StarTools

Load file with Open: select and load an integrated FITS file for processing.

Starts tracking with the Track/NR module button turning green.

For integrated **OSC color FITS** file, select the middle button in the popup window:

Linear, from OSC/DSLR with Bayer matrix and not white balanced

Color data are split out into RGB channels and a synthetic Luminance file is created.

L and RGB are weighted to account for the camera's doubled green pixels.

That is, Luminance is weighted to .25xRed, .5xGreen, and .25xBlue.

Top **Compose button turns green** indicating separate parallel processing of L and RGB.

They will be recombined in the Color module.

Loading an OSC file with Open is the same as using Compose with Luminance, Color:

L+Synthetic L From R(2xG)B, RGB (Color from OSC/DSLR).

For an unstretched **mono file**, select the first **Linear** button to load and process.

Selecting Linear for an RGB file will not separate luminance and color for processing.

For an OSC integration, it will not account for the camera's doubled green pixels.

To load previously stretched **FITS**, **TIFF**, or some **JPG** files (e.g., for color adjustment):

Select Non-linear sRGB source option button, and then select either:

Attempt to reverse, activate Tracking; or maybe Do not reverse, don't activate Tracking

See Adjusting the color of a processed file in Color module, p. 26 below.

Note: People say APP screws up Wipe and subsequent modules, unless these are **disabled**:

Tab2 toward the bottom, disable "adaptive/reduce Amp-Glow".

(if saving calibrated light frames at the bottom, disable "remove light pollution")

Tab 5 toward the top, disable "neutralize background".

Don't use "remove light pollution" or other APP tools.

Compose: loads separate LRGB files for processing

Click Compose instead of Open at the top and load each L, R, G, B (and narrow band) file.

Note: All files must be aligned (registered) first in APP and all have the same dimensions

Using Compose (instead of Open) enables Matrix parameters in the Color module.

Load L, R, G, and B data files with their corresponding buttons at the top:

Load Luminance file first if one is available with Luminance button.

Then **load the Red, Green, and Blue files** with their respective channel buttons.

If there is a missing color channel see Channel Interpolation below.

Can load a **color FITS integration** can three times using each of the R, G, and B buttons.

The separate R, G, and B channels will be extracted and loaded.

Using Open for a color FITS integration is easier and will process the same.

For **narrowband data**, see below for loading and use options.

Set Parameters:

Spectrum and Filters (can adjust certain defaults in subsequent modules?):

For OSC with UV/IR cut filter (or L-Pro filter??) or mono RGB files select:

Full Visual Spectrum (OSC with UV/IR cut or LRGB filter set)

For OSC camera and no filters select:

Extended Visual Spectrum (OSC without IR/UV cut, or modified DSLR)

For OSC narrowband files (Ha and OIII) select:

Duoband/Triband/Quadband (OSC or DSLR)

For OSC with light pollution filter like Optolong L-Pro?? select:

CLS or UHC filter

Scene (adjusts certain preset defaults in some modules):

Field-filing: one big nebula or galaxy

Widefield: one or more smaller nebulae or galaxies in a widefield view

Luminance, Color settings:

RGB, RGB (Legacy): Color is RGB as loaded. R+G+B are used for Luminance.

Ignores Total Exposure sliders and any L file loaded. No Compose mode used.

RGB, Mono: outputs only a mono Luminance file from R+G+B channels. Ignores total exposure times sliders and any L file loaded. No Compose mode used.

L, RGB: uses L for luminance (ignores exposure times), and RGB for color channels. Compose mode is activated. (If no L file is loaded, uses R+G+B for Luminance).

Mono➔ **L+Synthetic L from RGB, RGB**: creates L from R, G, and B, and L if loaded, using Total Exposure sliders. RGB are color as loaded. Compose mode is activated.

L+Synthetic L from RGB, Mono: outputs only a mono Luminance using preceding formula. No Compose mode used. (Might use in Compose as L for Ha/OIII sets).

OSC➔ **L+Synthetic L from R(2xG)B, RGB (Color from OSC/DSLR)**: creates L from R, G (using G's doubled pixels) and B (and L if loaded), using Total Exposure sliders. R, G and B are color data as imported. Compose mode is activated. (This is the same as using Open and Linear from OSC not white balanced).

L+Synthetic L from R(2xG)B, RGB (Mono from OSC/DSLR): outputs only a mono Luminance file using the preceding formula. No color data; no Compose mode.

L+Synthetic L from RGB, R(GB)(GB) (Bi-Color): creates synthetic L from R, G, B (and L if loaded), weighted by Total Exposure sliders. Color is R and an average of G + B loaded in each G and B channel. Use for narrowband mono datasets.

OSC➔ **L+Synthetic L from R(2XG)B, R(GB)(GB) (BiColor from OSC/DSLR)**: creates L from R, G (using G's doubled pixels) and B (and L if loaded), using Total Exposure sliders. Color is R as loaded and an average of G + B loaded in each G and B channel. Use for OSC narrowband captures with filters like the Optolong

L-Extreme or L-Ultimate for **HOO images**.
Recommendation: don't use L+Synthetic L formula if a good Luminance was loaded.
Maybe ok if L covers same spectrum and same night as the RGB data.
But can still end up smearing stars and things.
Note: "Mono" in any Luminance/Color setting outputs only a greyscale (synthetic L) file.
The top Compose button will remain gray, confirming a mono file for processing.

Total Exposure sliders set L, R, G, and B channels' contribution to the Synthetic L.
Sliders have no impact on how color channels are loaded.
Best sliders setting are those achieving the Synthetic L file with the lowest SNR.
E.g., R channel can be the cleanest and best SNR
B channel can have more noise and chromatic aberration.

Color Ch. Interpolation is On by default but has no effect if all 3 RGB channels are loaded.
If On, it creates an artificial color channel if the missing channel is needed for color.
It has no affect when a synthetic luminance or a mono channel is being created.
Leave On if creating a mono file from a single color channel for separate processing.
E.g., to separately process Ha or maybe a noisy Blue channel.

Click **Keep** after all channels are loaded and all parameters are set.
Click **Linear** in the pop-up when returned to the main opening screen.
The top **Compose button turns green** for files with color and luminance.
(The doubled OSC green pixels were taken care of in Compose).
Proceed with processing.

Narrowband Data

HOO image with Ha and OIII data

See **here** for workflow discussion.

- Using extracted Ha and OIII files from an OSC duoband (see APP work flow, p. 10) or mono files.
  In StarTools Compose load Ha file as Red and load OIII file in Green and in Blue (twice).
  Set Spectrum and Filters to 'Duoband/Triband/Quadband (OSC or DSLR)'
  Set Luminance, Color **for mono** to: L + Synthetic L from RGB, R(GB)(GB)(Bi-Color)
  For OSC: L+Synthetic L from R(2XG)B, R(GB)(GB) (BiColor from OSC/DSLR)
  Alternatively, set to: L + Synthetic L from RGB, RGB, and process as RGB image
  Some say this can create a better HOO image with more OIII bluegreen.
  Set sliders for each channel's contribution to the synthetic luminance
  Generally, OIII total (G or B or G+B) should equal the Ha (Red) contribution.
  May want to reduce B's contribution, for example, if it is noisy.
  Click Keep → click Linear in popup window→ continue with processing
  When in Color module can set the Matrix parameter for HOO.

- Using an integrated color OSC **Color FITS file** from captures with a duoband filter
  People say using separate Ha and OIII files to process with the above process is better to do.
  If integrating together in APP, use "HaOIII color" algorithm (or maybe the regular algorithm).
  In StarTools Compose:
  Load that integrated OSC FITS file three times in each Red, Green and Blue channel.
  Set Luminance,Color: L+Synthetic L from RGB,R(GB)(GB)(Bi-Color from OSC/DSLR)

Proceed with parameter settings as with above separate Ha and OIII mono files.

- Using separate Ha and OIII mono files which have been separately processed.

In Compose load Ha file in Red (and maybe in L?), and OIII file in Green and Blue.
Load those processed files with one of the LRGB Luminance, Color settings:
Luminance, Color: choose one that outputs the desired L and color files.
If needed, adjust Total Exposure sliders for the Luminance.
Keep → Non-linear sRGB source → maybe go directly to the Color module.

Combining Narrowband HOO image with RGB stars

Process Ha and OIII into an HOO of an object with preceding workflow, and save that image.
Process the RGB file(s) for the same object using either Open or Compose).
Focus on good star shape and colors, and save that image.
These two images must be registered together before using Layer.
Open Layer and follow Compositing Narrowband HOO image with RGB stars. See Layer, p.41.

Using Narrowband Ha (or OIII) data to enhance LRGB image

Three alternative uses: **NBAccent** module, **Layer** module, or use Ha in image's L or Red channel

1. Load Ha (or OIII) as NB Accent file for use in NB Accent module

If loading narrow band data as NBAccent file, do not load or blend it in L or R, G, or B channels.

In Compose, click **NBAccent button** and load narrow band file: Ha, OIII, or Ha+OIII.
Note: That narrowband file must be registered with the LRGB file(s); see APP p. 12.
Set **NB Accents Type** parameter for the NB file loaded (and how NB Accent module will use it):
"Ha/S-II from NB Filter" for mono **Ha data** in the red channel only
"O-III/Hb from NB Filter" for mono **OIII data** in green and blue channels only
"Ha/S-II+O-III/Hb from Duo/Tri/Quadband Filter" for **Ha** in R, **and OIII** in G and B.
See below for preparing a combined Ha+OIII file.

That narrowband file will be cropped, binned, and processed in parallel with the LRGB image file
A separate screen is displayed in Wipe showing its impact on the NB file.
NB Accent module will be activated and will use that narrowband file for its NB accents.

Preparing a **combined Ha+OIII** file to load as the NB Accent file:
Integrate HaOIII duoband lights in APP with Ha-OIII color algorithm
Save that file as 32 bit FITS file.
If mono Ha and OIII integrations, combine them with APP or StarTools:
In APP Combine RGB tool set formula to RGB1
Load Ha file in Red channel and OIII file in Green and Blue channels
Click (re-)calculate, and save as a 32 bit FITS file.
In StarTools Compose, set Luminance/Color to RGB, RGB (Legacy Software)
Load Ha file in Red and OIII file in both Green and Blue
Click Keep → Linear → Save.

Must register that Ha+OIII file with the main image RGB file(s)

2. Preparing Ha (or OIII) file for use as Ha highlights in the Layer module.

Ha and RGB integrations **must be registered** together for Layer (see APP sheet p. 12).
Load, process and save the integrated RGB image (using either Open or Compose).
Load and process the Ha file with Open → Linear and process it as a mono file.
(Don't close StarTools and it remembers the crop and bin settings).
Process similar to (but lighter than) the RGB file and save it (as mono file).
In Wipe maybe use the less aggressive Narrowband preset
Maybe use FilmDev and don't stretch it brighter than the RGB file.
Open **Compose** and set 'Luminance, Color' to **RGB, RGB (Legacy Software)**
Load the processed Ha file as the red channel.
Color Ch. Interpolation: **Off** to create a **pure Red Ha file**.
Click Keep and optionally Save for loading and use later.
Open Layer (see p. 42) to composite the processed Red Ha file with the processed RGB image.
Opening Layer immediately after the above loads that Red Ha file for use by Layer.
For an **OIII file** to use in Layer, load it in the green and blue channels and follow above process.

3. Use/blend Ha data for/in Luminance or in the Red Channel

If purpose is to emphasize HII detail; probably better to use Layer module (see previous page).
Note: APP Combine RGB Tool can add Ha to the L or Red channel for processing there.
However, it can't save that combined L or Red channel file alone. See APP sheet, p. 19.
But see B. below for creating a savable combined L file in APP registration.

A. Use Ha as Luminance

This may be best for strong Ha emitting nebulae to bring out the Ha color and detail
But yielding more correct spectrum coloring with RGB for color.
In Compose load Ha file as Luminance and RGB data in their respective channels.
Don't use any L+Synthetic in the Luminance, Color parameter (to use only Ha as L).

B. Add/blend Ha data to create a new combined Luminance.

Generally thought best **not** to blend Ha with RGB files for a combined synthetic Luminance.
It can create a pinkish salmon color that can't be corrected out.
If still want to create a new L channel with Ha, see APP p. 12, or use StarTools Compose:
First create synthetic L from the RGB data by loading its R, G, and B channels.
Set Luminance, Color: L + Synthetic L from R(2xG)B, **Mono** (Mono from OSC/DSLR).
Keep → Linear → (process some?) → Save and register that L file with the Ha file.
Open Compose and load that created synthetic L file as Luminance.
Load the Ha file with the Red/S-II button. (Other channels 'Not Set').
Set 'Luminance, Color' mode to 'L + Synthetic L from RGB, Mono'.
Adjust sliders for Ha contribution to the new combined Luminance.
Channel Interpolation On (default).
Keep → Linear → Save that synthetic Luminance with Ha blended in.
Can use it as Luminance in Compose with the RGB color data.
Maybe process separately first; see Separate Processing.

C. Add/blend Ha data to create a new red channel.

Adding Ha highlights with **Layer module** (see #2 above) may be a better approach than this.
This blending might help galaxies where with not much HII; just to make them redder)

Create the integrated Ha and Red files.
APP can extract Red channel from OSC subs or integration; see APP sheet, pp. 5 and 19.
StarTools can extract a mono Red file from an OSC integration:
Open Compose and load the OSC integration with the Red/S-II button.
Set Luminance, Color parameter to **'RGB, Mono'** (creates mono red file).
Set Channel Interpolation On (default).
Click Keep → Linear → (process some?) → Save.

