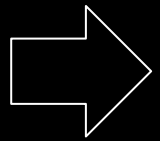

LUAstro
Siril Processing

What Is ‘Processing’?

Raw data from camera sensors must be interpreted to form an image. By default, astronomy data is in monochrome, and has to be “debayered” to form a colour image.



Typical phone cameras can process images automatically, but sometimes with poor or detrimental results.


Processing software

PixInsight

PixInsight

The PixInsight software license costs €300. (£251.77 January 2025)

BlurXT, NoiseXT, StarXT cost $99.95, $59.95 and $59.95. (£81.92, £49.13)

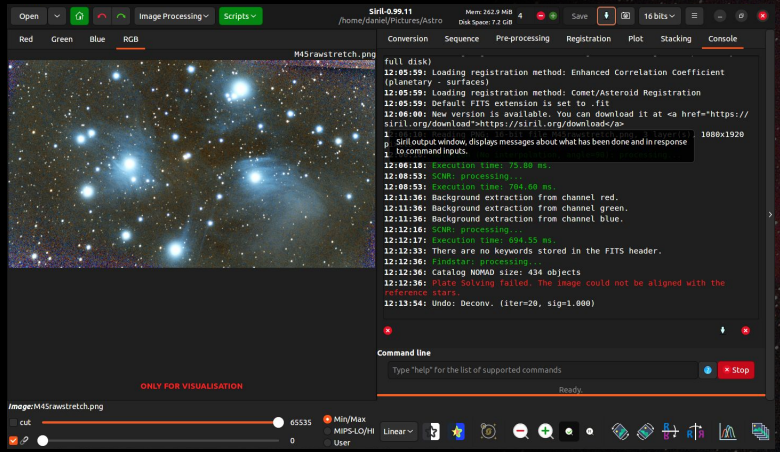
£431.95!

Orlando Prügel-Bennett

Siril

Siril is free and open source, as are StarNet and GraXpert.

StarNet is a good substitute for StarXT. GraXpert can be used for denoising.



C. Richard et al., Journal of Open Source Software, 2024, 9(102), 7242. DOI: https://doi.org/10.21105/joss.07242.

Examples

John Ray

These were both taken with the RedCat 51 scope, and processed purely in an older version of Siril, with a couple of tweaks in PhotoShop. These were some of my first attempts at processing.

Examples

John Ray

These are more recent reprocessed results. I stretched both images much more strongly with Asinh transforms this time (this helps darken the background relative to nebulosity), used GraXpert software to further denoise the images, and StarNet software to reduce stars (which makes nebulosity more clear).

