REMOVING HALOS FROM BRIGHT STARS IN O(III) FILTERED IMAGES USING PIXINSIGHT

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INTRODUCTION

Internal reflections in the optical train can produce halos around bright stars, and some have found that O(III) filters are particularly prone to this problem. For my setup, O(III) is the only filter that gives halos around bright star. The halos make it challenging to blend the O(III) data with my other data, and can produce pale or greenish halos around bright stars in colour images.

Many methods have been developed for using PixInsight to subdue halos around bright stars. Some involve making complex masks and/or PixelMath expressions. Others require accurate measurements of the halos to make models that can be subtracted to reduce the halo. These methods work very well, but they require multiple measurements for each star to be repaired, may require the use of multiple PixelMath expressions and masks, and take quite a while to actually perform on an image. This article presents an alternative method that has the following benefits:

- No measuring required
- No masks required
- Repairs haloes effectively without damaging details
- Quick and easy

In this demonstration, halos around bright stars will be repaired in an O(III) filtered image. Two images are used: the O(III) image to be repaired and a halo-free master from another filter, in this case, the Green master. It is recommended that copies of the Green and O(III) masters be saved to preserve the original data.

SUMMARY OF THE METHOD

Halos in the O(III) data are subdued by blending with halo-free data from the Green channel. There are three parts to the procedure:

1. Match Green's brightness to O(III)
2. Match Green's noise to O(III)
3. Selectively blend O(III) with Green to reduce halos

This halo reduction procedure should be completed immediately after stacking or after background modelization.

STEP-BY-STEP INSTRUCTIONS

1. Match Green's Brightness to O(III)

a) After calibrating, registering and stacking all data, make a copy of the Green master and O(III) master so that your original masters are preserved. Open both copies and apply an AutoStretch using CTRL-A in Windows or CMD-A on a Mac.

b) Apply LinearFit to Green, using O(III) as the Reference Image. To do so, drag the triangle to the green image (see Figure 1).

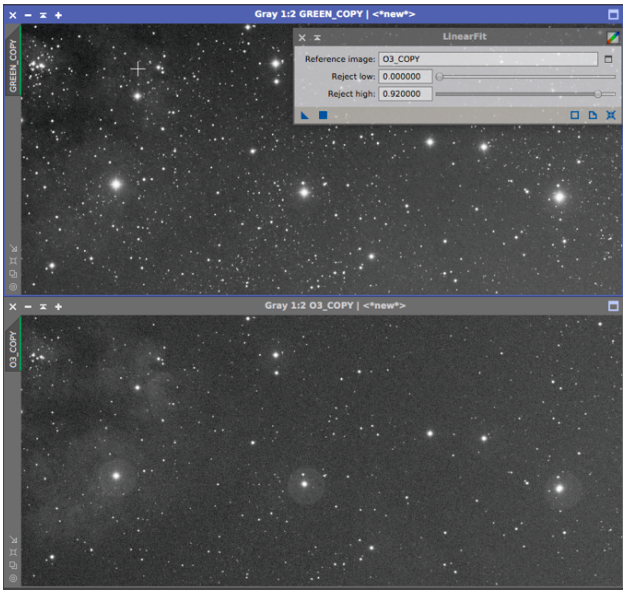

Figure 1: Linear Fit is applied to Green with default settings and O(III) as the Reference Image.

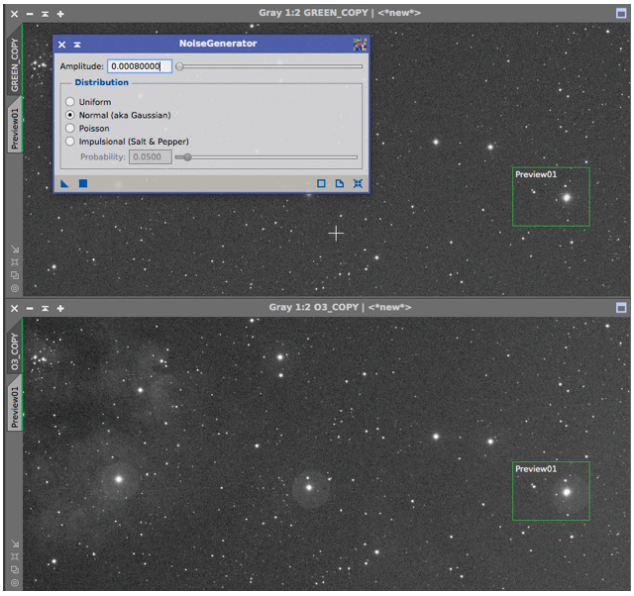

Figure 2: NoiseGenerator is used to increase the noise in the Green to be similar to O(III).

2. Match Green's Noise to O(III)

a) Make a preview in a low signal area of the O(III) image. Select the preview by clicking on its tab, and then drag the tab to the left border area of Green. This will give a matching preview in the Green image. Select both previews and apply an Autostretch to each of them.

b) Use NoiseGenerator on the Green preview, trying different settings (AutoStretch after each trial) until you find one that makes the Green preview look similar to the O(III) preview. Try the settings shown in Figure 2 as a starting point. When you find the best settings, apply to Green.