Register the red and Ha files together is necessary before blending.

To blend the red file and the Ha file into a new combined Red file, **open Compose**:
Load the red mono file in the Red channel (or extract it there from an OSC file).
Load the Ha file with the Green/Ha button.
Set Channel Interpolation On (default)
Set 'Luminance, Color' to 'L + Synthetic L from RGB, Mono' (for a mono blend).
Blend amount of each with Red and Green Total Exposure slider settings.
50/50 blend up to 80 Ha/20 red is recommended
Click Keep → Linear (no need to process more) → Save that **new Red channel**.
Alternatively, Layer might be used to blend red and Ha files with one of the Lighten modes.

Use that **new Red channel** with green and blue channels from the RGB data in Compose.
Process as regular RGB data in Compose above.
Option: Some say it is best not to combine Ha with RGB for a synthetic L that way:
Maybe better to use the original Ha file as sole Luminance file. See 3.A. above.
Or, use a Synthetic L made from only RGB channels. See APP p.5, or below.
Load one of those as L and RGB as above, and set Luminance, Color to 'L, RGB'

Add some Ha in the **Blue channel**?
Some suggest it helps to add a little Ha (like 15%) to the Blue channel too.
If so, use the foregoing Red channel process for the Blue channel.

For a synthetic Luminance from original RGB data without any Ha via the red channel:
Easiest way may be when integrating OSC RGB data. See APP sheet, p. 5.
In Compose, load original RGB data (mono files or OSC file) in R, G, and B channels
Set Luminance, Color parameter to "L + Synthetic L From RGB(mono)"
Or, "L+Sythetic L "From R(2xG)B, Mono (Mono from OSC/DSLR)"???
Option to set RGB sliders to weight channels' contribution to Luminance.
Press Keep → Linear → Save that Luminance file sans Ha for use above.

Separate Luminance and RGB files for Wipe and Processing:

Can be helpful for **OSC imaging** under heavily light polluted skies.
E.g., capture subs for Luminance with L-Pro filter, subs for RGB with UV/IR cut filter.
It is also suggested to use short RGB exposures, and a lot of them.
https://forum.startools.org/viewtopic.php?f=6&t=2719&p=13420&hilit=color#p13420

Integrate the L and RGB captures separately.
If only have one OSC integration, Compose can create L file from it for separate processing:
See using **L+Synthetic L from R(2xG)B, RGB (Mono from OSC/DSLR)** below.

Process the Luminance and RGB integrations separately:
For Luminance OSC integration, open **Compose** and load it in each R, G, and B channel.
Set Luminance,Color parameter to:
L+Synthetic L from R(2xG)B, RGB (Mono from OSC/DSLR)
Click Keep → Linear → process fully **or** just through Wipe → Save
If L and RGB files are previously registered (see registration below):
Same Crop (and Bin) settings must be used for this L and the RGB file.
The Crop setting is saved and applied again if StarTools is not closed.
Process to bring out as much detail as possible and save for Layer; see below.
Note: don't need Color module since this is a mono file.
Or, if saving after Wipe, use Compose to process it with RGB file; see below.

For RGB integration, use **Open** → process fully **or** just through Wipe → Save
Again, if previously registered, same Crop (and Bin) settings as L file must be used.
Process lightly for noise removal and smooth colors and save for Layer; see below.
If saving after Wipe, use Compose to process with the L file; see below.

Registration of the L and RGB files together is required before combining. (see APP work flow, p. 12).
Maybe best to confirm the Luminance file as the reference frame.

Combine the saved Luminance and Color files (again, they must be registered with same dimensions):
If **fully processed** L and RGB files were saved, see Layer at p. 43 for combining them.
If L and RGB files were saved **after Wipe** (and not processed further):
Open Compose to combine them:
Load the Luminance file (FITS or TIFF from StarTools) as Luminance
Load the Color file (FITS or TIFF from StarTools) in each R, G, and B channel.
Set Luminance,Color parameter to **L, RGB**
Click Keep → Linear
Process normally starting with the post-Wipe OptiDev (or FilmDev) global stretch
If get the no-Wipe pop-up in Color module just click OK.

Using mono R, G, and B integrations instead of OSC captures for above separate L and Color processing:
Create Luminance: load in RGB channels in Compose and set Luminance,Color to **RGB, Mono**.
(If separate L file was captured, just load and process is separately …… how?)
For Color: load files in Compose RGB channels and set Luminance,Color: **RGB, RGB** (Legacy).
Follow the above processing and combining options.

Initial OptiDev stretch : its defaults apply overly aggressive stretch of the image.

The purpose is to show everything, including the image's defects and problems.
Open **OptiDev** with its default settings and click Keep.
Use that overstretched image to Bin, to Crop edges, and to mask out defects for Wipe.

Bin applies software binning to trade resolution for increase SNR and reduced noise.
Helpful to use when image is oversampled and/or has a lot of noise.

For an overview of the imaging trains and binning formulae see Arcsec resolution sheet.

StarTools binning percentages are that of the original; i.e., smaller percentage = more binning.
71% is binned to be at 71% of the unbinned original
50% is like a 2x2 bin; 33.3% = 3x3 bin; 25% = 4x4 bin.
Amount of calculated SNR gained is shown at the bottom of the image.
Bin with one of the preset percentage buttons at the top or set with the Scale slider at the bottom.
Default is 50%, 2x2, when Bin opens.
If binning later a second time, the percentage is applied to that previously binned image.
E.g., if binned 50% before and bin 50% again, the result is 25% binned.
Some have suggested you can use Bin after SVDecon?
Mode parameter: new in ST 1.9????

A suggested StarTools visual check is to zoom in on a non-overexposed star:
It should roughly fit in (be "smeared" across) a 5x5 or 3x3 pixel box, but not less.
That gives some oversampling for SVDecon to use for its reconcentration of detail.

While Decon beneficially uses oversampling; too much noise hurts what it can do.
Binning to reduce noise can help Decon more than retaining oversampling.
Reduced noise and increased SNR from binning also helps other modules.

Crop

Mainly use to crop away dithering and other edges artifacts
To see the color channels file, click the top right Color button.
It toggles between Luminance and Color, and the NB accent file if one is loaded.
Drag a box the over the area to keep; release the mouse to show green edges to crop.
Can adjust x and y axes sides of box with sliders at the bottom
Can center green crosshair
The green is what will be removed.
Click Keep to crop the green edges and reopen the cropped image.

Mask editor (access with the Mask button at the top of any screen)
See description detail in the 1.8 manual, p. 82.

Top **Mask button is green** when a mask, other than a full mask, is in place.

Green parts of the mask are active for processing, depending on the module:
(C.f., sampled in Wipe and Color modules; or protected as in Super Structure).

Mask module opens main screen with top menu buttons:
Cancel: reverts to the mask before editing and returns
Keep: keeps the mask as edited and returns to main Mask screen or out of Mask module.
Auto: opens the auto star mask generator screen (see below)
Clear: clears the mask by turning off all green pixels
Invert: inverts everything; off pixels to green and green pixels to off.
Shrink: "shrinks" the mask by turning off green pixels with a non-green neighbor
Note: If Shrink till all green on a star disappears, Grow cannot make it reappear.
Grow: "grows" the mask by turning on any non-green pixel with a green neighbor
Undo: undo the last operation
Open: imports a saved mask for use
Save: saves the current mask to a file for later use.

Brush Mode tools are available for use on the image in Mask module main screen:
Its tools (described further here) are selectable at the bottom of the screen:
Flood Fill Lighter Pixels adds adjacent lighter pixels until it can't find lighter ones.
Effective for selecting stars or bright objects like a galaxy.
Flood Fill Darker Pixels changes all around clicked on pixel until it can't find darker ones
Good for selecting darker areas of an image
Single Pixel Toggle changes the individual pixel clicked on
Single Pixel Off changes pixels while holding and moving mouse; like an eraser.
Similar Color selects nearby pixels that are the same color as the on clicked on
Similar Brightness selects nearby pixels that are similar brightness
Try when selecting stars missed by Auto star mask
Line Toggle draws a line between points where mouse is clicked and released
Lasso selects area within line drawn by the mouse pointer.
Good for selecting image's main object and larger things like dust donuts.
Grow Blob grows the selected blob to add touching pixels
Good for expanding stars to cover halos or increasing mask of a main object.
Shrink Blob shrinks the selected blob of touching pixels
Circle (Click Center & Drag)

To Mask out large objects; e.g., the main object, dust donuts:
Use Lasso and/or Flood Fill Lighter to select object and then maybe Grow Blob.

For a full mask covering all pixels in an image, click **Clear → Invert → Keep**.

Auto button in Mask main screen opens the **auto star mask** screen
Stars preset runs automatically with its default parameters.
Creates a star mask; often a pretty good one.
Use the available Parameters to modify it as needed.
Other Presets:
Fat stars: sets parameters to select larger areas around stars
AltStars: enables the Star Mask Generator parameter (see below)
Helpful for detecting small/faint stars and their halos.
Not available if Tracking is off.

Parameters in the Auto Star Mask screen:

Selection Mode: specifies the types of features to be selected by the auto mask generator:
(See here for further details discussion on these and other Modes).
Light Features + Highlights > Threshold (default); Generally **best for selecting stars**
Applies a combination of the following two algorithms
Light Features: selects bright stars and things using the following parameter settings:
Feature Size sets maximum feature the Auto Mask algorithm attempts to mask.
Its function varies with image size.
Increase to detect more larger stars.
Decrease to select smaller stars or to exclude larger non-star features.
Include Only: defines colors to use or ignore in detecting the defined features.
All (Max) is default and generally the best to use
All (Average) can help ignore noise
Specific colors: detector uses the first and ignores the color after the "!".
E.g., "cyan ! red" includes cyan and ignores red pixels.
Filter Sensitivity: sets how sensitive the Light Feature detector should be.
Lower setting will detect more features, stars, and pixels.
Higher setting detects fewer features and stars, and less noise.
Highlights > Threshold: selects any pixel with brightness above the Threshold setting.
Threshold: percentage of full brightness, which pixels in mask must be above.
Lower percentage will select more stars and other features.
(Functions differently in other Selection Mode algorithms).

Old Mask parameter: defines what Keep does with the old existing mask:
Clear (default): clears the old mask and uses only the newly created mask
Add New To Old: adds the new mask to the old mask.
Subtract New From Old: subtracts new mask pixels from the old mask.
Can remove stars in a specific area; e.g., to exclude stars from a lassoed area.
Add New Where Old Is Set: includes only pixels in **both** the old and new mask
E.g., a star mask with stars only in a previously masked (green) part of an image.
Star Mask Generator parameter (set to On by the AltStars preset):
If On, the following additional parameters are enabled for Auto star mask creation:
Star Aberrations: specifies quality to help distinguish stars from other stuff.
Increase if poor data or stars are undersampled.
Star Size: indicates image's average star size to help distinguish stars better.
Adjust to help distinguish stars from nebulosity or structure detail.

Signal Source: probably just keep the preset selection.
Linear: uses the original linear unstretched data.
Could be useful for Decon to exclude oversaturated stars and nebulosity
Stretched: uses the current stretched image as is.
Stretched (Tracked): uses linear data but considers how it is stretched in current image.
Reduces false positives caused by noise and tends to detect stars well.

Creating particular star masks:

Inverted star mask:
For inverted mask excluding only stars, create star mask → click Invert → Keep.
For an inverted star mask covering only background:

Create a regular mask with Auto → Stars to open auto star mask screen
Set Threshold ~10-20%
Click Keep and adjust with Shrink or Grow as needed.
Invert to make only background green → Keep, Or:
Clear and try again, changing Threshold and other parameters

To pick up more or missed stars in the Auto Star Mask screen:
Lower **Filter Sensitivity** and/or **Threshold**
Increase **Feature Size** to help pick up larger stars.
To add individual stars to the mask go ahead and click Keep:
Set Brush Mode to 'Flood Fill Lighter Pixels' and click on missed stars
Click Keep.

To create a mask of only big fat bright stars:
Open auto star mask screen with Auto → Stars or Fat Stars
Set Selection Mode to 'Highlights>Threshold'
Set Threshold to ~90% so only bright start cores are in green.
(Higher percentage restricts the mask more to brighter items).
Click Keep → Grow as needed to cover those stars → Keep.

To create a star mask covering smaller stars only
Click Auto → Stars to open auto star mask screen:
Set Feature Size to 1 (to select smaller stars)
Increase Filter Sensitivity if needed to cover fewer stars
Click Keep
To cover **only the fainter of those small** stars in that mask:
Click to reopen auto star mask screen with Auto →Stars (or FatStars)
Set Selection Mode to Highlights > Threshold
Set Threshold to ~ 75% which should select the brightest stars
Set Old Mask to Subtract New from Old
Keep

To exclude background noise from star mask:
Click Shrink until noise is excluded.
Then click Grow to expand the mask back on other parts without the noise.
Create mask with noise excluded:
Auto → Stars for the auto star mask screen
Set Selection Mode to 'Highlights>Threshold'
Set Threshold to ~60% or so and adjust:
If noise is still being selected increase Threshold.
If too few stars detected, reduce Threshold to increase them.
Adjust Filter Sensitivity to increase or reduce size of stars covered by the mask
Click Keep → use Shrink/Grow as needed.

Star mask covering stars and halos:
Auto → FatStars → adjust parameters → Keep→ Grow/Shrink as needed→Keep
Or, clear and try AltStars with the Star Mask Generator parameters

To exclude part of an image from the star mask.