Examples

Finlay Daniel-McKeigue

Seestar S50, Siril, Pixlr E

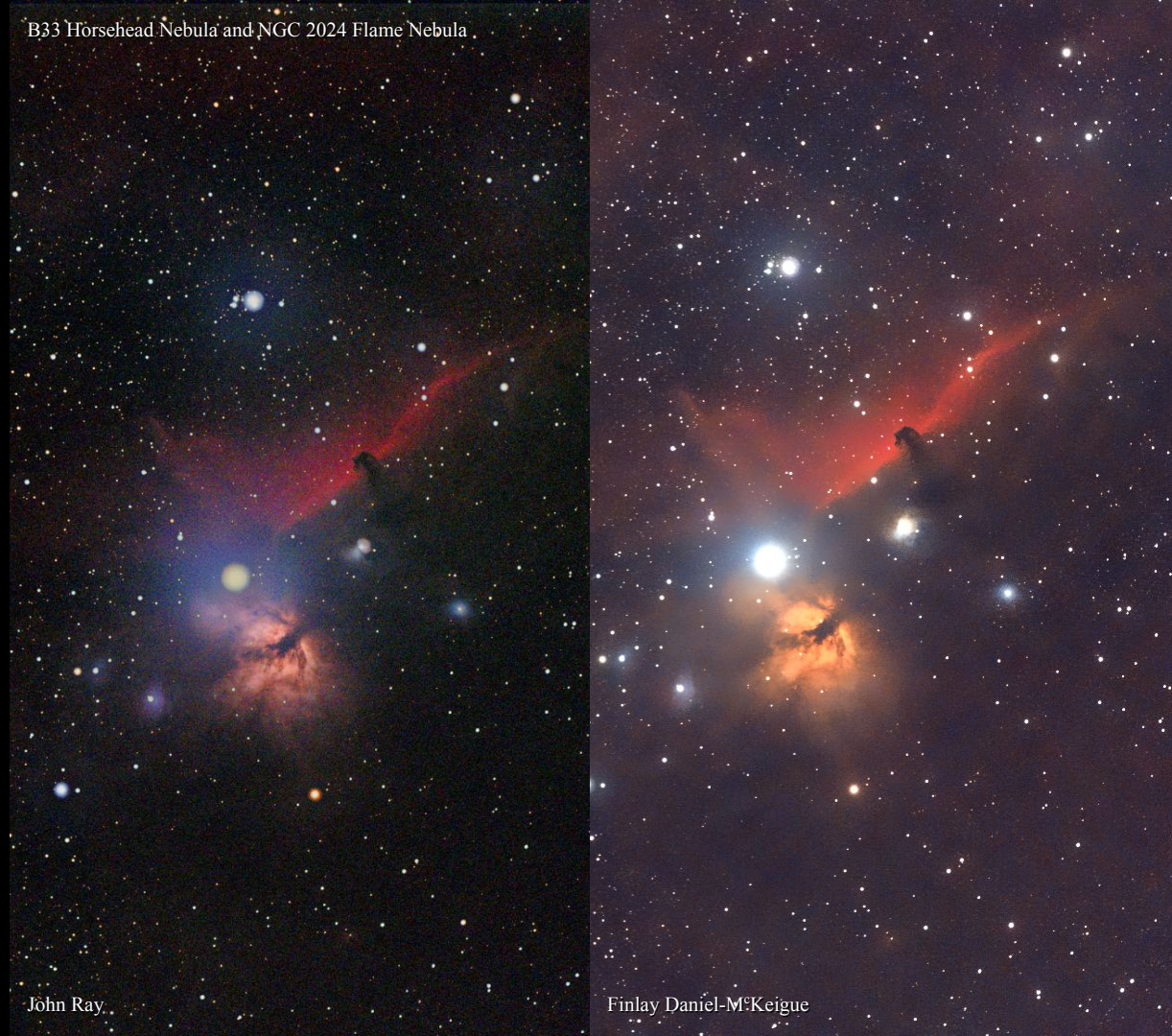
Jupiter

Examples

The same data can be processed very differently.

John’s image is sharper, and perhaps more true to what a human eye might see.

Finlay’s image has been stretched to show the fainter dust, revealing details that otherwise would not be seen.




Processing & Setup

Downloading the data

After ensuring that you have Siril downloaded on your device, you can now download the data.

Astronomical data is usually stored in “.fit” files, which are usually quite large (one observing night can yield up to 10GB in files), and so will take time to download.

The data can be downloaded by visiting the link below:

www.luastro.space/documents/Siril-data/

Or by scanning the QR code on the right:

Preprocessing

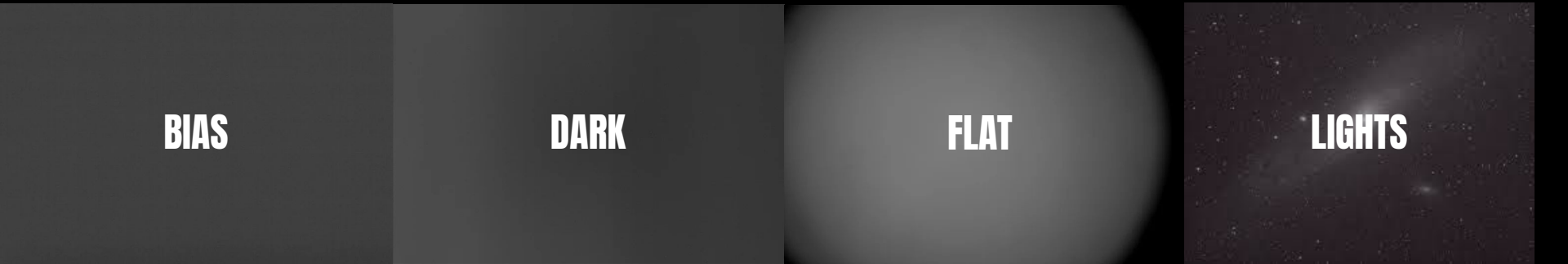
Before the data can be processed into an image, all of the subframes should be combined - ‘stacked’ - into one file. Your subframes will be one of four types.

- Lights - exposures of your target

Calibration Frames

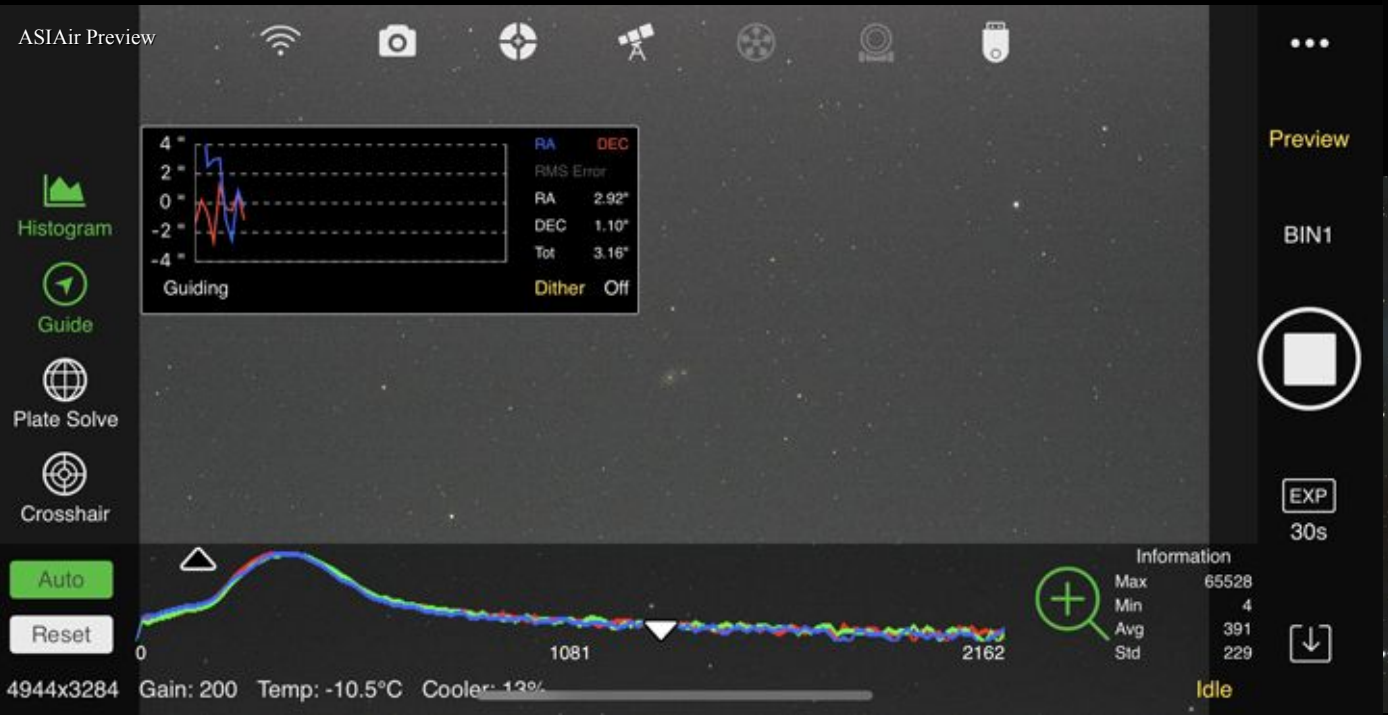
- Biases - very short exposures with the lens cap left on
- Darks - exposures with the lens cap left on
- Flats - exposures of an even bright surface

