hankins	1	9	9.0min	---	---	---	---	---	---
Hankins_WR110cal_test	Matthew Hankins	1	9	9.0min	---	---	---	---	---	---
Harrington-Jupiter	Amber Harrington	1	3	3.0min	---	---	---	---	---	---
Harrington-K Cas	Amber Harrington	1	11	1.7min	---	---	---	---	---	---
Harrington-M40	Amber Harrington	1	3	3.0min	---	---	---	---	---	---
Harrington-RR Lyrae	Amber Harrington	1	2	0.3min	---	---	---	---	---	---
Lee -Galaxy	Allen Lee	4	120	1.04h	---	---	---	---	---	---
Lee nebula	Allen Lee	2	120	1.63h	---	---	---	---	---	---
Lee-Clusters	Allen Lee	1	30	45.0min	---	---	---	---	---	---
M1	Stephen Caldwell	1	9	9.0min	---	---	---	---	---	---



On the sidebar in System Status, click **Schedule Browser**.

To start a new observing plan, click **"Create New Project"**.



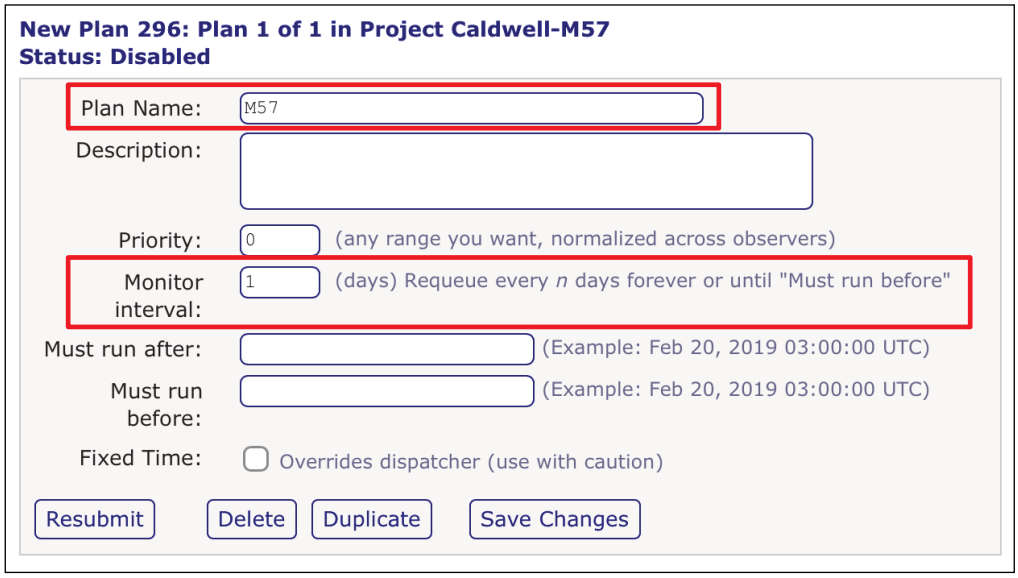


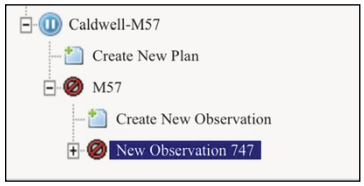
Give your project a name. Include your last name. Description and email are optional.

Click **"Save Changes"** to save your information.

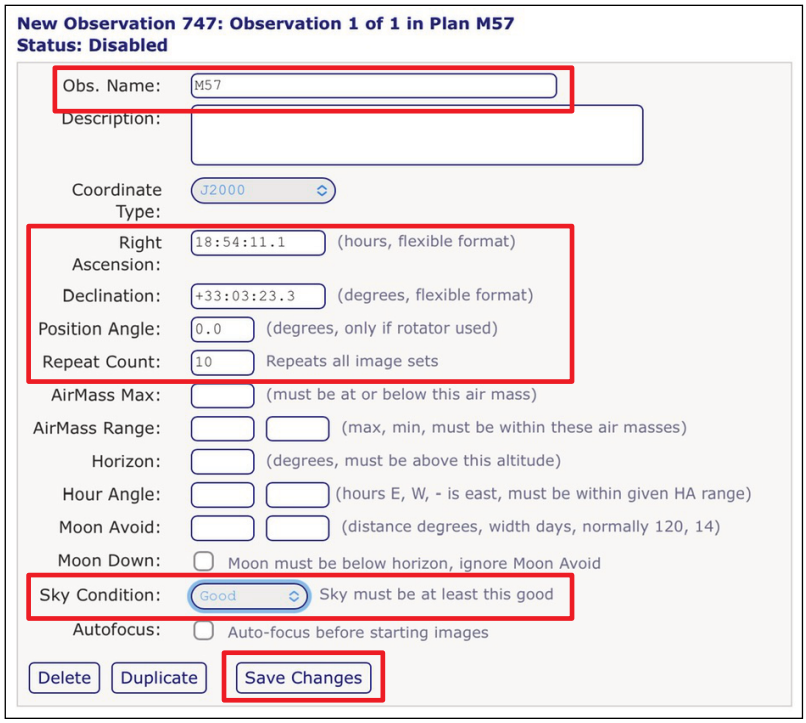
Remember to click "save Changes" after filling in information on all forms.