(E.g., create a star mask for stars outside the image's main object or structure).
Open Mask, clear the mask, and select the object to exclude:
Use Lasso to circle it, or Flood Fill Lighter to click on it (repeatedly).
Click Invert (if needed) to make the object non-green.
Click Auto → Stars (or FatStars or AltStars):
Set Old Mask parameter to **Add New Where Old is Set**
Adjust parameters as needed for the star mask.
Click Keep (creates star mask for stars outside the (non-green) main object.

To include some stars in excluded main structure area in the preceding mask:
After setting the preceding mask, click Auto again → Stars
Set Signal Source parameter to Stretched (Tracked) this time
It is less detecting than Stretched preceding setting.
Set Old Mask parameter to Add New to Old.
Should add less aggressive star mask in that protected area
Leaving the more aggressive detection outside the protected area.
Click Keep.

Wipe calibrates image background and removes light pollution and gradients.
It removes color channel bias (e.g., too much green) and sets an initial color balance.
It's goal is not to remove all noise but to set up for a gradient free dark background later.
Wipe can also correct calibration issues such as vignetting and camera sensor problems.
See detailed Wipe description in the 1.8 manual, p. 117.

Wipe looks to set a true dark background level to be able to remove light pollution/gradients.
Wipe samples all areas in the green mask for that background level and a **full mask can work**.
However, artifacts and anomalies hurt background determination and should be excluded:
Crop to remove edge stacking artifacts and other such edge anomalies.
Mask out anomalies like dust donuts.
Dark Anomaly Filter ignores small pixel clusters (see that parameter below).
It may help to mask out objects in the image that are definitely not background
See Masking out things that are not background below.

Open Wipe: An **aggressive temporary stretch** is applied that exaggerates image and gradient problems.
The goal of Wipe is primarily to achieve a **uniform background** -- not a dark background.
The subsequent Global stretch is when the desired dark background should appear.
(If not, come back and run Wipe again; see Global stretch below).

Luminance and Color are wiped separately and have separate screens in Wipe to check:
Luminance background should be uniform and with the same shade across the image.
Color background should be a uniform color across the image.
Noise can cause a bright color, which is ok for Wipe if constant across the image.
Increasing DAF (and other parameters) can help **remove color cast** variations.
Wipe also separately checks NB Accent file if one is loaded.

Select Preset which best addresses the image's situation:
Basic – (default, runs automatically) sets parameters for general gradient removal.

Should work well with well calibrated data.
Looks for gradual background gradient changes such as light pollution or moon.
Vignetting – applies a vignetting model to remove vignetting gradient toward corners
Narrow Band – Light touch wipe for data with less risk of visual light pollution.
Generally optimized for narrow band where light pollution is less of a problem.
It looks for a single conservative background value and applies it to whole image
Doesn't look for gradient undulation in the image.
Uncalibrated1 – for uncalibrated data such as no flats.
Tries to correct for vignetting too.
Uncalibrated2 – for poor quality uncalibrated data
More aggressive than Uncalibrated1;
Amp Glow – when there is amp glow brightness on one edge

Parameters: adjustments are typically needed to achieve for a Wipe that will give a good image result.

Dark Anomaly Filter: excludes small abnormally dark clusters from background determination.
Typically increase until Wipe's Luminance screen does not darken further.
Higher pixel settings excludes dark anomalies in size up to that setting.
It is essentially a gaussian blur that blends pixel anomalies with adjacent pixels.
Note: bright anomalies like satellite trails do not adversely affect Wipe.
Binning can have a similar effect and can reduce the need to increase the DAF.

Correlation Filtering: removes correlated artifacts and noise patterns that may be seen as detail.
Best applied for artifacts smaller than resolved detail (especially in oversampled data)
Can improve SNR and prevent worms or clumps in image after noise reduction.
Sets pixel size below which such artifacts are removed; up to 1.7 pixels may be good.
Note: Binning can mitigate the need for a higher Dark Anomaly Filter and Correlation Filtering.
Note: Changing preset does not change Dark Anomaly or Correlation Filtering.

Gradient Aggressiveness: controls threshold between detail and gradient to be removed.
Default is 75% in the Basic preset; up to 95% can be effective for complex gradients.
Higher settings help achieve a uniform background and a uniform color in color screen.
Higher percentage removes more gradient but risks removing more image detail too.
See discussion below on gradient background undulations.

Gradient Falloff: increase if gradients are increasing toward the image corners.
Typically needs adjusting only when there is vignetting.
Flat frames should prevent this problem.
Setting is 75% with Vignetting preset.

Gradient Edge Behavior specifies how gradient is assumed to extend beyond the edges
Grow opposite axis is best for poorly calibrated data or undulating background
Bounce Back is best for well calibrated data or image-filling nebulosity
Absorb 50% is kind of a middle ground

Synthetic calibration parameters (generally settings from the presets are ok):
Synthetic Flats: Two algorithms to help with vignetting
Synthetic Dark/Bias: Sets an algorithm to detect and repair dark and bias issues
Can help with banding issues

Synth. Bias Edge Area: Adjustment to help some synthetic dark/bias algorithms.

Sampling Precision: controls the number of samples from the image Wipe uses.
Setting from the presets is usually good. Maybe increase up to 512 x 512 pixels.
Increasing setting takes more processing time and generally doesn't help.

Background gradient pixel brightness undulations in Wipe:
Real detail, such as nebulosity, tends to have higher brightness change from pixel to pixel
Light pollution gradients have less undulations among pixels.
Wipe looks for those low undulating pixels to set as "true" background.
Any remaining signal in those pixels is determined to be gradient.
That determined signal bias gradient is then removed across the image.
Gradient Aggressiveness parameter controls that undulation threshold.
Higher percentage setting results in a higher undulation threshold.
Higher threshold results in more signal to be removed as gradient.
Image artifacts can screw up determining the "true" dark image background.
Removing or excluding them from consideration helps**.** See above.
Note: Narrowband preset does not use pixel undulations to calibrate and set background.
It finds a single background point and applies it across the whole image.
It sets Gradient Aggressiveness to 0%.

Click **Keep**: The image is returned to linear with the light pollution and gradient removed.

Masking out things that are not background:
The **masked-out areas (**non-green) will not be sampled for background calibration.
But all image areas are processed by Wipe for gradient removal.
Click Mask → select things to exclude → (Invert to **make them non-green**) → Keep
Use Lasso to select structure detail (and dust donuts).
Can use Flood Fill Lighter for bright structures such as galaxies.
Faint nebulosity and galaxy arms can adversely affect background determination.
Can result in overly aggressive gradient removal and detail loss.
Masking out too much background can yield poor Wipe results.
Some say if in doubt, leave area unmasked in green for Wipe to analyze.

Edit the Wipe Mask if anomalies such as dust donuts show up and were not masked out:
Go ahead and click Keep (the flawed result) in Wipe.
Create or edit the mask as needed. See Masking above.
Either just open Wipe and run it again with the modified mask; or:
Alternatively, click Restore button at the top of the main screen → click Original.
Takes you back to the main screen with binned and cropped linear image.
Open Wipe again for a fresh run with the updated mask.

Global stretching after Wipe

Wipe returns the image to linear condition with background calibration and gradient removal.
A new global stretch is needed with **OptiDev** or **FilmDev**

The dynamic range freed up from eliminating gradients can be put to good use.

Goal of the Global stretch:

1. Good detail in the image's main object(s); and
2. Dark or mostly dark background and mostly noise free.

Note: It is possible to redo the global stretch at any time during the processing work flow.

If OptiDev or FilmDev can't get good image detail and dark background, maybe run Wipe again:

Click Cancel or Keep their result and open Wipe for a second run; or

Go back to original image for a fresh run of Wipe:

Click Keep → Restore → Original → open and redo Wipe

If mask needs changing (see Mask module), do that before clicking Restore.

OptiDev sets the black and white points and applies its calculated optimized global histogram stretch.

OptiDev works only on the Luminance data; don't worry about color, if any is visible at all.

OptiDev's goals are applying a global stretch that gives the image:

- **good detail and dynamic range** for the main object(s); and
- **dark and uniform background,** with **noise controlled**.

Parameter adjustments are needed to achieve the best compromise for these competing goals.

FilmDev is an alternative for the global stretch instead of OptiDev.

FilmDev might be better for noisy data or for images with no detailed ROI to use.

OptiDev can be more susceptible to mistaking noise for detail.

Especially if noise cannot be excluded with Ignore Fine Detail parameter

Open OptiDev and click **Redo the global stretch** in the popup window.

The complete redo beneficially reallocates bottom end dynamic range freed up by Wipe.

OptiDev does not use a mask; any mask set (like the mask used for Wipe) is ignored.

If the OptiDev stretch shows new anomalies (e.g. dust donuts) not masked out before using Wipe:

Cancel OptiDev, edit the mask to remove them, and rerun Wipe before returning to OptiDev.

Parameters: adjust as needed to achieve the best combination of good detail and dark background.

- **Set ROI**: Drag ROI box over important part(s) of the image; can adjust it with X and Y sliders

  OptiDev's stretch is optimized primarily for the image's dynamic range inside the ROI.

  That calculated stretch is globally applied across the whole image.

  Different ROI size and location significantly change OptiDev's calculated global stretch.

  Include some object fainter details (or use no ROI) to preserve more of them.

  Avoid including much background to darken it more.
- **Outside ROI Influence**: allows OptiDev to consider more or less of the area outside the ROI.

  Default is 15%; 100% setting = 50% influence inside the ROI and 50% outside.

  Setting it to 0% can clip some areas outside the ROI to black (or close thereto).

- **Ignore Fine Detail**: excludes noise and small anomalies from being seen by OptiDev as detail.

  Sets pixel size below which they are ignored for setting background and not preserved.

  Increasing pixel size darkens the background.

  Typically increase until background doesn't darken further.

Pixel setting here becomes the Dark Anomaly Filter setting used in Wipe.

- **Shadow Linearity** allocates weight of the stretch toward image's shadows vs. bright areas.
  Above 50% allocates more of the dynamic range stretch to images's shadow/darker parts.
  Below 50% allocates more stretching to brighter parts and away from the darker areas.
    Lower percentages will darken the background and reduce noise.
    Lower can also reduce details in the structure's fainter bright areas.
      Detector Gamma parameter may help in recovering them.
- **Detector Gamma**: Optional gamma correction of data before the stretch.
  The default 1.0 is usually good and is the basis for an "optimal" stretch calculation.
    Above 1.0 makes bright details stand out more.
    Below 1.0 darkens image and the background and lessens brightness of details.
  Increasing Gamma after necessary background darkening, can help recover object details.

Top buttons:

Reset: restarts OptiDev with parameters resets to defaults and no ROI.
No ROI: removes the ROI setting.
Cancel: cancels out of OptiDev (e.g., to run FilmDev instead or go back to Wipe).
To rerun Wipe: Cancel → Restore → Original → reopen and run Wipe again.

It is **usually a tradeoff** between a dark low noise background and preserving object fainter detail.
Some noise can be removed in subsequent modules (see list below); **however**:
Low noise background and higher SNR after Optidev, generally leads to **better results**.

Subsequent modules to deal with detail preservation vs. dark noise free background problems:
Some **detail** can be recovered with local stretching in **Contrast** and **HDR**.
Details can be brought out in other modules such as Sharp, Decon, and Entropy.
Some **background noise** can be reduced (maybe with some detail loss) in:
Contrast: decrease Locality and/or adjust the two Shadows parameters.
SuperStructure: use Isolate or DimSmall presets.
Denoise: applied when turning tracking off.
Flux: use Noise preset.
FilmDev: reduce Gamma parameter
Gimp: open and adjust the StarTools saved image with Curves or Levels.

Click Keep when result is generally acceptable.
Apply local stretching of details in Contrast, HDR, and enhancement in Sharp and Decon.

Note: OptiDev's optimized global stretch can be reapplied after processing subsequent modules.

Separate processing of stars and the image main object:

Works best with large defined main objects like galaxies.
Note: StarNet++ can create separate FITS files for processing (see Siril sheet p. 9).
Loading and processing those separate files may not work in Startools though.
Load, Bin, Crop, and Wipe original image
Apply a very gentle OptiDev stretch focusing on stars; maybe place ROI on a star.
Or, maybe better to use FilmDev for a gentle stretch
Continue processing, focusing on nicely colored small stars
Maybe use Contrast, Decon, Color, Shrink, and Superstructure.
Turn off tracking
Open **Heal** and follow the process to create a starless and then the **stars-only image**.

Save that stars-only image.
Load the original image again and apply the same bin and crop.
Wipe, stretch and process the image this time to bring out main object detail
Don't worry too much star color or bloat.
Turn off tracking when the main object looks good.
Open **Heal** again and follow the process to create a **starless image** for that processed main object.
Keep that starless image
Process that starless image further as needed to completely remove all stars and halo artifacts.
Might use Superstructure Isolate with main object mask (see p. 27)
Maybe with 40 pixel of Mask Fuzz and less than 100% Strength
Maybe use Filter in Reject Mode with circular mask around errant halo glows.
Open **Layer** and recombine that starless image with the saved stars-only image.

Film Dev*, as **alternative** to OptiDev, for the post-Wipe global stretch.

FilmDev may work better than OptiDev when:
There is a lot of noise which can disrupt OptiDev's operation.
There is no ROI with sufficient detail for OptiDev to use.
FilmDev, like OptiDev, does not use a mask and ignores any mask set.
(See also FilmDev use later at the end of processing to darken background)

Open FilmDev and click Redo Global stretch.
As with OptiDev. the goal is **good object detail with dark background** and noise controlled.