Siril manual preprocessing guide



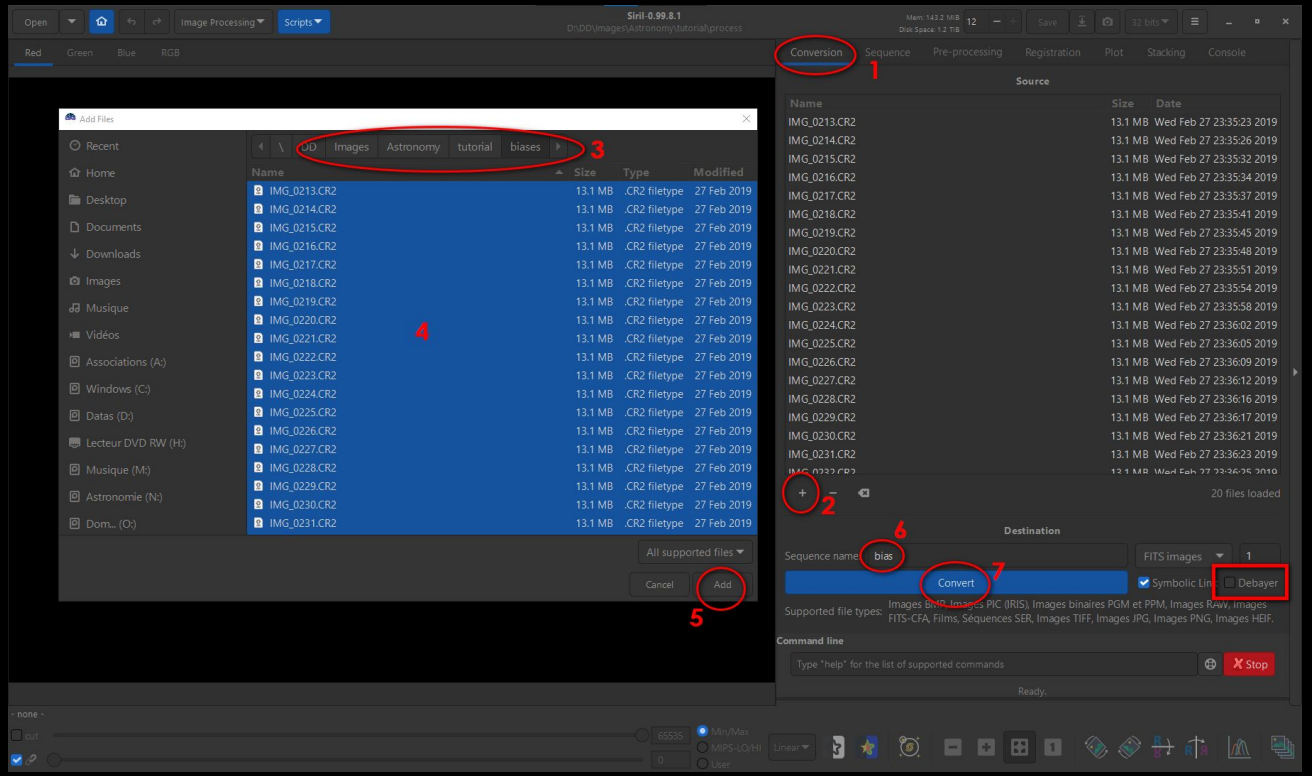
Stretching

M45 Pleaides



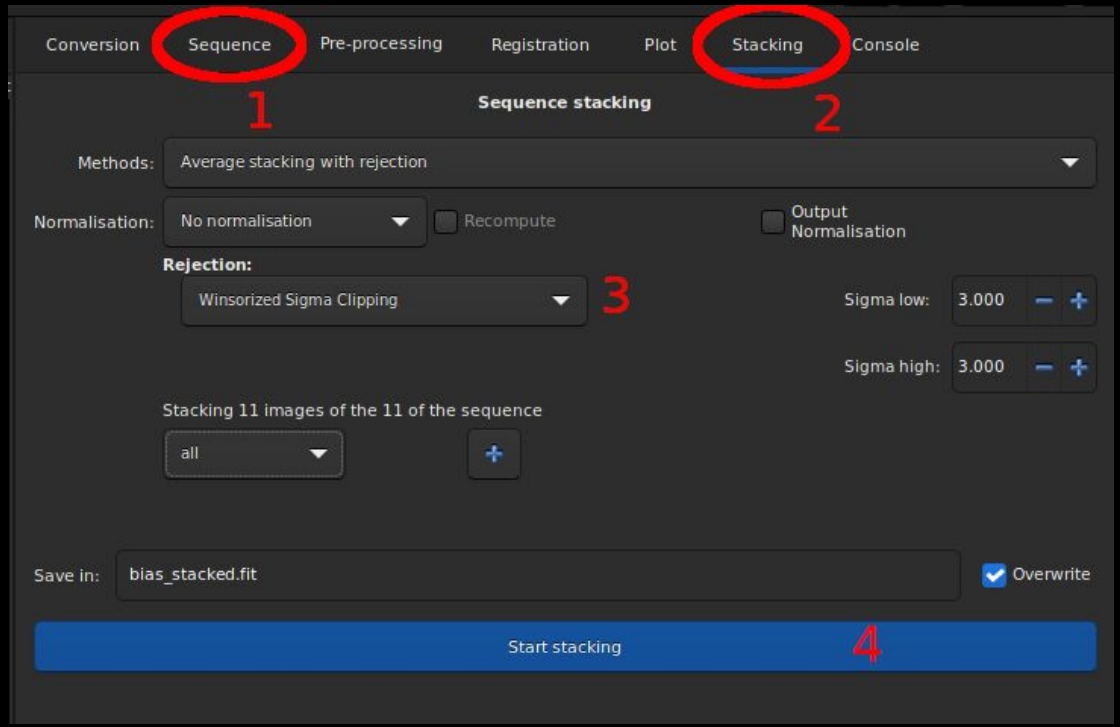
Setting a directory, and converting files to sequences