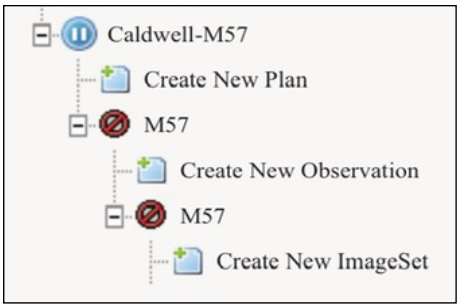
Click on the "**+**" to expand the Project. Click on "**Create New Plan**" and in your observing plan's name. Keep priority at "0", and change the Monitor Interval to suit the parameters of your plan. In this example, our Monitor Interval is "1", so the plan will requeue each night.



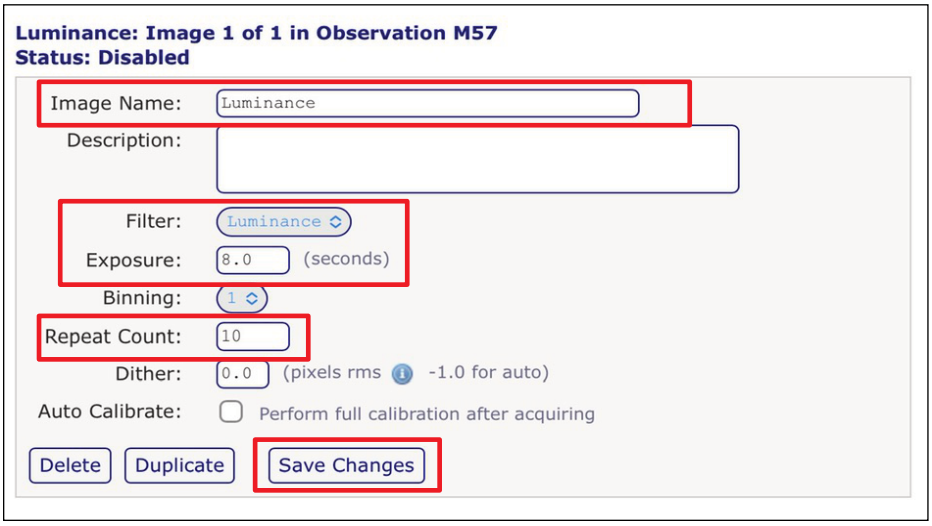


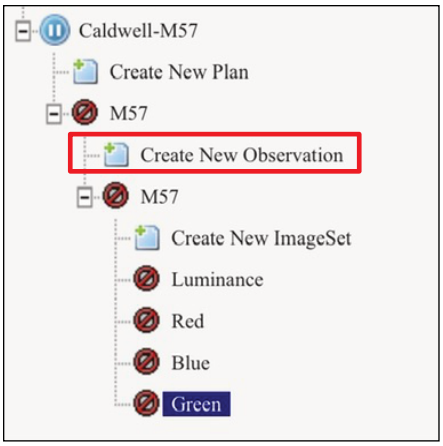
Click on the "**+**" to the expand your Plan. Click on "**Create New Observation**" and type in a name for you observation. Type the RA and DEC for your target. Type in the Position Angle (if using). Type in the number of time you want all images to repeat, and specify the Sky Conditions. Click "**Save Changes**".



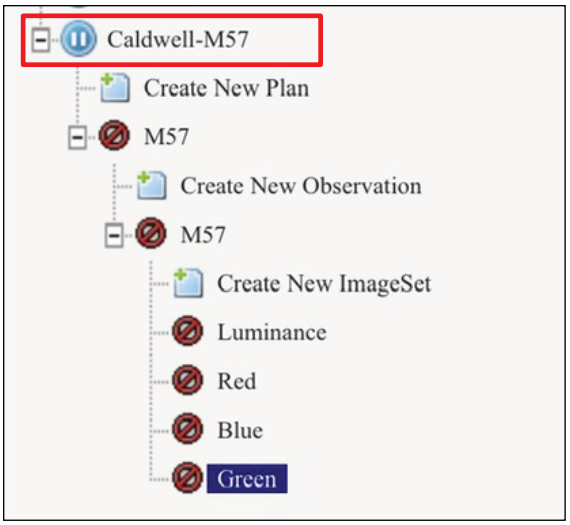


Click on the **"+"** to expand Observation. Clcik on **"Create New ImageSet"** and type in a name ffor your image, typically the filter you are using. Choose the filter, and type in your exposure time (in seconds). Type in a repeat count. Click **"Save Changes".**