Parameters:

Digital Development slider sets the black point, the white point, and the strength of the stretch.
Typically needs to increase to 95+ % for a proper needed histogram stretch.
See histogram graph below the image.
Home In button is a semi-automated way to set the slider for an optimal stretch.
Click on it and again until percentage stops increasing.
May need to manually bump it up some too.
Click again and adjust if other parameters are changed.

Gamma: applies a simple non-linear stretch; can be an alternative to Digital Development.
Default 1.00 is best setting if doing the Digital Development stretch.
Maybe fine tune Gamma a few tenths after setting the Digital Dev stretch.
Dark Anomaly Filter: filters out "dark anomalies" up to the set pixel size.
Auto black point detector ignores those pixels in setting "true" darkest background.
Generally, increase the pixel size until the background stops darkening.
Dark Anomaly Headroom reduces dynamic range given the filtered out "dark anomaly" pixels.
Sets percentage of their original dynamic range those filtered out pixels are given.
That frees up dynamic range available for brighter parts of the data.
Lowering percentage darkens background; reducing it to 0% may clip.

White Calibration sets how the **white point** is detected and set for the global stretch:
Use Stars (default): looks for big bright stars, especially ones with bright cores.
Use Dark Anomaly Filter: uses that filter but instead it excludes the whitest pixels.
May help if no bright features and/or a lot of hot pixels: DAF must be active.

Color channel Luminance Contribution

R, G and B sliders adjust the color channels' contribution to luminance.
They can change the hue of the image colors???
Only active for color images; grayed out for mono images.
Skyglow: basically moves the histogram black point to lighten the background.

Contrast further compresses small dark anomalies which frees up dynamic range for reallocation.
It applies an optimized stretch locally to enhance contrast and detail in large to medium features.
Works better on larger image features such as galaxies, nebulae and globs.
Large is relative and high dependent on image size and its structure "busyness."
HDR may work better to enhance small to medium size features.
Its compression of dark small pixel areas works to **darken background** and reduce noise.

A **Full Mask** (all green image) is needed by Contrast.

Presets:
Basic (default): **darkens image locally**, removing glare; generally, it works well.
Equalize: darkens bright areas and lightens dark areas to bring out small details.
Gives a more tranquil image.
Local: Generally a more aggressive stretch/unstretch of busier structure areas.
Can bring out more detail in image structures (at expense of background).
Note: It is best to **Cancel and reopen Contrast** to reset it when changing presets.

Parameters:
Recommendation is select a preset and adjust the Locality parameter as needed:
Locality: controls size of pixels' surrounding area evaluated for brightness adjustment.
Min and max pixels' brightness in that area are used to adjust the pixel brightness.
Changing Locality can result in different enhancement decisions by Contrast.
Increasing Locality percentage generally creates more contrast in structure elements.
Decreasing Locality percentage usually gives tamer contrast in the structure elements.
Decreasing Locality will usually darken background and reduce noise.

Shadow Dynamic Range Allocation sets amount of compression for **small darker pixel areas**.
Applies to the darker areas up to the pixel size set Shadow Detail Size parameter.
If Shadow Detail Size is 0, this Allocation parameter is grayed out.
Lower percentage compresses the dynamic range of those pixel areas more.
0% gives those pixel areas no dynamic range and they essentially become black.
Lower percentages can darken the background and reduce background noise.
Higher percentage allocates more dynamic range to those small "shadow" pixel areas.
Can enhance darker details in structures; but can increase background noise.
100% means they get to keep all of their original dynamic range.

Shadow Detail Size sets pixel size below which Shadow Dynamic Range Allocation works on.
Larger pixel size allows larger pixel areas to have their dynamic range be compressed.
Larger pixel size Shadow Dynamic Range Allocation darken background more.
Some say to increase up to 10-15 pixels.
Effectiveness probably depends on pixel size of the image.

Brightness Retention: sets if and how Contrast tries to maintain brightness of the original image.

Turn/leave Off: no attempt keep brightness; can allow background to darken more.
Global Mode Align: attempts to keep the same brightness by matching histogram peaks.
Global Align Darken: Only keeps only pixels that are darker than the original image.
Might help bring out details in darker areas.
Expose Dark Areas: Yes keeps dark areas' dynamic range if needed to brighten for contrast.
Normally contrast is increased for those dark areas only by darkening.
Might help; but can increase background noise.
Turn/leave **Off** to darken background; especially with higher Locality percentages.
Precision: sets size and amount of samples taken in calculating background level.
Default of 256 x 256 pixels is usually good.
Where gradients change rapidly, a larger pixel precision may be helpful.

HDR

Optimizes local pixel brightness mapping to enhance small to medium size details.
HDR can perform differently depending on image pixel size as a result of:
Focal length, camera pixel size, binning, crop, and Context Size parameter setting.

HDR doesn't use a mask. Effectively it uses a **full mask** and ignores any mask set.
(See below after Keep for option to remove any adverse effect on stars by HDR).

HDR can be run more than once; e.g.:
Use different Context Size to target different sized details for enhancement.
Use Gamma adjustments to dig out details, then run Boost parameters to enhance them.

HDR has an optional **Preview Box** for quicker running of HDR to see changes there.
After adjusting for desired result there, click **All** to apply that box's results to the whole image.

Presets:
Reveal – (runs default when HDR opens) Moderate detail boost for both shadows and highlights.
Generally good for most images. But, the Shadows Boost may increase background noise
Maybe adjusting Gamma parameters can enhance details more.
Tame – Targets detail recovery from within bright area such as bright galaxy cores
Has higher Gamma Tame which can give too much harsh detail contrast in bright areas.
If too aggressive, lower Gamma Tame or try Reveal or DSO Core preset.
DSO Core -- Similar to Reveal but with some added Shadow Detail Boost for dark area details.
Higher Shadows Detail Boost can increase background noise
Optimize – Has more aggressive Highlights and Shadows Detail Boost for starker detail recovery
Equalize – Higher Gamma Tame and Lift to enhance detail midtones in dimmer bright/dark areas
Its higher Gamma Shadows (Lift) can increase background noise.
Preset parameter settings may be too strong with overly harsh contrast or a broken glass look.
For less aggressive result, use a less aggressive preset or try lowering these parameters:
Gamma Highlights (Tame), Highlights Detail Boost, **Shadows Detail Boost**
Lowering **Context Size** might also help.
HDR has two basic phases for enhancing details:
Local Gamma correction for midtone enhancement of details;
Controlled by the **Gamma sliders** (and Quality parameter).
Local histogram remapping to enhance existing highlight and shadow details.
Controlled by the **Boost sliders** (and Context Size slider).

Parameters:

Quality: sets precision of Gamma adjustments; default Medium is usually good.
High can help, maybe for images with small busy detail; takes more processing time.

Context Size: sets upper limit of local area for HDR to apply dynamic range optimization.
The effect depends on the image's details to be enhanced:
Higher percentage can enhance larger details (and takes more processing time).
But might overly contrast subtle details such as in nebulae.
Lower focuses on smaller details (like down to just star size detail in globs).

Signal Flow: Tracked (default) avoids enhancing low SNR areas and noise as detail.
Visual: works without regard to SNR; can hurt subsequent modules like Decon.

Gamma parameters: adjust local gamma for latent detail recovery in larger contiguous areas.
Increasing them moves more dynamic range into the mid-tones to increase detail contrast.

Gamma Highlights (Tame): increase to add detail contrast in bright areas like galaxy cores.
Lower it if the contrast is too stark. Lower (or 0) can retain smoothness in bright area.

Gamma Shadows (Lift): increase to enhance shadow details within darker areas.
But, it can increase background noise. Lower (or 0)to darken background.

Gamma Smoothen helps transition between areas stretched with Gamma adjustments
Default of 20.0 pixels is usually good; increase for smoother transitions
Decrease to see more contrast in the Gamma recovered details.

Boost parameters adjust the local histogram stretch to enhance existing details
Attempts to avoid affecting luminance of larger contiguous areas.

Highlights Detail Boost adjusts local histogram stretch for enhancement of bright details.
Increase to enhance bright details, separate from brightness their contiguous areas.

Shadows Detail Boost adjust local histogram stretch for detail recovery of dark details.
Increase to accentuate darker details without affecting brightness of the contiguous areas.

Boost and Gamma parameters can work together or can be used in separate HDR runs:
For bright details use:
Highlights Detail Boost controls strength of bright detail enhancement.
Gamma Highlights (Tame) can dig out bright details lost in larger bright areas.
For darker details use:
Shadows Detail Boost controls the strength of darker detail enhancement.
Gamma Shadows (Lift) can reveal dark details from larger shadow areas.

If black dots in the center of stars appear, try lowering Shadows Detail Boost.
Also try increasing the Context Size parameter.
Click Keep; Option to undo any adverse effect HDR has on stars, see Layer at p. 43.

Sharp* works to brings out faint detail in light and/or dark areas details in the image.
It uses unsharp mask sharpening applied at the image's various pixel scales.
Best to use Sharp after local stretching with Contrast and HDR.
Typically use before Decon, but can be used later.
See using after SuperStructure (even after Track off) to resharpen the main object

An inverted star mask is needed, basically covering the structure of the image to be sharpened.
Exclude stars, and their halos, from the mask to avoid star bloating and haloing.
The masked (green) parts of the image will be processed for enhanced sharpening.

Non-green star pixels are still processed but only for dark detail emphasis.

Open Sharp; the first screen sets upper limit Structure Size for sharpening:
Large (default) = ~120 pixels is usually good.
See Scale parameters below for targeting feature pixel size for sharpening.
Click Next which opens the mask creation pop-up window:
Auto-generate star mask creates **inverted star mask** and returns to Sharp
Proceed with Sharp processing or Click Mask to review or edit that mask.
Or click Generate Mask Manually to create mask covering only structure and no stars.
Put structure in the mask and then use Mask Subtract to exclude stars from it.
It also can help the exclude very bright details in the structures like a nebulae.

Select preset on return to Sharp module after the mask is created:
DSO – (default) Optimizes settings for DSO's
Generally preset parameter settings are good.
DSO Light – Same as DSO but with local brightening for contrast
Sets Dark/Light parameter to 100% light enhancement
DSO Dark – Same as DSO but with local dark structure detail enhanced for contrast
Sets Dark/Light parameter to 100% dark enhancement
Planetary – For planets and the moon
Parameters: If making adjustments, typically adjust the Amount parameter first.
Then maybe target the sharpening more with the Scales sliders.
Amount: sets the strength of the overall sharpening across all scales (default is 300%).
Adjust/increase to bring out and sharpen structure detail as much as possible;
But without increasing noise
Helps to exclude background from the mask as detailed above.
Decrease Amount if noise is being enhanced too much
Can zoom in to see detail change.
Scale parameters: set which detail/structure sizes get sharpened.
Default is 100% for all scales; 0% means no enhancement for that scale.
With all at 100%, smaller scales get sharpening priority over larger ones.
See also SNR Size Bias parameters below
Scale 1 is for smallest details, like on the single pixel level
Scale 5 is the largest; set by Structure Size setting (Large is ~120 pixels).
Maybe run with all scales at 100% then run Sharp again on smaller scales.

Dark/Light Enhance: specifies how Sharp improves contrast (set by presets).
By lightening detail contrast, by darkening its surrounding area, or some of both.
(Maybe controls which side of the "edge" the contrast is increased??)
Toward 0%/100%(right) lightens bright details instead of darkening
E.g., to enhance faint nebulae without darkening surrounding areas
Toward 100%/0% (left) darkens contrast areas instead of lightening
Maybe for like for galaxy dust lanes?
Protection: prevents dark and bright clipping, especially at high Amount settings.
On at Shadows/Highlights Softclip is default.
Off can increase contrast and sharpen noticeably; but may clip.

Size Bias Parameters: resolve conflict if size scales compete over the same pixels.
Higher percentage gives sharpening priority to smaller scale detail
Lower percentage favors larger scale detail
High SNR Size Bias: resolves conflicts in good SNR signal areas; default 85%.

Low SNR Size Bias: resolves conflicts in poor SNR areas; default is 0%.
Generally, DSO's have only large scale low SNR signal; leave at 0%.
Note: If Tracking is off, these parameters use local luminosity as proxy for signal quality.

Mask Fuzz smooths transition between the masked and unmasked parts of the image.
Grayed out if no mask is set.

SVDeconvolution*

Helps to reverse the blur from atmospheric and other image distortions.
Works to make stars and image details more focused.
Use Decon after stretching modules of Contrast, HDR, and Sharp.
Some say to use at the end of the Luminance processing, maybe just before Tracking Off.

Decon works better with somewhat oversampled data and without too much noise.
Decon can increase noise, especially at higher strengths,
If image has bad noise maybe run a pre-Denoise noise reduction module first; see here.
E.g., for noisy images, better to Bin to remove noise than keep oversampling.
Also, the increased SNR from binning helps in other modules.
Decon will coalesce and improve non-overexposed stars (maybe better than Shrink).
Aggressive Decon settings, however, can cause artifacts like star ringing.
Shrink can help remove ringing that Decon Deringing parameters can't control.

Open Decon and select **Deep space (stars available)** in the Mode of Operation window.
The required **Decon star mask** is then created automatically.