Home button



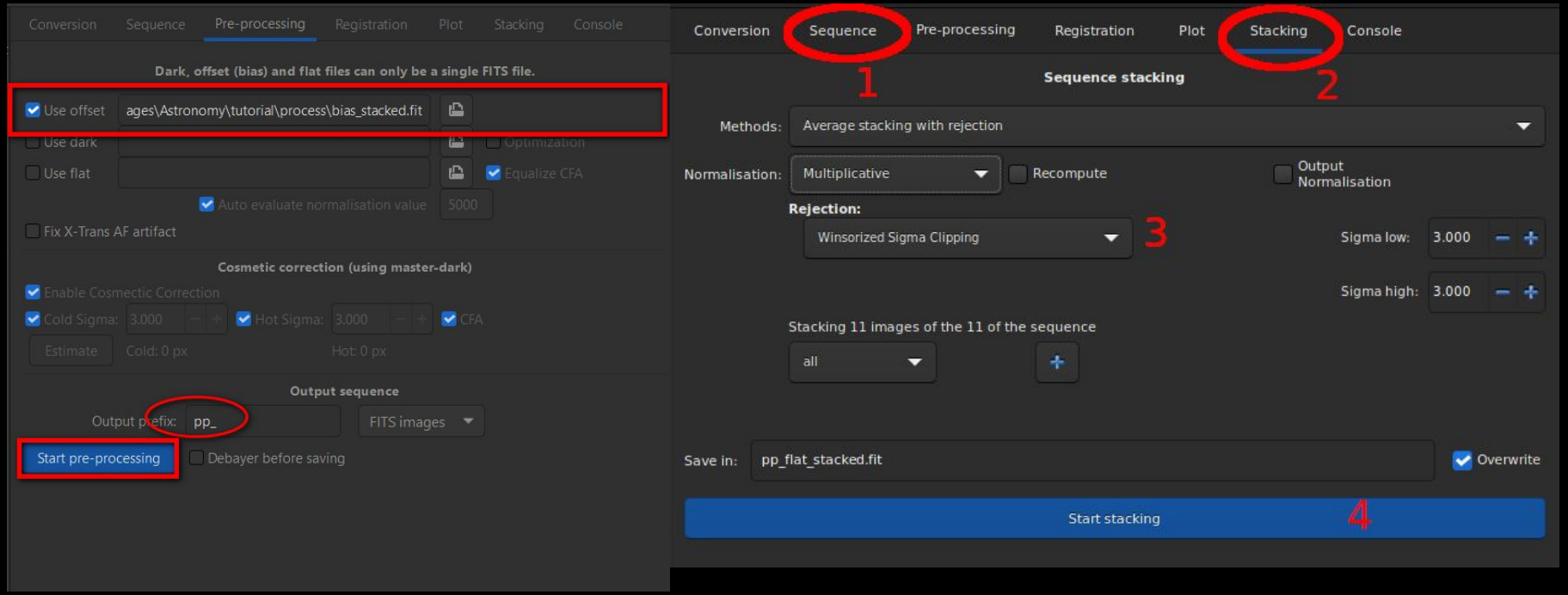
Pre-Processing Biases

Stacking inputs for Bias frames



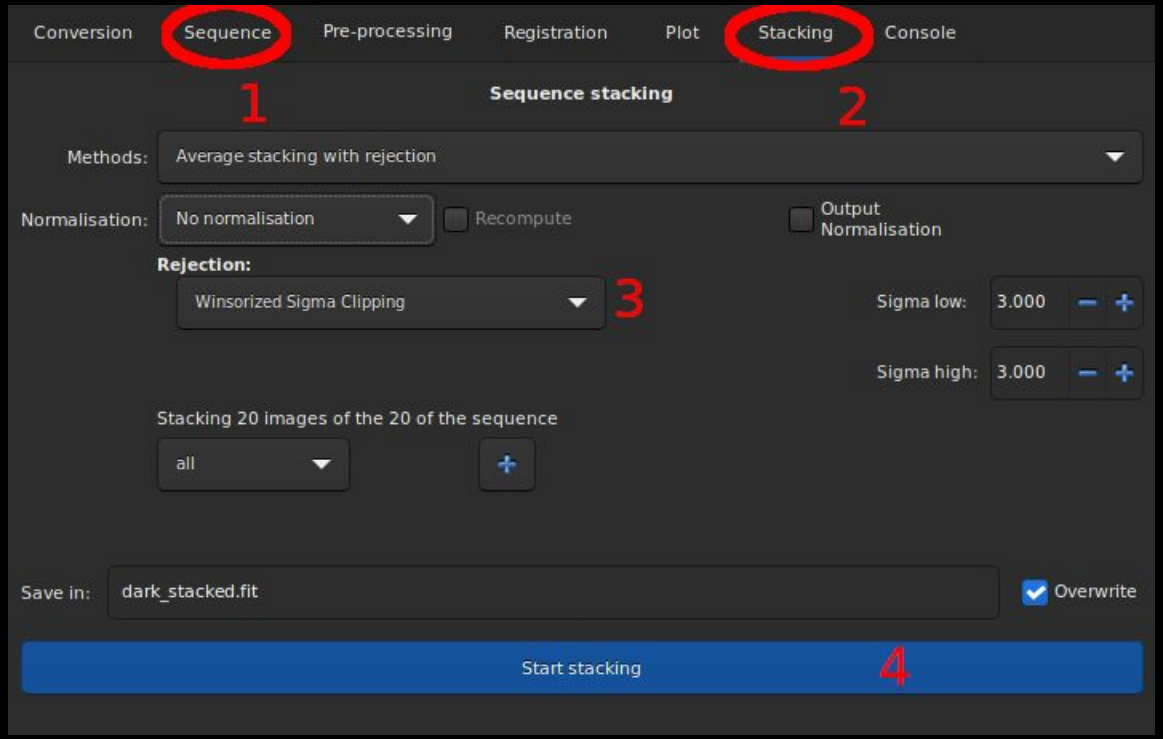
Pre-Processing Flats

First, the biases are subtracted from each