Managing IR in Video Astronomy
by Jim Thompson, P.Eng
Test Report #3 – September 9th, 2011

Objectives:
My objective on this evening's test was to do a thorough test of a large number of different filter combinations, and determine how they affect the view produced by a Mallincam astro-video camera. The following filter combinations were tested:

1. no filters
2. Baader Planetarium UV/IR cut filter alone
3. Astro Hutech IDAS LPS-P2 alone
4. Baader Planetarium UHC-S alone
5. Astronomik UHC alone
6. Lumicon #29 Dark Red alone
7. generic 680nm High-Pass alone

Methodology:
I used a single deep-sky object as my target: M31 the Andromeda Galaxy. I used my Canon 17-102mm zoom TV camera lens, which screws directly to the Mallincam via the 'C' mount thread. The lens was operated at 102mm focal length for the duration of the test, giving a field of view of roughly 2.5° by 3.3°. The camera and lens were mounted to my Orion Atlas mount, and remotely controlled through my laptop from inside the house.

I used my Mallincam Xtreme to capture all image data. The camera and capture device were running with the following settings:

- AGC 3
- gamma 1
- APC vert & horz 1
- white balance ATW
- contrast 65 (full)
- hue 62
- saturation 35, 0 for #29 Dark Red & 680nm High-Pass filters
- sharpness 1
- TEC set to "off"

Brightness and Integration time were adjusted throughout the testing, as will be described below. I did not reset the white balance after doing it an initial time at the beginning of the testing when

in the “no filters” configuration. I did adjust the saturation from the default of 35 down to zero when testing the #29 Dark Red and 680nm High-Pass filters.

On my Canon TV lens, I use 2” filters that through a step-down ring can screw onto the front of the lens, in front of the primary. This allowed for very quick filter changes, but still required me to refocus after each filter change.

Results:

Testing was done during a very clear (100%) night with below average transparency (2/5) and average seeing (3/5). The Moon was located approximately 90° to the west of M31, was clearly visible for the duration of the testing, and was 3 days from full. M31 was located in the northeast, starting low at 35° above the eastern horizon and finishing at around 65° above the eastern horizon by the end of the testing.

All the images captured were done at fixed a fixed set of INT times, stepping up from 4sec to whatever maximum INT gave a brightness setting of 0 and started to wash out the background. The first batch of images below compares all the filter configurations to each other at an INT time of 10sec, which is the maximum I could get to with no filters. It is clear that adding a filter cuts a large amount of the light getting through to the camera. It would also appear that the filters that do not block the IR band (UHC, #29, 680-pass) are showing more of the galaxy than those that do block the IR band (LPS-P2, UHC-S).

No Filters – 8sec INT, 0 BRT, 36º ALT

IR Cut – 8sec INT, 0 BRT, 38º ALT

LPS-P2 – 8sec INT, 56 BRT, 40º ALT

UHC-S – 8sec INT, 86 BRT, 42º ALT

UHC – 8sec INT, 95 BRT, 46º ALT

#29 Dark Red – 8sec INT, 118 BRT, 50º ALT

680 Pass – 8sec INT, max BRT, 57º ALT

No Filters – 8sec INT, 37 BRT, 65º ALT

The next batch of images compare each filter configuration at the maximum INT time that could be achieved at zero brightness. These images better present what each filter can achieve, and which configuration in the end is best. The impact of each filter on total INT time is also very evident.

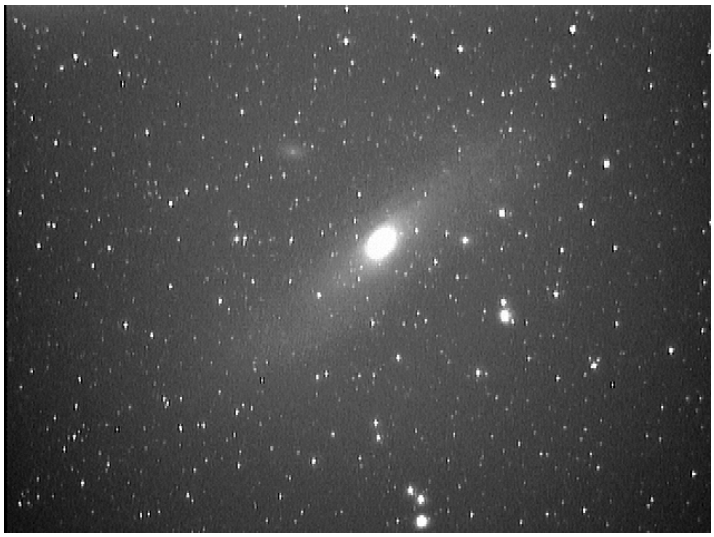
Filters – 8sec INT, 0 BRT, 36º ALT

IR Cut – 10sec INT, 0 BRT, 39º ALT

LPS-P2 – 20sec INT, 0 BRT, 41º ALT

UHC-S – 25sec INT, 0 BRT, 44º ALT

UHC - 45sec INT, 0 BRT, 48º ALT



#29 Dark Red – 65sec INT, 0 BRT, 54º ALT

680 Pass – 120sec INT, 0 BRT, 63º ALT

No Filters – 15sec INT, 0 BRT, 65º ALT

An interesting thing I noted during the testing was how the white balance shifted around with each filter. The no-filter view was inherently orangish due to the light pollution. Each filter tested shifted the colour balance around even though I did not touch the white balance settings (left on ATW for the whole test). I assume that if I had reset the white balance after applying each filter, the colour balances would have been roughly the same in the end. The colour shifts noted were:

- UV/IR cut = yellowish-green
- LPS-P2 = light bluish
- UHC-S = dark bluish
- UHC = bluish-green
- #29 & 680-pass = very reddish (when SAT not zero)

Conclusions:

1. The IR cut filter performed as I expected, being clearly worse than no filter.
2. I was surprised to find that the LPS-P2 and UHC-S did not do better than the UHC, in fact they were much worse. This is all due to the fact that the LPS-P2 and UHC-S have a built in IR cut.
3. The Astronomik UHC performed the best out of the three light pollution/nebula filters I tried. The UHC did not however provide any appreciable advantage to no filter, giving roughly the same view but at 3x the INT. The Astronomik UHC (with no IR cut) would appear to be a good choice if you plan to observe a combination of galaxies and nebulae in the same evening, as I have found it to be excellent on emission nebula.
4. Both the #29 Dark Red and 680nm High-Pass filters provided the best view of M31 of all the filter configurations tested. The improved view comes at the cost of a much longer INT time; 4x longer for the #29 and 8x longer for the 680-pass, when compared to no filters. Note that the INT with the Astronomik UHC was 3x longer than with no filter.

If you have any questions, please feel free to contact me.

top-jimmy@rogers.com