SVDecon has **three modes** (the name of the active mode is just under the image display):
Synthetic: turns on and runs automatically when the Decon mask is created
Applies a synthetic PSF model to the image for deconvolution; see below.
Single-sample: activated with Sampling button at the top and selecting one masked star.
Applies the PSF model from that star for deconvolution across the whole image.
Spatially variant: activated when 2 or more masked stars are selected
Applies a variable PSF model across the image for deconvolution.

Synthetic PSF model.
Runs automatically with default settings; can give decent deconvolution results.
Synthetic models can work well to correct for **atmospheric distortions**.
Synthetic PSF Model: selects which synthetic PSF model to use.
The default Moffat Beta=4.765 PSF model may be the best to use.
Synthetic Iterations: sets iterations for the synthetic model algorithm to go through.
Default is 10x; increasing number of iterations can reverse more "blur."
But, too high can cause star ringing and/or increase noise.
Synthetic PSF radius can help correct atmospheric (seeing) distortions
Increase for improvement until artifacts (black ringing) appear
See also Parameters below for both the Synthetic and Sampled models

Sampled PSF models use the PSF data from one or more selected star samples.
Sampled PSF algorithms work to correct for both **atmospheric and optical distortions**.
The Sampled PSF model begins to run with the selection of each star.
Selecting stars for the Decon sampled PSF model:

Click **Sampling** at top right to show the Decon-masked available stars.
One selected star uses its **Single-Sample PSF** for the whole image.
Two or more for **Spatially Variant** PSF model applied across the image.
Synthetic mode and Synthetic Iterations are turned off with first star is selected.
(Could add back use of Circle of Confusion model; doesn't give much help).
Best to select at least one star, preferably more, from each of 6-9 segments of image.
G**reen core** stars are best to use; yellow cores are borderline but ok.
Avoid red cores, stars next to another, and stars with blue mask outlines
Stars from different areas are more important than just good green cores.
A blue box will appear on the selected stars.
Pixels inside both the star's mask and the blue box are used for the PSF.
To remove a selected star, click and hold on it.

Drag an optional preview box to see changes there and speed up processing of changes.
If using that box it is best to choose a bright, detailed noise-free area
After satisfied with the result in that box, click All button.

Click Result top right to see the applied Decon result.
It toggles back to Sampling button for the Decon mask if more selected stars are needed.

Parameters:
Sampled Iterations: sets number of iterations to run; default is 10x.
Increase iterations for more strength and further blur reduction.
But, too many can cause black star ringing and/or increase noise.
Note: Leave Synthetic Iterations at 0 (unless running Circle of Confusion too).
Spatial Error: increases the PSF sampling area for the Decon algorithm to use.
Increase (above 1.0 default) if there is strong blur or badly deformed stars.
"e" button sets an estimated Spatial Area setting to use.
Increasing Iterations can also help (and help avoid star ringing).
Reduce Spatial Error if bright artifacts begin to appear.

Following Parameters work for both Synthetic and Sampled PSF models:
Dynamic Range Extension: increases dynamic range for reconstructed bright details.
Increasing can help recover latent detail in bright galaxy cores.
Can also help make saturated or blown out stars more concentrated.
Increasing too much can increase background noise.
Maybe increase until detail in bright areas stops improving
Deringing Focus sets how strongly deringed areas are coalesce into light points.
Increase or Reduce? if star ringing appears; reduce Deringing Fuzz to help.
Deringing Fuzz: smooths deringed areas into surrounding detail.
Reducing this percentage (a bit counterintuitive) can help reduce ringing.
Linearity: Reducing can do something to help with bright stars/ringing and highlights.
Like bright non-linearity due to stacking different exposure length subs?

Modules that can be used before Color if noise is bad:

Superstructure using Isolate settings.
Flux Noise setting as an alternative to Superstructure.
OptiDev can be rerun any time before Track off/denoise.
Bin Image can be binned or binned further to reduce noise (and increase SNR).
Denoise: can improve detail in noisy images (e.g., in nebulae) if run before Color.

Color: recombines the color data with luminance and color balances the image.
It does not change the luminance data unlike other modules.

Typically run Color before Denoise/Track off.
However, its color balancing doesn't work well if there is a lot of noise.
See above pre-Color noise reduction options, including Denoise for noisy images.

When Color opens, its **auto color balancing** runs automatically if a full mask is set.
If not, Partial Mask warning opens first; can select mask to use for auto color balance.
R, G, and B sliders are set to the calculated best color balance.
It could be the image looks pretty good after this auto color balance.
Using a **star mask for color balancing** instead of using a full mask:
Can result in a better color balance, especially if a good star field is present.
The assumption is the average color of a good star field is "white."
(Can mask other "white" features to use but using a star mask here)
Create star mask with the Mask button in Color module:
E.g., click Auto → **Stars**(default) → (adjust) → Keep → (Grow/Shrink) → Keep
Fat stars preset works to select only the brightest stars and avoids noise.
Can use Add New to Old parameter to combine stars selected by both.
To exclude the main object when creating the star mask, see Mask at p. 12.
Click Sample (back in Color module) to color balance on average of stars in star mask.
Apply that color balance to whole image: Click Mask → Clear → Invert
Or just Invert???? Adjust; invert again and adjust stars; keep

Or, **Max RGB** color balancing option: click Max RGB button (with **full mask** in place)
Increase Green Bias Reduce slider until green is mostly or all gone.
Try to balance the total of red and blue colors across the image with their sliders.
Click Normal to see the effect; click Max RGB to toggle it again to adjust more.

Narrow band images cannot be color balanced; they have no proper white point to reference.
For those images, Color module's function is to balance those narrowband channels.

Presets:
Constancy: (default) recommended for most regular images.
Applies the Scientific (Color Constancy) style parameter for color presentation
Legacy; the way software used to render the visual spectrum
Probably colors will be more washed out; will need to increase saturation
SHO(HST); good for datasets of Hubble palette (SHO)
SHO:OHS; remaps the SHO some
Bi-Color; for OSC camera duoband data loaded in Compose module.

Reset button resets all sliders and displays image without any Color module adjustments.

Parameters:
Style parameter: sets color handling:
Scientific Color Constancy(default): recommended for more accurate colors

Renders colors independent of the luminance data.
Avoids washed out colors in highly stretched areas.
Artistic parameters are legacy-like where colors and luminance are stretched together.
True colors can get skewed and washed out in stretched bright areas
Detail Aware uses some tracking information; **Not Detail Aware** doesn't.

LRGB Method Emulation: sets how luminance and color are combined by Color module:
Straight CIELab Luminance Retention is used by Constancy preset and is usually good.
RGB Ratio, CIELab Luminance Retention is used by the other presets.
It might help mute color if colors are overdone in Straight CIELab.
May also better preserve star color

Bias Sliders: R, G, and B sliders are set from the calculated color balance.
Can be set to use the sliders to increase or reduce the R, G, and B bias in the image.
Cap Green: sets green level to a percentage of the higher of red or blue level
Some say it is better to adjust the Green Bias Reduce slider instead of this blunt tool.
Or, click on a particular Green dominant area (per instruction below the image).

Color saturation parameters:
Saturation Amount: allows colors to be rendered more or less vividly.
Bright Saturation controls how much color and saturation are introduced in highlights
Dark Saturation controls how much is color is added in shadows
Increasing dark saturation can increase background noise.
Reducing Dark Saturation can reduce background chroma/color noise.
(**Note**: SuperStructure **Saturate preset** can enhance colors of the main object).

Highlight Repair can help fix aberrant colors around stars and other highlights.
Click on and increase pixel size for increased repair size (gently) as needed.
See also using Shrink to correct aberrant star colors.

Mask Fuzz, active for smoothing if less than a full mask is used.
Can help to reduce aberrant star colors if star mask is used.

Matrix parameter (only active if the RGB channels were loaded with the Compose module).
Allows selection of optional color mapping using popular channel blends.
For Bi-Color preset and duoband data loaded in Compose, use HOO.

Stars can be processed separately from main image for better color
See this process to separate and process stars and then recombine with the main/starless image.
Another option is to use a LP filter like L-Pro for luminance and UV/IR for RGB. See above.

UV/IR filter (blocking non-visual) for OSC camera helps prevent yellow cast that can't be corrected out.
Using Color to further process the colors of a stretched/processed color image.
Use Open to load that processed FITS, TIFF, or JPEG file as a non-linear sRGB source.
Select **activate Tracking** to process its color data separate from Luminance.
Open Color and if Tracking is enabled:
In LRGB Emulation parameter select one of the Luminance Retention options.
Color's parameters adjust the color data independent of Luminance.
If Tracking is not enabled, that option is not available and the parameter is grayed out.
Color will adjust color and luminance data together???
After desired adjustments in Color, Save or proceed with further post-Color module processing.

See also Compose loading options for combining certain processed L, RGB, Ha and OIII files.

Modules available after Color and before Track Off/Denoise:

Superstructure (for noise, its Isolate preset can be used before Color or after Track Off).
Shrink
Filter
NB Accent
Flux (for noise, its Noise preset can be used before Color or after Track Off).
Heal (can be used before or after Track Off)
Repair (can be used before or after Track Off)
Entropy (can be used before or after Track Off)
Layer (better to use after Track Off/Denoise)
OptiDev can be rerun anytime before Track off/Noise Reduction
Bin Image can be binned further any time to increase SNR.

Super Structure allows adjustment of large scale structures separate from rest of the image.
Works to improve and emphasize the main image structures.color;
Also, pushes back busy star fields and reduces noise to darken the background.
Super Structure works with both luminance and color.
Typically used after Color module.
It can use before Color, particularly for noisy images. (see Using Isolate Preset below)

Full Mask is typically used.
Optional mask of main object and/or star mask (in green) can be used.
Can help with noisy and busy star background (and/or to reduce star halos).
See Using Isolate Preset next page on using a mask.

SuperStructure steps:
1. An Airy Disk defracted light model is (re)created from the original image.
SuperStructure does this when opened and can take some time.
2. A composite is created from that defracted light model and the original image
3. That composite image is then selectively merged back with the original image.
That merger is intended to create/restore/enhance "glow" of the image.

Presets (preset parameter settings can be pretty good):
DimSmall: (runs as default) enhances the main structure, plus:
Reduces busy star fields, darkens background, and reduces noise.
Isolate: Similar to DimSmall but generally gives more contrast.
More aggressive in darkening the background and reducing noise.
See details below on using Isolate with noisy images.
Note: DimSmall and Isolate can reduce image sharpness at higher strengths.
See Strength parameter below.

Brighten: brightens detected main object structure (with no background help)
Saturate: to adjust color saturation of main object with little background effect.
See function of Saturate and Gamma parameters with this preset.
See also Using Saturate Preset below.

AiryOnly: displays the Airy Disk defraction model created by Super Structure

Parameters (Preset settings are usually pretty good):

Gamma: Sets gamma of Airy Disk defraction model before composited with original image.
Can be an effective way to control DimSmall and Isolate presets.
(See, e.g., Gamma use in Isolate preset below to control noise).
In Saturate preset, it allocates saturation from shadows to midtones to highlights.
See Using Saturate Preset below.
Brightness, Color: specifies if one or the other or both are processed; usually set by the preset
Compositing Algorithm: how the Airy Disk defraction model is composited with original image
Multiply Gamma Correct: default for DimSmall and Isolate Presets
Power of Inverse: default for Brighten Preset
Screen: default for Saturate Preset
None: Displays only the SuperStructure composite before merging it with the original.
Strength: sets the overall strength of SuperStructure module's effect. Default is 100%.
Higher percentage can begin to reduce sharpness of the main object.
Avoid that with lower percent and/or using Sharp afterwards to restore sharpness.
Gamma adjustment can also impact the module's general effect.
Saturation: set color saturation percent of image main structure (before merging with original)
Detail Preservation: Algorithm selecting detail between composited image and original image.
Linear Brighten Mask [or Darken] progressively keeps more of original image details.
Off: no original image detail is used; displays only the composited image.
Detail Preservation Radius (only applies if Detail Preservation is set to Min Distance to ½ Unity)
Sets filter radius for smoothing the merging of composited model with original image.
Brightness Retention: when on, retains overall brightness (histogram peak) of the original image
Turning off can help reduce background noise and brightness
Airy Disk Radius: sets radius used for underlying PSF in calculating Airy Disk model.
Changing this restarts Airy Disk model calculation (and takes time).
It can have different effects the on main object and can reduce star ringing
People say smaller for wide fields; larger is generally best for narrow fields.
To see the calculated Airy Disk model click the AiryOnly preset.
Mask Fuzz: if mask is used it smooths transition between masked and non-masked areas.

Using Isolate Preset to darken background, reduce noise and push back/dim busy star field
Generally, it works well with default parameters and without a mask.
Can use after Denoise module for more reduction of background noise (and stars).
Maybe increase it Saturation parameter for more color emphasis in main object.
Can use before Color, especially if needing to remove a lot of noise; maybe with mask.
Mask option for additional help to remove noise:
Create a mask with **main structure in green** to exclude it from noise reduction.
Option to add star mask to protect against halos if stars are not too busy.
Mask Add New to Old parameter to add a star mask.

Adjust Mask Fuzz as needed (maybe to 3-4?)

Other parameter adjustments:

Maybe lower Airy Disk Radius to sharpen the main object (maybe to like 5%?)

Lowering Gamma functions like moving black point to darken background

If main object becomes blurred, can use Sharp module afterwards to resharpen it.

Using Saturate Preset to enhance colors

The Gamma parameter functions to allocate saturation between highlights and shadows.

Higher saturates shadows more; lower saturates highlights more.