flat, then the flats themselves are stacked.



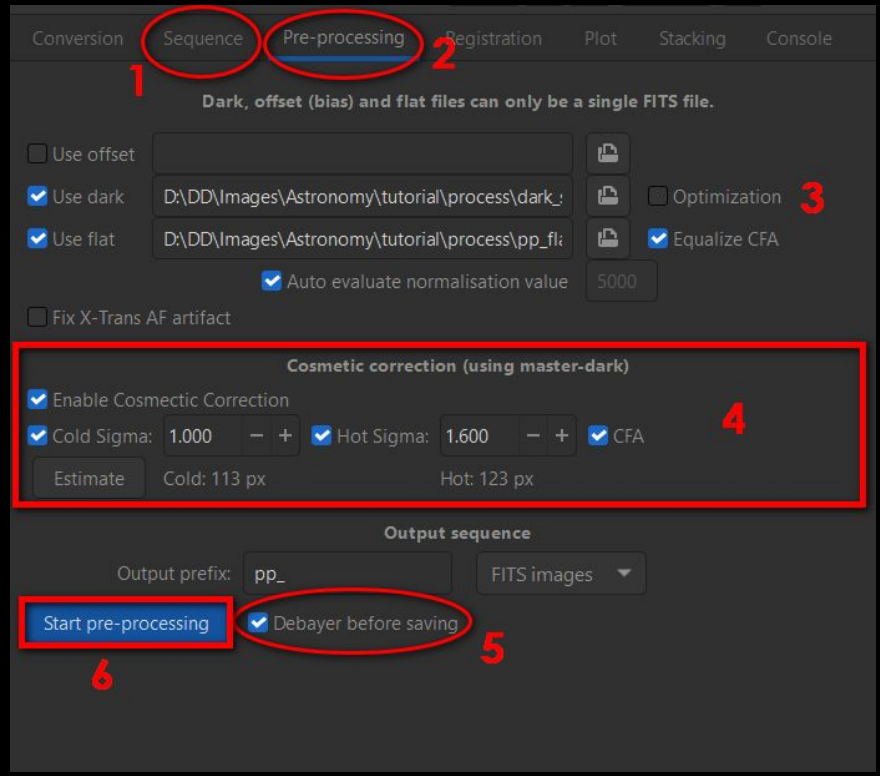
Pre-Processing Darks

Stacking inputs for Dark frames



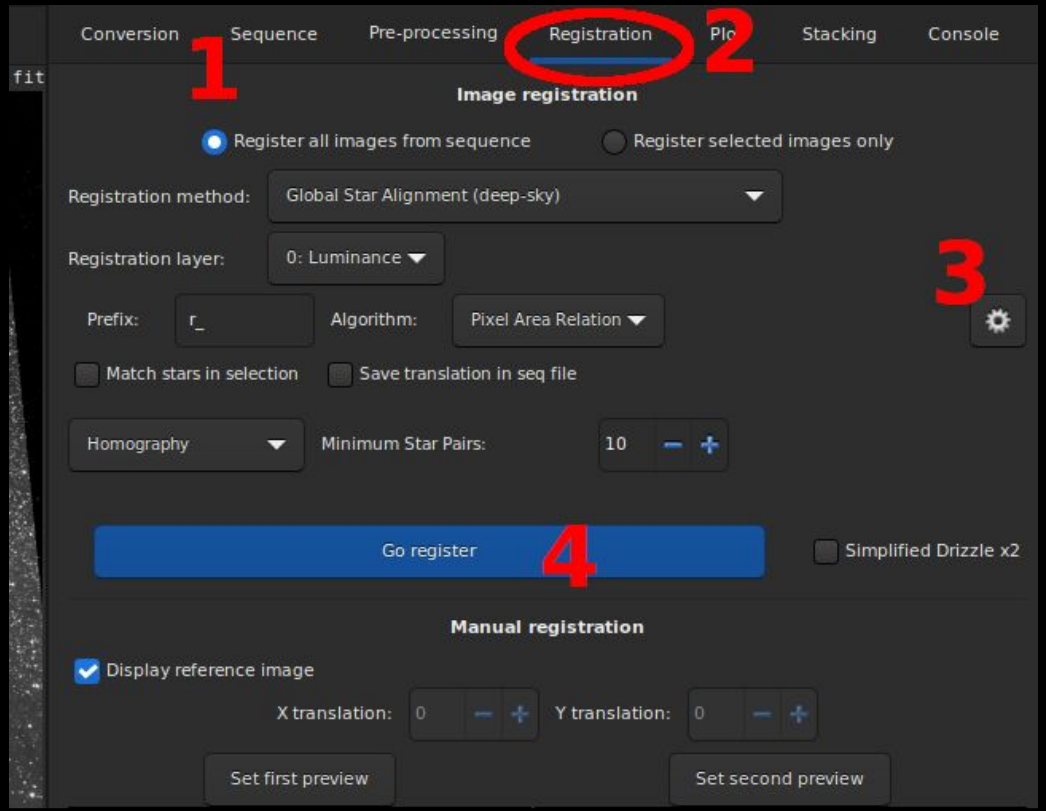
Pre-Processing Lights (the fun ones)