3. Selectively Blend O(III) With Green to Reduce Halos

a) Open the CloneStamp tool and click on the O(III) image to make it the Target Image.

b) Select the Green image by clicking on its title bar (at the top of the image).

c) Place the cursor at the extreme top left of Green (coordinates 0,0) and CTRL-click to select this as the source image and position. Change the radius to 1.

d) Click on the same coordinates in O(III) (coordinates 0,0).

e) Change the radius to about 50-100 so you can see a circle, and then adjust to be slightly bigger than the diameter of the halos (Figure 3). Set the softness to be between 0.1 and 0.2 and the Opacity around 0.5.

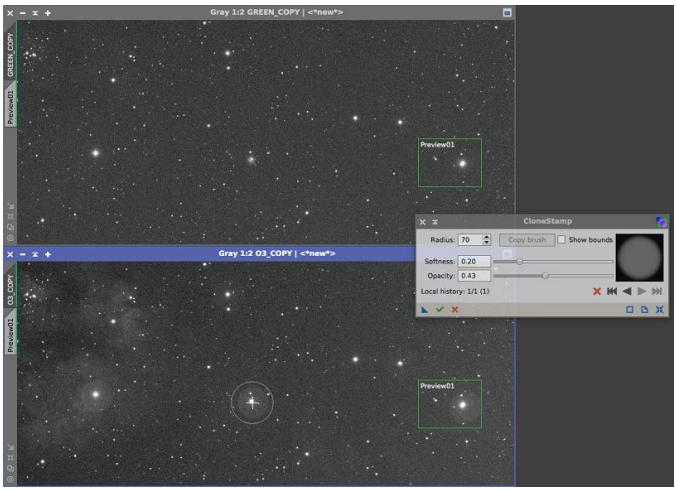

Figure 3: Set the CloneStamp Radius to a little bigger than the size of the halos.

f) Click on the halo you want to remove.
- If result is too dark, undo it by clicking ◀ and try again with reduced opacity.
- If result isn't dark enough, try clicking a second time, or undo it by clicking ◀ and try again with increased opacity.
- Note that if noise looks very unnatural, you should go back to step 2(b) and improve the noise matching before continuing.

g) Repeat step (e) and (f) until all the stars with halos have been corrected, adjusting radius, softness and opacity for each individual target star to get the best result. Try to set the radius just big enough to correct the halo.

h) When all halos have been corrected, click the green checkmark at bottom left of the CloneStamp process window to make the changes permanent (Figure 4).

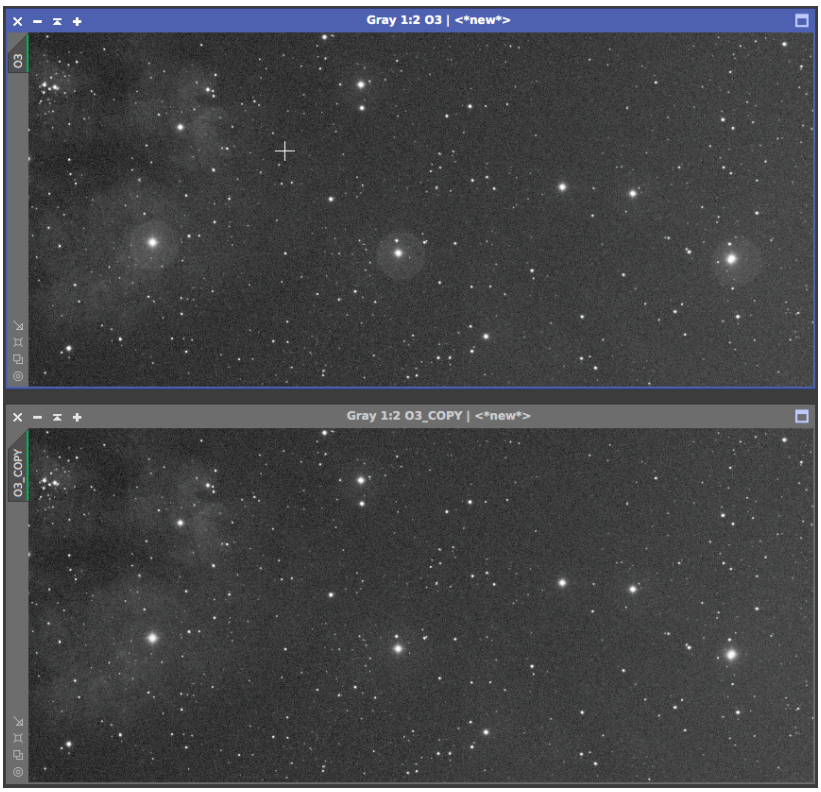

Figure 4: O(III) master before (top) and after halo reduction.
The bright star near top centre was not corrected.

Once you are satisfied with the result (Figure 4), save your halo-free O(III) master and it's ready for you to use in further processing.