Can mask out parts (make non-green) to exclude from saturation enhancement??

Using mask to enhance nebulosity but keeping background stars at original brightness.

Create mask covering only the nebulosity; that is, excluding stars:

Mask → Auto → Stars → set Filter Sensitivity to 1 → Keep

Invert so stars are white and background is green

Shrink if needed to make small stars white

Keep

In Super Structure module (probably start with DimSmall preset):

Gamma: .20 to .50

Brightness, Color: set to Process Both (for color image)

Saturation: 50%

Detail Preservation: Linear Brightness Mask

Detail Preservation Radius: default

Composting Algorithm: Power of Inverse

Strength: 50 to 80%

Brightness Retention: Off

Airy Disk Retention: default 50%

Mask Fuzz: default 1.0 pixels

Shrink* can modify stars by shrinking, tightening, or re-coloring them.

It can also reduce star ringing, remove halos, and improve star color.

Shrink **works on both luminance and color** so best to **use after Color module**.

Shrink can be used more than once with the Shrink and Dim presets.

Note: there are other modules that can repair/modify stars. (See list below).

A **good star mask for Shrink is essential**:

Can **Auto-generate mask** when Shrink opens.

Include halos if wanting to remove/reduce them.

See masking options below to select more or fewer stars, or protect image's main object.

Presets, the two basic modes are **Tighten** or **Dim**:

Tighten: (runs by default) Shrinks overexposed or bloated stars and draws in any colored parts.

Should make stars more concentrated and have improved color

If ringing is increased, try increasing De-ringing parameter

If halos are introduced, try reducing Color Taming parameter.
See Reducing Bloom Around Bright Stars below

Dim: reduces luminosity of stars

Classic: basically Dim with parameters turned down.
Probably better to use Dim (or Tighten) and lower Iterations and adjust Regularization.

Un-glow: adds additional Un-glow parameters to **remove halos** around bright stars.
The Un-glow parameters are enabled in addition to Tighten or Dim settings in place.

Parameters:

Shrink's strength is controlled by the Iterations parameter (given it is an iterative process).
The Regularization parameter mitigates the strength of the iterations.

Iterations: sets the number of times Tighten or Dim algorithm runs and strengthens their effect.
Increasing Iterations can also strengthen Color Taming when used with Tighten or Dim.

Regularization parameter dampens the effect of each Iteration to remove/prevent artifacts
Increase if pitting, stringy and other artifacts start to appear around stars.

De-ringing: mitigates star ringing artifacts created by Sharp or Decon
To apply only de-ringing with no Tighten or Dim, set Iterations to 0.

Color Taming: applies for stars to take on color of surroundings and appear more concentrated.
Increase pixel size to search more area for colors. See also Iterations parameter.
To use as a stand-alone operation with no Tighten or Dim, set Iterations to 0.

Halo Extend: grows the mask temporarily to include more of star's surroundings.
Does the same thing as Grow so you don't have to go back and reopen Mask module.

Un-glow parameters are turned on by adding the Un-glow preset.
They actively work to suppress halos around stars. (See Removing Star Halos below).
Un-glow Kernel: sets width of the halos around stars to detect and attempt to fix.
Un-Glow Strength: turn on and increase to **throttle/decrease** the Un-glow strength.

Removing/reducing star ringing (such as caused by Sharp or Decon)

Turn on **De-ringing** parameter and increase its pixel setting as needed.
Also use **Color Taming** and increase **Halo Extend**.

Removing/reducing star halos:

Create a star mask that covers the stars and their halos.
Can click on really bright stars with **Mask** Flood Fill and Grow to cover halos as needed.
Or, if a bunch of bright stars, start with Mask → Auto → Stars:
Set Selection Mode to Highlights > Threshold.
Set Threshold ~90% to put cores of brighter stars in the mask.
(Higher percentage restricts the mask more to bright items).
Click Keep and click Grow as needed to cover stars and their halos.
Click Keep to return to Shrink or open Shrink with that mask.

Set **Iterations** to 0 to see results with no Tighten or Dim applied.
See below to apply Tighten for more effect.

Set **De-ringing** parameter to Off.

Increase **Color Taming** as needed for star halos to take on color of their surroundings.

Increase **Halo Extend** if needed.

Click **Un-glow** preset to enable Un-glow for additional halo removal help.
Increase **Un-glow Kernel** as needed.
(Note: increasing **Un-glow Strength** reduces the Un-glow effect).

Increase **Tighten Iterations** to further draw star bloom and halo color into the star.
Maybe adjust **Halo Extend**, **Color Taming**, and **Un-glow Kernel** parameters.
If de-ringing is needed, see above Removing Star Ringing.

Using Shrink to correct star colors (e.g., bi-color blue/white cores)
Create mask covering all stars (and halos) that need color correction
Open Shrink and set Mode to Tighten
Iterations: set to 0
Color Taming: start at 2 and increase up to 5 to 10 pixels
Don't increase too much to completely white out the stars
Halo Extend: 1or 2 pixels
Un-glow Kernel: Off
Star color should morph to uniform color closest to adjoining color of star core.

If Auto Star Mask is not acceptable in Shrink:
Maybe try Halo Extend first; otherwise create a new mask:
Click Auto to do another auto mask as described above
Click Mask to open the full Mask editor for a modified star mask
Can always create star mask first, then open Shrink and select Keep mask as-is; or
Select Generate mask manually when Shrink opens.

- To **select more stars**, in Mask module click Auto → Stars:
  Set Selection Mode to **Highlights > Threshold**
  Set Threshold ~**90%** (lower the percentage to select more stars).
  Click Do which creates a mask with star cores in green.
  Click Grow as needed to cover whole stars. (Or Shrink).
  Click Keep when mask is acceptable which returns to Shrink module.
  Or, click Clear and change parameters and Do again.
- To **avoid selecting non-stars** (e.g., nebulosity), in Mask module select Auto → Stars:
  Set Include Only, e.g., to **Cyan; !Red** (Which will ignore the red channel)
  Cyan = Blue + Green, which should be ok for star detection.
  (If need to detect fainter stars, set Signal Source to **Stretched**, (not Tracked))
  Click Do and click Keep when acceptable, which returns to Shrink module.
- **To protect the image main structure** from a star mask and effects of Shrink:
  Open Mask module first before Shrink
  Clear it and select Lasso from the Brush Mode parameters.
  Circle the **main structure** and make it **non-green** and click Keep.
  (If necessary, click Invert to make it non-green).
  Open Shrink module and click **Generate mask manually** in the popup.
  Click Mask button → Auto → Stars
  Set Old Mask parameter to **Add New Where Old is Set**.
  (If need to detect fainter stars, set Signal Source to **Stretched**)
  Click **Keep → Keep** (if acceptable), which returns to Shrink module.

Other modules available to modify/repair stars:
Decon in particular can concentrate stars so that Shrink module is not necessary.
Shrink is better at controlling bloated stars than Decon.
Shrink also can remove star ringing caused by Decon (and by Sharp).
SuperStructure can push back and dim a busy background star fields.
Maybe use Shrink after SuperStructure for additional improvement.
Filter can remove blue/purple halos
Repair can help reconstruct severely misshapen stars, and can remove/dim smaller stars.

Heal can remove all stars.

Filter* enhance (or reduce) features according to their color

Such as increasing OIII color or reducing artifacts such as star halos.

Use Filter after Color and before Track off/Denoise.

Filter works by **clicking on a color** in the image to apply the **Filter Mode** algorithm to that color.

Repeat clicking on selected color point(s) enhances algorithm's the effect.

Optional Mask can be used to limit the Filter Mode algorithm to the mask (green) areas.

Parameters:

Filter Mode sets the algorithm to be applied with the selected (clicked on) color:

Conservative Nudge (default): boosts selected color linearly without overexposing

Nudge (Screen): non-linear boost of selected color

Pass: preserves the selected color and attenuates all others

Reject: blocks the selected color leaving all others unchanged

Can be used to reduce brightness of star halos.

Fringe Killer: works to eliminate halos by drawing color form neighboring pixels.

Requires a mask; see using Fringe Killer mode below.

Saturate Visual H-alpha: red color is boosted while the color clicked on is preserved.

Saturate Visual H-beta/O-III: works to make **cyan color more prominent**.

Note: Color clicked on is preserved/not boosted. Cyan boosted elsewhere.

A mask can be helpful for the Saturate Filter Mode; see below.

Sampling Method selects the area sampled to set the color used by the selected Filter Mode.

Single Pixel: uses that single selected pixel's color

3x3 Average: uses surrounding 9-pixel color average

Filter Width sets width of color spectrum that the selected Filter Mode uses.

Larger allows use of a wider spectrum around the color at the clicked location.

Smaller requires more precise color match.

Width is not a sharp cutoff; the effect fades moving away from selected color peak.

Mask fuzz blends the transition between masked and non-masked areas (if a mask is used).

Using **Fringe Killer** to remove blue/purple halos around stars:

(Reject Mode is also a possibility to remove bright star halo colors).

Create a **Mask** covering the offending stars and their halos.

Maybe use Fat Stars mask and grow until the discolored halos are all covered.

Might use Circle tool to cover large star halos.

Set Filter Mode to **Fringe Killer**

Try Filter Width set to 1.

Click on different parts of one or more colored halos you wish to remove.

Can repeat a few times; maybe on different parts of the halo with the bad color.

Increase the Mask Fuzz if needed.

Using **Fringe Killer to desaturate stars**; e.g., to correct "magenta" stars in HOO images:
Create a star mask covering the problematic stars
Open Filter and set Filter Mode to Fringe Killer
Click on and keep clicking on the bad (magenta) color until it is gone and stars are white.

Using **Saturate Mode to increase OIII** with a mask:
Create a mask covering the OIII targeted area in the nebula
Remove stars (and any halos) from that mask
Create a star mask and select Subtract New From Old for Old Mask parameter
Open Filter and select Saturate Visual H-beta/O-III for Filter Mode
Click on **non-OIII colors** in that masked area
Repeat clicks as needed and desired.

Entropy changes luminance contribution from selected color channels to bring out latent details.

It evaluates and correlates "busyness" among R, G, and B channels as indicators of latent details.
It then boosts or attenuates their pixels' luminance to increase contrast and highlight those details.
That reweighting can also improve the selected colors' brightness and tone.
It may also tidy up the background.

Entropy works best on image-filling objects such as nebulae and galaxies.
It also works well on narrowband images with discrete color channels from different elements.
E.g., may be able to enhance OIII structure and color.

Use after the Color module; Entropy icon is grayed-out until then.
Perhaps run Color module again after Entropy with its recovered detail before Track off.
If untracked and already denoised, Entropy applies its own noise reduction.
Entropy also works on stretched/processed color images, including JPG's.

Presets: select color to use (subject to Channel Selection change) for the Entropy enhancement.
Default (All); runs by default: reweights luminance data for all color channels.
SHO SII: for **Red** Channel enhancement in narrowband
SHO Ha: **Green** Channel enhancement in narrowband
SHO OIII: **Blue** Channel enhancement in narrowband
Visual Ha: **Red** Channel enhancement in broad band.

Parameters:

Channel Selection: selects color channel combination to use for detail enhancement.

Strength sets the strength of the module's detail enhancement

Resolution: sets the Entropy mapping resolution
Medium (default): runs automatically and is usually good.
Low: focuses on larger more general detail areas of the image

High: will focus on smaller details in the image. (takes longer to process).

Dark/Light Enhance sets darken/brighten balance for contrast enhancement of details.
Left toward 100/0 will darken more; e.g. to better show bright galaxy details
Right toward 0/100 will brighten more; e.g. to enhance faint H-alpha

Midtone Pull Filter Strength: sets amount the enhanced L is pulled toward midtones.
Can make the detail and color enhancement more visible.
.

Midtone Pull Filter sets smoothing of enhanced detail with original image.

NB Accent adds narrowband accents to the image

Use to accent certain elements as opposed to adding to luminance or chromance of main image.
Only available if narrow band channel is added in Compose module. See page 3 above.
The NB file is then processed in parallel with the main image's LRGB data.
If narrowband file is used in Compose as part of Luminance or RGB, don't use it here.
Don't use narrow band data in both places.
It is best to use after Color and before Tracking off/Denoise Module.

Even if NB data is not very good and noisy, it is ok to use.
Stage 1 below can clip noise to black.
Using SuperStructure Saturation preset afterwards can enhance the NB accents.

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Typical use is to apply Ha, OIII, or both, narrowband accent data to an RGB image.
See Compose at page 3 for preparing an Ha+OIII file to load as an NB Accent file.
See Stage 2 Response Simulation parameter below for use of an Ha+OIII file.

Stage 1: Apply stretching to define what NB signal will be available for accenting in Stage 2.
Clip to black all unwanted parts of the NB data file.

Parameters (same type as in OptiDev):
ROI parameters with ROI initially set as the one used in OptiDev
Ignore Fine Detail to remove noise and other small issues to darken background
Shadow Linearity: lower to remove more shadow areas and background.
Threshold parameter (in place of the OptiDev Detector Gamma):
Can increase to clip to black any unwanted parts of the NB image.
Best to use this parameter as last resort as it can remove faint good data.

Click Next button

Stage 2: Sets how the NB signal data defined by Stage 1 is added to accent the base image.
Select **Nebula** or **Galaxy** preset, depending on the image subject

Parameters:

Strength parameter controls the emphasis of the accent

Gamma: optional gamma adjustment of the NB accent data coming from Stage 1

Can lower to increase contrast.