Pre-processing inputs for Light frames



Registration / star alignment

Inputs for registering
Light frames



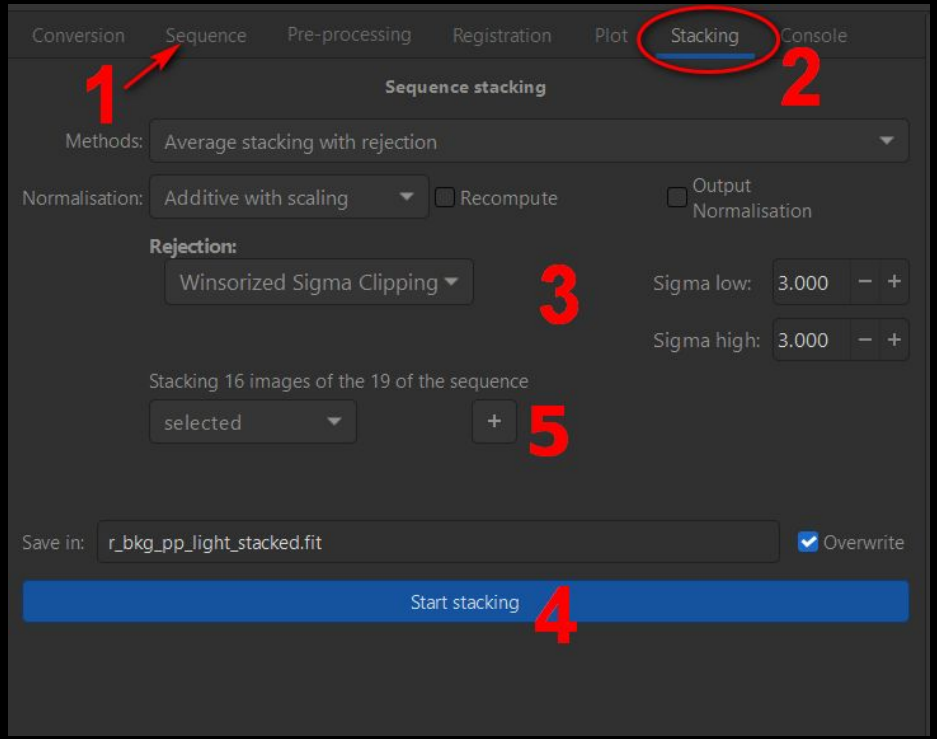
Analysing Images / removing outliers

Occasionally due to light pollution, errors with scope alignment, vibrations near the telescope, etc. some final frames may be less accurate than others.

This step is where we can remove these frames, before finally stacking the images.

Stacking the Images

Inputs for stacking the Light frames



Post-Processing

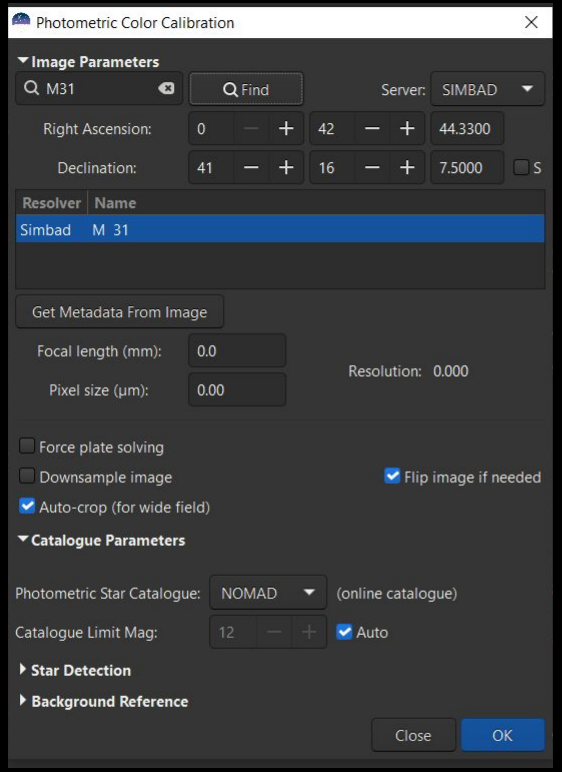
A variety of software can be used for post-processing your data. As we've used Siril so far, we will go on to show its uses for post-processing your lights to create a stacked image.

This is where other software, like PixInsight, can help produce a better final result.

Photometric Colour Calibration

Before applying transforms, it is usually best to apply photometric colour calibration first. This compares your final image to previous images taken of the object and calibrates (matches) the colours. This can only be done before applying transforms.