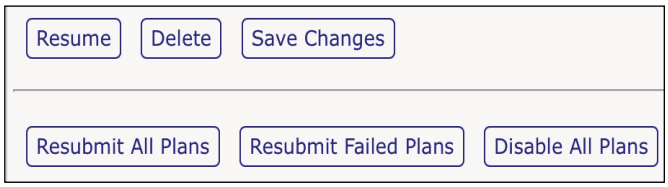


To add other filters or image-sets to your observation plan, click "Create New Imageset" and fill in the information for each new filter or image set. Be sure to click "Save Changes" on each image set.

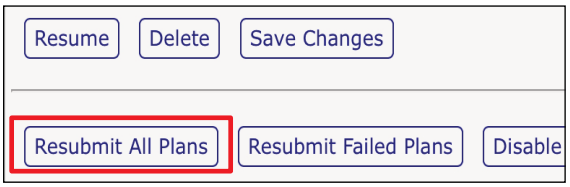


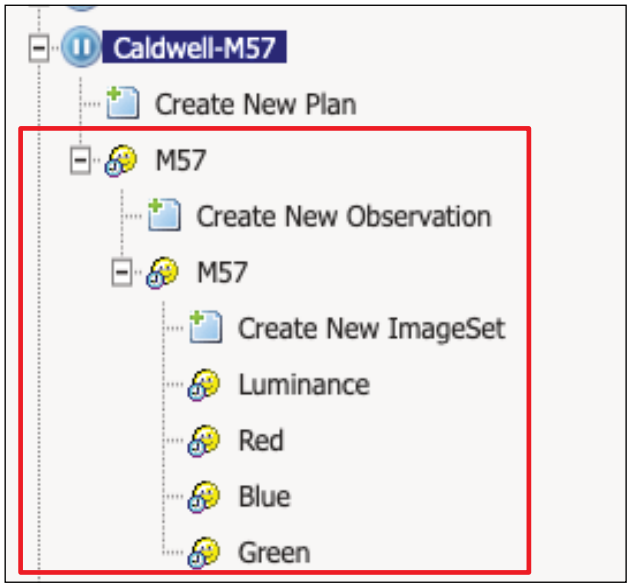
To submit the Observing Plan and enable the Project, click on your project.

In your Project's form, you will use the buttons below.

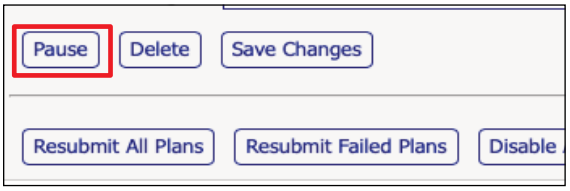


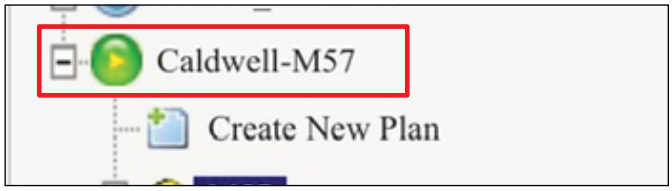
To submit your Observing Plan, click "**Resubmit All Plans**" The *no signs* will change into smiley emoticons.





To enable your Project, click "**Pause**". The pause sign will change to play.





3.0 Further Exploration

The following books, websites and apps maybe of interest to you as you begin creating observing plans and learn about processing images.

Books

A Practical Guide to Lightcurve Photometry and Analysis, Brian Warner. 2006. Springer Books.

Observing and Measuring Visual Double Stars, 2nd Ed., R.W. Argyle. 2012. Springer Books.

Scientific Astrophotography: How Amateurs Can Generate and Use Professional Imaging Data, Gerald Hubbell. 2013. Springer Books.

AAVSO Guide to CCD/CMOS Photometry, Version 1.0. *https://www.aavso.org/ccd-camera-photometry-guide*

Websites

American Association of Variable Star Observer (AAVSO) *https://www.aavso.org*

Center for Backyard Astrophysics *http://cbastro.org*

Sky Maps *http://www.skymaps.com*

Software

C-Munipack (Windows): Photometry, image reduction tool. Free. *http://c-munipack.sourceforge.net/*

Registax: Image processing software. Free. *http://www.astronomie.be/registax/index.html*

FITS Liberator: Image processing. *Free. http://www.spacetelescope.org/projects/fits_liberator/*

Aladin Sky Atlas: Star atlas program. Free. *http://aladin.u-strasbg.fr/aladin.gml#AladinDesktop*

The Sky X Pro: Planetarium software. $349 US. *http://www.bisque.com/sc/pages/TheSkyX-Professional-Edition.aspx*