Luminance Modify and Color Modify Inputs set how NB data modifies the base image

Luminance Modify Input controls if and how much its luminance is modified

The NB data can apply to brighten base imagee details.

Color Modify Input controls if and how much the base image's color is modified

The color(s) assigned to the NB data can modify the base image color.

Response Simulation parameter selects the color channels for the NB data to be added.

The selected channels must match the NB channels loaded in Compose (see p. 3).

Single color uses either the NB red channel **or** the NB green+blue channels.

Can mono NB data be made to have a 2-color application????

Two colors use both the NB red channel **and** the NB green+blue channels.

These are good for OSC NB image captured with dual band filters.

(Balmer Series color includes other interpolated HII emissions from the Ha data).

Band Balance: active and available if two colors are selected in Response Simulation

Sets the color of the applied NB data ranging between the two colors.

Brightness Correlation: specifies level of main image detail that must be pre-existing

Above that level NB accenting is allowed; Off allows all; 100% allows none.

Off for Nebula preset; 50% for Galaxy preset

Detail Size: sets maximum pixel size of NB detail that can be added as accent data.

Smallest size is 1 pixel; largest is 100 pixels; 0 mean no maximum size limit

0 for Nebula preset; 100 pixels for Galaxy preset

Can check before and after and pre/post tweaks

Other parameters:

Gamma

Can lower to increase contrast.

Accents should be clear and balanced with the rest of the image.

Band Balance is when data has two narrow bands

Brightness Correlation defines how much detail must exist in master image before it will be accented

Track(off)/NR turns off tracking (and the Compose module) and applies noise reduction.

(See following page for list of modules available to reduce noise before tracking is off).

If De-Noise module cannot control background noise, may require new global stretch:

Click Restore button → Linear, Wiped → new OptiDev or FilmDev and reprocess.

First, make sure the mask is set to a full mask (make the whole image green).

Open Track/NR module:

Click **Apply Noise** Reduction to open the Unified De-Noise module.

Or click **No Noise Reduction** to turn tracking off with no further noise reduction.

See Note below on ways to reduce noise in other modules before Track/NR.

In first De-Noise screen:

Option to enable removal of **walking/raining noise**; do this before setting Grain Size:

Set Walking Noise Size parameter above 1.0, which is off.

Use mouse to drag a line to set the direction of any walking noise seen.

Walking Noise Angle slider can adjust that angle.

Adjust Walking Noise Size parameter to eliminate that noise in the image.

Grain Size: sets upper limit pixel size of visible noise; anything larger is not noise.

Increase pixel size until no noise grain or clumps are seen (can zoom in to see).

Focus on removing noise; don't worry about detail becoming blurry here.

When applied, detail will be clear since it's signal is tracked.

Maybe start with 7-12 pixels; Can be up to 15-30 pixels with noisy data

Click **Next** to apply those settings.

Can drag a selection box to speed up processing of parameter changes.

Maybe include both background and large scale structures and zoom in.

Click Full when that area box is satisfactory to apply to full image.

Parameters:

Detail Loss parameters control the **strength of the noise reduction**:

Defaults are 50%; 0% turns noise reduction off

Brightness Detail Loss sets noise reduction aggressiveness in bright areas

Higher percentage is more aggressive but can cause detail loss

Reducing percentage may help to restore/increase detail.

Color Detail Loss sets noise reduction aggressiveness for color data

Higher percentage is more aggressive but can cause color loss.

Higher can reduce color blotching.

Scale parameters: control amount of noise reduction at different feature pixel sizes:

Higher percentage reduces more noise at that particular scale.

Scale 1 controls noise reduction at the smallest detail, like single pixel size

Scale 5 controls noise reduction of largest grain size.

Reduce scales 5 and 4 to reduce image detail loss.

Increase Scale 5 as a last resort to reduce large grain clumps.

Grain Dispersion is set by and similar to the Grain Size parameter setting in first screen

Increase if large gain noise clumps appear and still need removal.

Lowering it can restore detail but may increase larger grain scale noise.

Scale Correlation: helps prevent noise in "busy" areas from being preserved as detail.

Generally, pattern/structure correlation between image scales sizes is detail.

However, noise in those areas can also be seen as detail and preserved.

Lowering the percentage helps prevent such noise from being mistaken as detail.

Lower removes more noise but can remove true detail in busy areas too.

Lower may help remove artifacts like star halos.

Increasing the percentage allows more scale correlation being seen as detail.

Higher can increase detail, but prevent more noise from being removed.
Equalized Grain: reintroduces grain/noise for aesthetics if background is "too smooth."
Best to leave it at default 0%. (Only applies to luminance).

If detail is lost or reduced too much (check with Before/After button):
Set initial Grain Size and the Grain Dispersion parameter no higher than needed
Try reducing Brightness Detail Loss and maybe reduce Color Detail Loss too.
Try reducing Scale 5 and Scale 4 settings.
Try increasing Scale Correlation parameter.

Suggested parameter setting workflow:
(also not sure about scale now in percentages)
Set Brightness Detail Loss at 30% and reduce Scale Correlation to 2
This allows you to see the effects of parameter changes
Increase Grain Dispersion until no further smoothing of background noise.
Set zoom to 100% (or below).
Increase Scale Correlation from 2 to 6 to see increase detail in larger structures
Reduce Brightness Detail Loss making sure background noise is smoothed out

Press **Keep** when satisfactory results.
Click Back button and Cancel to discard all changes since starting this module.

Note: Ways to reduce noise before the Track (off)/Noise Reduction module:
OptiDev: can run a second time or go back and run it differently on the Wiped image:
Click Cancel (if needed) → Restore → click Linear, Wiped → run OptiDev anew.
Wipe module: Can go back to redo Wipe and rerun OptiDev and the subsequent modules:
Click Cancel (if needed) → Restore → click Original → run Wipe anew.
Super Structure: e.g., Isolate or Dim Small presets.
Contrast: strongly reduce Shadow Dynamic Allocation parameter.
Color: reducing Dark Saturation reduces background color noise
Flux module: e.g., noise preset to reduce background noise around DSO's (see above).
Bin module: Bin more to increase SNR.

Modules available to use after Tracking off/Denoise:

Superstructure
Flux
Entropy
Heal
Repair
Layer
FilmDev
Bin

Flux* Flux uses fractal patterns to identify details in order to:
Sharpen DSO image details, particularly in nebulae and not so much for galaxies and stars.
Remove noise, particularly background noise.
Secondarily it can:
Improve stars, making them more concentrated and "sparkle" (e.g., in globs), and
Augment or add missing details (possibly adding stuff that is not there).

Flux can be used at any time during the workflow:
Perhaps bests to use **after** stretching in Contrast, HDR, and Sharp (and maybe Decon).

Can use before Color with or in lieu of SuperStructure, especially for a noisy image.
Can use Flux's **noise removal** after Tracking is off lieu of or in addition to Denoise; e.g.:
When touching up already processed images where Denoise is not available.
After using Layer module after Tracking is off.
Some say Flux's **Sharpen** (or Detail) is best used **after** Tracking/Denoise is off.
Can run Flux more than once with separate algorithms, but only once for each.

Open Flux and in the first Setup screen **click Next** to "extract flux" to apply.
Best to leave Wavelet Library parameter at Small (default) for more flux "knowledge."
Large can better relate detail to other detail, but with less noticeable effect.
Large is also less effective when noise is involved.
In the second, main Flux screen **set the desired mask** for use:
A **full mask** can be used**, or**:
An **inverted star mask** can prevent Flux from distorting the stars, when using:
Sharp for sharpening DSO structure, or
Noise for removing background noise.
Mask→ Auto→ Stars →Keep →Invert →Keep again to return.
A **star mask** can be used to improve the stars using the Sharp preset.
Mask→ Auto→ Stars →Keep →Keep again to return to Flux

Select **Preset:** Noise and Sharpen are ones to use (default settings are generally good):
Noise: settings for reducing background noise; uses a full mask or an inverted star mask.
See more details below on using Noise for noise reduction.
Sharpen (runs by default): settings for sharpening DSO details or improving stars.
Use an inverted star mask for DSO sharpening; use a star mask for stars.
Detail: seeks to add natural-looking but **possible artificial** details in image structure.
Maybe use an inverted star mask. It provides no sharpening.

Parameters:
Algorithm: filtering algorithm applied; best just to use the one selected by the preset:
Modulate Unsharp Mask; used by Sharpen preset.
Performs localized sharpening of only "interesting" details
Tries to leave other details such as noise, alone.
Filter Amount parameter controls the strength of the sharpening.
Modulate MOMH + Post-ADNR; used by Noise preset.
Add Detail; used by Detail preset: adds detail to the image; no sharpening.
Flux amplifiers control the amount detail flux is amplified:
Positive Flux for amplifying bright flux details
Negative Flux for amplifying darker area details
Detail filter: sets minimum allowable size for flux concentrations for the algorithm
Lower pixel setting allows more and smaller detailed flux to pass through
Increasing allows only larger flux clumps through to the algorithm
Brightness Mask Mode: sets optional masking filter using luminance information.
Default is Off for Sharp; may try different ones for Noise.
Brightness Mask Power: sets power added to pixels in the optional Brightness Mask.
Grayed out if Brightness Mask Mode is Off.
Filter Amount: sets **strength of the Modulate Unsharp Mask sharpening algorithm**.
Mask out stars to avoid high settings making them oversaturated and too fat.
Has some unknown effect on some of the other algorithms.

Filter Radius: sets maximum size of details sharpened by **Unsharp Mask Algorithm**
Increase pixel size radius to sharpen larger details (more aggressively?)
For **other Algorithms** it sets the filter pixel width.
E.g., in Noise preset algorithm, increase setting for more noise reduction.
Filter Fuzz: blur applied to the identified flux before its use by the sharpening Algorithm
Increasing will expand the pixel area around the identified flux to be sharpened
Increase reduces intensity; may need to increase Filter Amount strength
Disabled for Detail Algorithm since it has no sharpening.

Mask Fuzz smooths transition between masked and unmasked areas if a mask is used.

For background noise reduction with the **Noise** preset and possible parameter adjustments:
(Maybe with a full mask or an inverted star mask).
Detail Filter: increase to reduce Flux sharpening of smaller pixels/noise.
This adjustment may have the most effect,
Positive Flux: lowering can round stars more.
Negative Flux: increasing can help make stars rounder and more compressed
Filter Amount: lowering can prevent brightness from making star cores too fat.
Filter Radius: increase to spread out and reduce small/noise sharpening intensity
Filter Fuzz: increase to avoid increasing small pixel size noise.

Heal* removes stars, dust donuts and other unwanted elements from an image:
And replaces the removed pixels with plausible substitutes derived from surroundings.
Heal can be run before or after tracking is off and can be used more than once.
If creating a **starless image** in Heal, Layer can be used afterwards to create a **stars-only image**.

Creating a Starless Image (see discussion here and here).
See main image prepatory processing steps for a good stars only image at OptiDev, p.16.
Create star mask covering stars and entirety of their bloat and halos (in or before Heal):
Mask → Auto → Stars → (adjust parameters as needed) → Keep:
Only stars and their halos and no structure detail should be in that mask.
Increase **Filter Sensitivity** as needed to pick up less detail.
Exclude background color if needed to limit the mask to the stars:
E.g., set Include Only parameter to "Red**!**" to exclude red of nebula.
Click Keep the masl to return to (or open) Heal module
In Heal (to remove stars from the current StarTools image):
Set **New Must Be Darker Than** parameter: to **Off** (default).
Off means no cap on the maximum percentage of white for pixel removal.
Set **New Darker Than Old** parameter: to **Yes**.
Replacement pixels must be darker than the pixels removed.
Adjust Heal parameters as needed to cover and eliminate all stars and halos:
Grow Mask: grows the mask for Heal; (works the same as Grow in Mask).
Growing the mask can help with good star removal.
Alternatively, go back and adjust mask to cover all stars and halos.
Quality: influences how long Repair looks for substitutes for each removed pixel

Higher (or Ultra) can be marginally better; but takes longer processing.
Some say to always **use Ultra**.
Neighborhood Area: distance Heal looks for good replacement pixels.
Neighborhood Samples: For stars leave off at 0 (default).
Increasing might help if removing a large structure or area of the image.
Click **Keep** that **starless image** when good (and can save if desired).
Proceed immediately with the following to create the stars-only image.

Creating a stars-only image immediately after creating that **starless image**:
Clear the mask: Mask → Clear → Invert → Keep
Open **Layer**, which places that current starless image in both the left and center panels.
Click **Undo->Bg** button at the top to put the **original image** in background (left) panel.
That is, the image going into the previous module (Heal) is in background panel.
Set Layer Mode to **Subtract**, which subtracts the foreground from the background.
That is, the starless image (with full mask) is subtracted from the original image.
The extracted **stars-only image** is the result in the right panel.
Click Keep, can process it further if desired, and **Save** that **stars-only image**.

Open the starless image to process it further:
Click top **Undo** button immediately after saving the above stars-only image.
Opens starless image from memory; i.e., image going into the previous (Layer) module.
Process that starless image further as desired, Keep and either:
Proceed with Layer to recombine it with the stars-only image (see following step), or
Save that starless image in order to open and process stars only image further.
Then recombine them in Layer.
Alternatively, if following steps at OptiDev p. 16, for separate starless and stars-only processing:
Open the main image and process it for a good main object result.
Extract a starless image from it with the above Heal process.
Open Layer to recombine it with the above stars-only image per the following steps.

To recombine starless and stars-only images, use Layer, see p. 41.