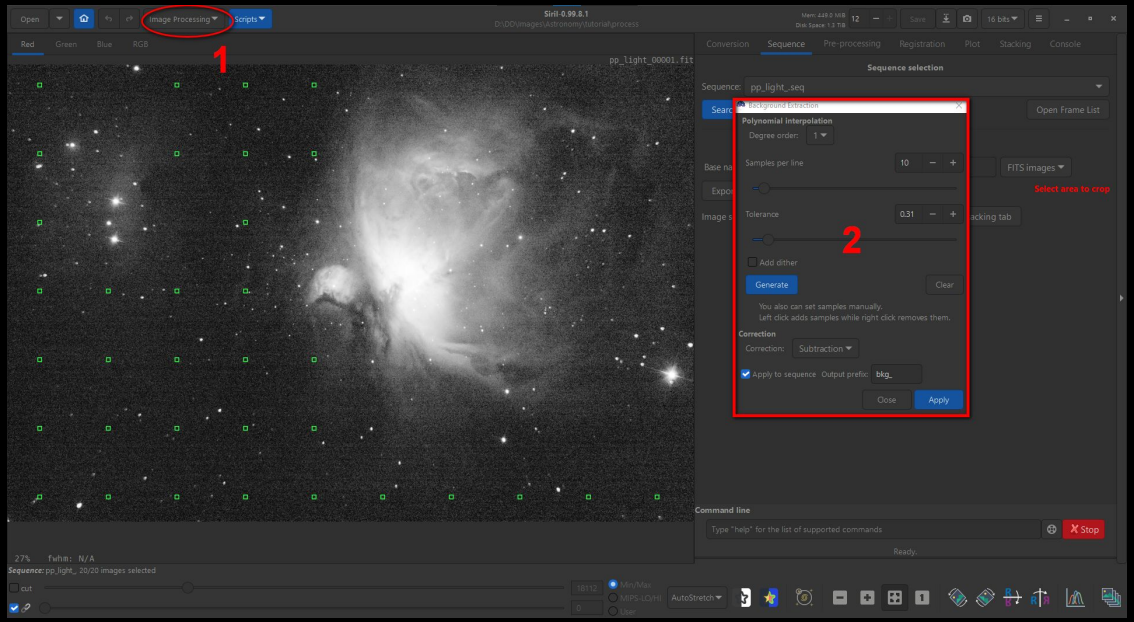
To do this, click on Image Processing → Colour Calibration → Photometric Colour Calibration.
Enter the object of the image (e.g M31, NGC1234, etc.)
Click on “Get Metadata from Image”, turn the options of “Auto-crop” and “Flip image if needed” on, and then click OK.



Gradients

After stacking, a gradient is often seen over the image (due to external light).

This can be removed with Siril's background extraction.

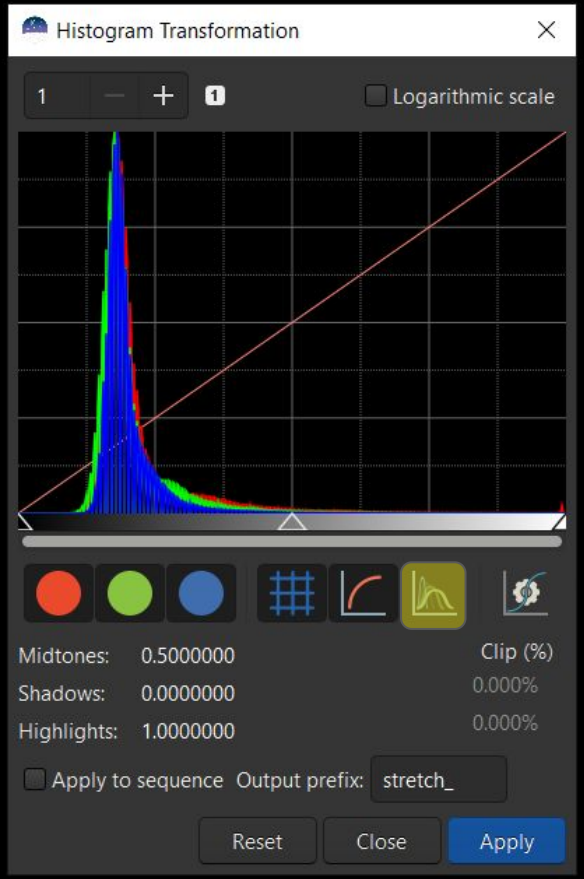


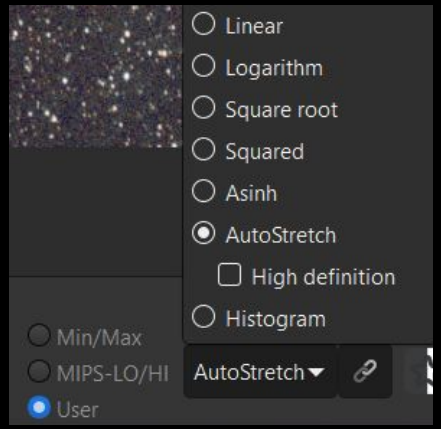
Histogram Transform

The QR Code links to a short explanation of how to histogram transform images on Siril.

The Blackpoint (BP), Midpoint, and Whitepoint (WP) can be moved manually. Alternatively, by clicking the “autostretch” button (highlighted in yellow), they are moved into what Siril determines to be the best place.

The BP should be before the main peak, the midpoint at the end of the main peak, and the WP at the end of all the data.

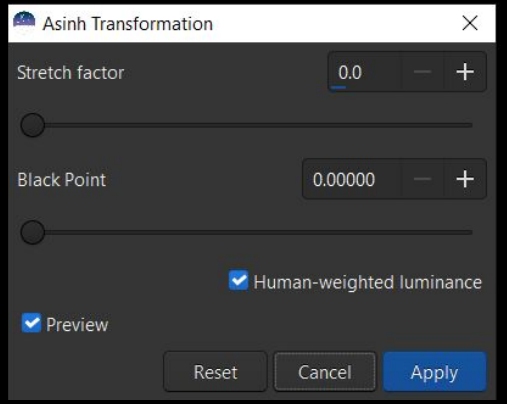


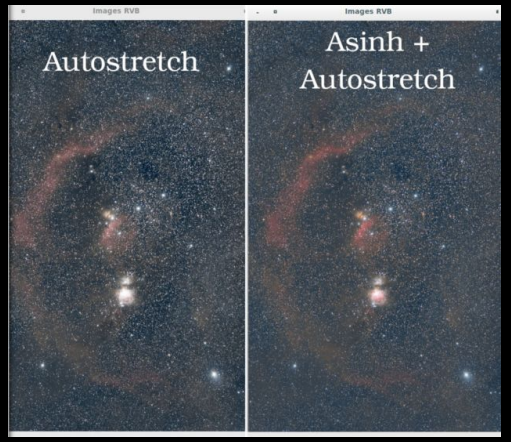


OPTIONAL Asinh Transform

Other ways to transform your data exist, but they tend to have more niche uses. Siril provides an option called “Generalised Hyperbolic Stretch Transformations” that uses all of the available options in one step, but it’s a little too complicated to go into detail here.

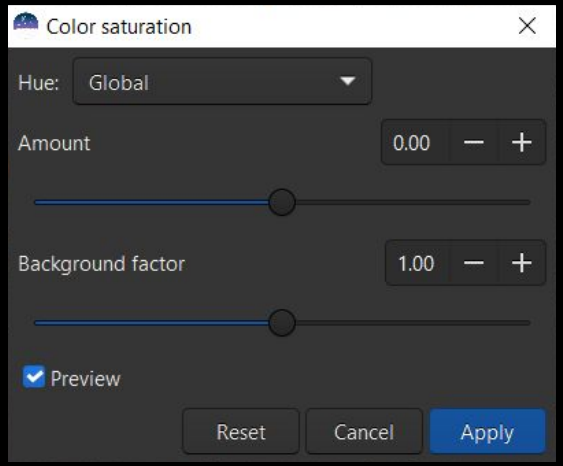
The Asinh transform is one of these. It can help to preserve fainter nebulosity on images with a large change in intensity. It is the first option in Siril’s Image Processing menu and can be used by altering the Stretch factor to capture more detail, and then adjusting the Black Point to make the background dark again. It’s often best when only used lightly, hence why we don’t often bother using it. Most of our images are without it.





Manually change the saturation

Sometimes, due to lower total exposure times or the effects of photometric colour calibration, certain hues in your final image may appear under-saturated. This can be altered using the “Colour Saturation” menu in Siril (other software like Photoshop works well, too).



Star Deconvolution

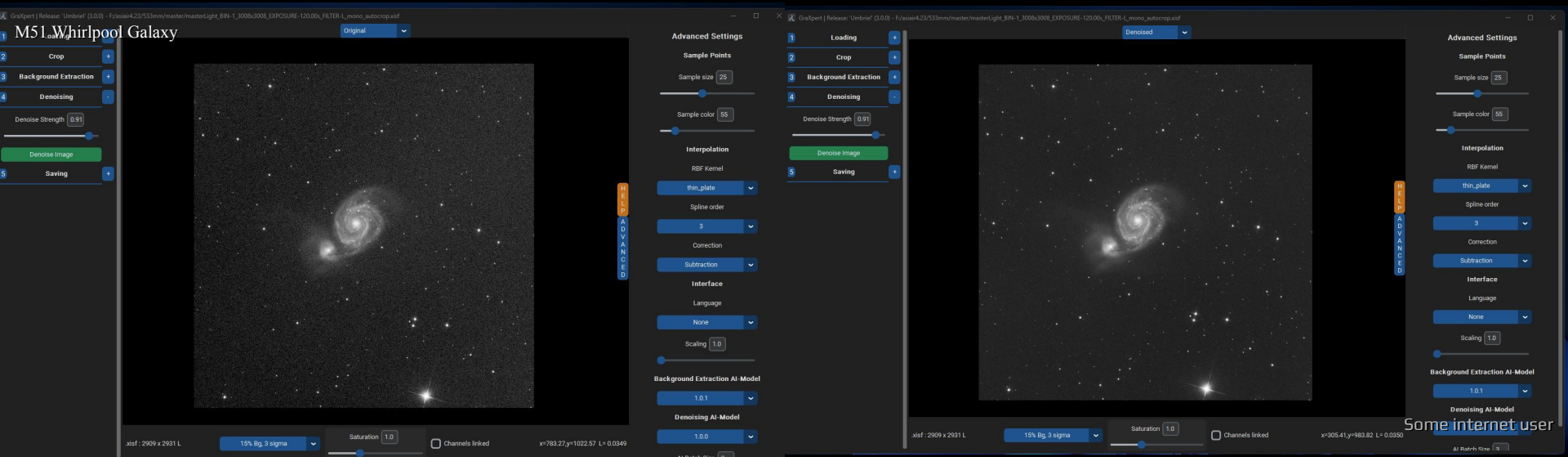
The final step of post-processing in Siril is Star Deconvolution. This is simply An algorithm that decreases the blur in stars, by identifying them and reducing their pixel count via a fancy algorithm.

As shown in the gif to the right, it can make a drastic difference in image quality for pictures of star clusters or galaxies.

Bonus techniques

GraXpert

GraXpert is primarily for removing gradients, but its noise reduction tools are what we mainly use it for. Siril also has inbuilt denoising, but it is less effective. Only 16-bit .tif files are compatible with GraXpert (any final .fit files can be transferred into this format via Siril).



StarNet

The open source equivalent to StarXT, StarNet is more prone to leaving imperfections in the starless image.

Drizzle

Drizzling is an algorithm developed for the Hubble space telescope which upscales images without neural networks.

In Siril, drizzle can be enabled during registration. Beware that it greatly increases processing time, memory usage and image file size.

The End

Thanks for coming!