Creating comet-only and (focused) stars-only images to combine in Layer:
Process the comet image taken with the comet in focus
Remove the stars to create a starless comet image (see above)
Process a separately image of the comet's area of the sky with the stars in focus.
Recommended to use short exposure subs for the stars image.
Remove the comet from that image for a stars-only image with the process below.
Combine those two images in Layer (not sure of the best settings to do that).

To remove dust donuts or other such unwanted elements in an image:
Put the unwanted thing in a mask (in green).
In Heal set 'New Must Be Darker Than' to a low percentage of maximum brightness; ~10-15%.
The target percentage is just above (maybe 5% above) the darkness level of background.
Reduce further if element to be removed is mistaken for stars and not fully removed.
Adjust Heal parameters (see above) for good replacement pixels.
If new "stars" are created in the removal area, lower the percentage.
Click Keep

If true stars were removed when removing the dust donut, add them back in:
Open the Layer module and click the 'Undo▸Fg' button
Set Layer Mode parameter to Lighten and the stars should be added back in.
Click Keep

Layer (can do a lot of things; see https://forum.startools.org/viewtopic.php?f=12&t=1149)

Best to **use after all denoise** is done and **tracking is off** to avoid creating artifacts.
If artifacts are not created by Layer, it is ok to use it before tracking is off.
Combined images must be the same dimensions and aligned/registered
Binning and cropping must also be the same

See below for some particular applications.

Open Layer: current StarTools image is loaded in **both** foreground and background panels
Click Open button to select second image, which is placed in the foreground (center panel)
The right panel is the composite of the two images based on the Layer algorithms.

Control buttons at the top:
Keep: keeps the composite (right panel) image
Mask: opens Mask module to create a mask for the foreground (center) image
Only the masked (green) parts are used by Layer for the composite image.
Paste►Bg: pastes the **Copy Buffer** to the background (left) panel
Paste►Fg: pastes the **Copy Buffer** to the foreground (center) panel
Undo►Fg: pastes **Undo Buffer** into foreground (center) panel
Undo Buffer is the image as it existed before start of previous module
Undo►Bg: pastes **Undo Buffer** into background (left) panel.
Copy: copies the composite result (right) panel to the **Copy Buffer**
Swap: swaps the foreground and background images
Open: loads an image in the foreground (center) panel

The order of Layer's function:
Filter Type (and optional mask, like a star mask): applied to foreground image.
Layer Mode: the main operation which combines of foreground and background.
Optional **Brightness Mask**: further refines how pixels are combined.

Parameters:

Layering is mainly controlled by **Layer Mode** and **Blend Amount** strength:

Layer Mode: defines how the foreground is layered on top of the background
Blend (default): Copies foreground over background
Lighten: Copies lighter pixels of foreground and background
(Other lightening modes: Screen, Add, Power of Inverse).
Darken: Copies pixels that are the darker of foreground and background
(Other darkening modes: Multiply, Multiply Luminance)
(More extreme darkening: Subtract, Difference, Divide)
Add: Adds foreground image to the background image (lightens).

Subtract: Subtracts foreground image from the background image (darkens).
Brightness of Foreground: applies foreground luminance to the background
Can use this to combine L (background) with RGB (foreground)
Color of Foreground: extracts foreground Color and applies it onto background
Can use this also to combine L (background) with RGB (foreground)
Screen: projects foreground and background images together (lightens)
Color Extract Foreground: result has only color data; no luminance data.
Multiply Luminance: multiplies luminance info of the foreground by the background; use with Color Extract for recombining L and RGB images.

Blend Amount: sets strength applied to foreground in the selected Layer Mode.

Filter Type: sets filter applied to foreground before layering; **three basic types**:
Noise reduction: Gaussian; Median; Mean of Medium Half; Differential Adaptive Noise; Mean of Medium Half Distance Weighted.
Bring out detail: Minimum; Maximum; Lightness; Local Histogram Equalize; Local Max Entropy RGB Selection; Sobel; Fractional Differentiation.
Blending Foreground and Background: Min Distance to ½ Unity; Max Contrast.
(These can also be used for combining different exposure length images):
Filter Kernel: sets pixel matrix used by the selected Filter Type (and Mask Fuzz if used).

Brightness Mask Mode: optional additional pixel blending control
Sets use of foreground vs. background blending based on brightness or darkness
Can be effective to reduce noise.
Brightness Mask Power: sets power of the selected Brightness Mask
Sets threshold for pixels to have impact in that Mask's application.

Mask Fuzz: amount of smoothing blur applied if a mask is applied to foreground
Can be particularly effective when a foreground star mask is used.
Cap Mode: Defines how negative and over unity pixels are treated
Offset X and Y: optional pixel offset of foreground panel to background panel

To make dark darker and light lighter, use Overlay, SoftLight, or HardLight.
Desaturation (B&W): Desaturate fg (either Average or Luminance)

To combine stars-only image with the starless image:
See OptiDev, p. 16, and Heal, p. 39, for creating the starless and stars-only images.
Set up Layer: put the starless image in the background and stars-only image in the foreground.
If starless image is active, opening Layers puts it in both background and foreground.
Click Open button and select the saved stars-only image which loads it in the foreground.
(If reversed, use Swap button to put **starless** in background and **stars-only** in foreground)
Set the Layer Mode parameter to **Lighten** or **Add**, or maybe try **Screen** or **Power of Inverse**
The resulting combined image is in the right panel.

Adjust Blend Amount to control brightness of the stars in the combined image (right panel).
Below 100% dims the stars; above 100% starts to dim the starless image object.
If stars become blown out, try setting Cap Mode parameter to Normalize.
See other parameters above as needed, and Keep.

Adding narrowband data, i.e., **add Ha, to LRGB** image to create highlights.

Can be good for objects like galaxies that don't primarily emit Ha throughout.
This creates highlights instead of blending the Ha into the red or L channel.
See Preparing Ha file for use with RGB image in Layer
Ha and LRGB files must be registered together and have same crop and bin.
In Layer load the Ha file in background and the RGB file in the foreground.
Set Layer Mode to **Lighten** (will pick the lighter of each pixel between the two).
Adjust 'Blend Amount' to alter the Ha vs. RGB contribution to the image.
Different 'Brightness Mask Mode' settings can also change that balance.

Compositing narrowband (HOO) image with RGB stars

Process the narrowband (HOO) and RGB images separately. See Compose, p. 3.
These images must be registered together before opening Layer.
Open Layer module:
Load the processed HOO image in background and the RGB image in foreground.
Create a star mask for the RGB image in center foreground panel
In Layer: Mask → Auto → Stars → (adjust) → Keep → (shrink/grow) → Keep
Set that mask to include the stars with colors you want to use.
Use AltStars?? Only works if RGB image is tracked??
If exclude any will composite HOO keep those from its image?
Set Layer Mode to Color of Foreground
The right panel composited HOO image takes on the RGB color stars in the mask
Adjust Mask Fuzz and Filter Kernel Radius to smooth the composited image.

Combining separately processed Luminance and Color files

See Compose above for creating and processing separate Luminance and Color files for an image.
Both files must be registered together for Layer to combine them.
Restart StarTools and use Open to load the processed and saved Luminance file
Select Linear for that file; don't start Tracking.
Open Layer, which places that L file in both background and foreground panels.
Load the processed and saved Color file, which places it in foreground panel.
Set Layer Mode to "Color Extract Foreground"
The (normalized) colors, independent of Luminance, are in Composite panel
Click Copy button to place that Composite panel result in the buffer.
Click Paste►Fg to put the buffer with those extracted colors in foreground panel
Change Layer Mode to "Color of Foreground" (or "Multiply")
Combines Luminance from background with Color from foreground
Adjust parameters as needed for desired result in the right composite panel:
If dark parts of its background are too bright, set Brightness Mask Mode to:
"Where Fg is dark, use Bg" or "Where composite is dark, use bg."
Brightness Mask Power can adjust the impact of that Brightness Mask.
Blend Amount can increase or decrease the saturation of the colors.

Removing bad effects from an immediately preceding module:

Click Keep of result in preceding module.
Open Layer to put that result in both background and foreground panels.
Create a mask covering the offending parts of that previous module's result.
For example, create star mask to undo adverse effect on stars.
In Layer, copy that mask to the foreground (middle panel): click "Undo➤Fg" button
That green mask coverage is what will be undone from previous image.
The result (after removing the masked effect) is shown in the right panel.
The non-green parts are unchanged from the preceding module result.
Adjust Mask Fuzz slider to smooth transition as needed.
Can also adjust mask if needed.
Keep

To correct for purple stars (at the end after Tracking is turned off)
Select Layer Mode Invert fg (foreground)
(Anything that was purple will turn green)
Keep
Launch **Color** module
Set Cap Green to 100%
Keep
Launch **Layer** again
Select Invert Foreground again

Combining images of different exposure lengths (HDR like combining for details)
Process and save both images
Both must be the same size and be aligned.
Recommended to use FilmDev instead of OptiDev.
Maybe to have similar stretches????
In Color module use same Red, Green and Blue slider settings
Restart StarTools and use Open to load shorter exposure image
Open Layer and use its Open button to load longer exposure image
Places **longer exposure image in foreground** (center) panel
Layer Mode: set to Blend (default)
Might try others?
Filter Type: use Max Contrast or Max Distance to ½ Unity
Adjust parameters (see above)
E.g., Blend Amount adjusts relative intensity contributed by two images
Option to combine two filter results:
Apply the first filter and copy result (third panel) with Copy button
Click Paste►Fg and change and apply the second filter
(Will optional Paste►Bg have a different result??)
Increase Filter Kernel Radius until smooth blend is achieved

Process the other exposure length image and open the Layer module
That image is placed in foreground (center) and background (left) panels

Repair* attempts to detect and repair stars misshapen by guiding errors, coma, or other aberrations.
It can also attempt to repair saturated star blooming
Repair also can function to remove or reduce/dim smaller stars in a busy star background.
Complements the Shrink module in this respect.

Repair works on both luminance and color, and tries to retain star color.
Therefore, best to use after Color module.
Either before or after Tracking is off.
Can be used more than once with different algorithms.

1. A **star mask** is needed:
   Click Mask button when Repair opens to create a star mask.
   Mask→ Auto→ Stars →Keep →Keep again to return to Repair
2. Select the desired **Algorithm parameter**:
   Warp (default) – best algorithm to apply first to fix misshapened stars.
   Takes the star's pixels and warps them into a circular shape.
   Redistribute – reconstructs badly distorted stars that Warp can't fix
   Attempts to reconstructs stars using their bright blob of pixels.
   Core is Avg Location – uses average of star's pixel blob for its location.
   Maybe the better Redistribute algorithm
   Core is Brightest Pixel – uses brightest pixel for star location
   Redistribute may not result in natural looking stars.
   Debloom – attempts to fix stars affected by CCD blooming.
3. Click **Do**
   Must click Do after any parameter change.

Parameters (default settings are generally good; must **click Do** after any parameter change):
Grow Mask: increasing can help remove artifacts created by Repair algorithms
Radial Samples: (applies only to Warp algorithm)
Sets number of samples to take to determine roundness of a star (default is 32).
Increasing number of samples can help to round badly distorted stars
Sub Sampling (applies only to Warp) sets subsamples per pixel for the Radial Samples.
Higher value can improve roundness but takes more processing (default is 4x)

Keep.

Regarding star repair, other modules that might be used:
See **Shrink** for controlling size, brightness, star color, and halos around stars.
See **SVDecon** can work to shrink/tighten non-overexposed stars
But Shrink can control bloated or overexposed stars that SVDecon can't
See **Superstructure** can be better to push back busy star field.
See **Heal** for removing stars
See **Filter** for removing blue/purple halos

FilmDev for final adjustments at end of workflow (after Noise Reduction and tracking off).

When opening select the **Stretch the image as-is** option

To darken or push back background some try:

Reducing the Gamma percentage
Increasing the Dark Anomaly Filter pixels

With the default settings try adjusting these two parameters (to move the histogram):
Gamma adjustment moves the histogram to darken the background or brighten the object
SkyGlow increase (like to 2%) if background is too dark to give a more natural look.
The effect is to push histogram to the right.
Adjusting these two can help reduce background mottling.
(If background is too bright try SuperStructure Isolate preset with different strengths)
Digital Development slider increase also moves the histogram to the right.

Synth* augments (or replaces) stars to look like a telescope's view with diffraction spikes.
Use only once with tracking off toward the end of the workflow.
Create star mask covering all stars (not just a few).
Avoid noise in the mask.

Select Newtonian or Refractor to set default parameters
May need to set aperture and focal length.
Click Next.
Overlay Mode

Lens

Use to correct coma and chromatic aberration (stars not round or color blurred at edges)
Is Repair better for this?
Use after Bin but before Crop

Save

Save as Tiff after the noise reduction (can do modules again)
Click Mask → Clear → Keep before saving

Hotkeys

Zoom out	-	Mask editor	M
Zoom in	+ or =	Open	O
Zoom fit-to-screen	0	Save	S
Cancel	ESC	Screenshot	X
Keep	K		
Blink before / after	B		

A suggested work flow for star clusters:
OptiDev

Bin 50%
Crop
Wipe (Uncalibrated 1 preset; probably overkill but usually ok with extremely wide fields)
OptiDev (ROI over cluster and reduced Shadow Linearity)
Decon (default settings)
Color (with Cap Green at 100%)
Super Structure (Isolate preset or Brighten preset; Airy Disk Radius set to 3%)
Tracking off with default noise reduction