Orbit

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Roger Hill, Editor

When I wrote last month that we needed more volunteers, little did I realize how very true that was. A few nights ago, most of the Board got together to have a look at some of the things that we wanted to achieve this year. There was a lot of talk (I've rarely seen a better group at generating ideas) but a lot of the talk centred on what used to be done, and what can be done.

First off, I noted that one of the things that I used to really enjoy about the Centre was that there was something going on each week. There was a General meeting (like now), a discussion group (armchair astronomy), and twice a month there was Amateur Telescope Makers at Bill Fautleys workshop.

A number of ideas were thrashed about to try to bring this sort of thing into the 21st Century. So what we're going to see starting in the New Year is a mixture of monthly meetings, observatory nights and outreach.

The aim will be that there should be something just about every week. Observing nights at the Observatory will, because of the weather, always have to have a "Plan B" that can take place . For instance, if an Observatory night is planned for observing the Moon and it's cloudy, there might be a discussion on the history of the early solar system ,and theories about the formation of the Earth-Moon system. Another night might be "Piggyback astrophotography" but the Plan B might be a discussion about sources of noise and how to manage them.

You get the idea by now, I'm sure.

How can you help? Well, you can give us some ideas of what you would like to see on those Plan B nights.

Other events that we can look forward to will be the Banquet, Astronomy Day, a couple of total Lunar Eclipses (yes, we arranged these just for you!), a picnic and a "smackdown" event.

And AstroCATS...can't forget AstroCATS. If you liked last years event, the 2014 version promises even more of what you liked. The speakers will be great, the list of exhibitors is growing, and the facilities will be top notch.

Oh, yes, and NOVA will be run again. I will do my best to try to keep it to every other week, which means it will take 16 weeks to run, from the end of January to the end of April, or possibly early May. Some moves are afoot to make the observatory a much more comfortable place to be, but we want to have it finished before mosquitoes become a problem.

As with the last one, Mark Pickett will be helping out. I want to keep the evenings to about 90 minutes inside the observatory, with the remaining time spent under the stars. I may have the assistance of a professional instructor, too, whose brain I can pick to ensure an even better experience for the students.

I'm going to propose a change to the pricing model, too, but I have to discuss this with the Board first.

Lastly, you'll notice that the front cover picture this month is of IC434, the Horsehead Nebula. I was outside on November 23, in my observatory, and I decided to use a 300mm F/4 lens I bought a few years ago. It's quite sharp, but the colour correction is not up to modern standards. If you use it only with one wavelength, though, it's quite sharp. I have a 6nm bandpass Hα clip in filter, and I used Betelgeuse to focus using LiveView. I was so pleased with result, I want to take several hours of exposures one night soon, and really bring the nebula out.

Anyway, enough for now...talk to you next month!

Roger

A couple of years ago, when I bought my Celestron 15x70mm binoculars, I found a great site done by Oberwerk, an optics company based in Colorado, that sells fine optics. The binoculars they sell, no matter the supplier, are thoroughly tested by them before they ship them out to their customers. They produced the following document about collimating binoculars, and it is directly applicable to the Celestrons. So, if you bought a pair (and I know that several members did), you will eventually need to collimate them.

Roger.

Binocular Collimation—Oberwerk Corporation, Dayton Ohio

A binocular is actually a pair of refractor telescopes joined together. The alignment between these two telescopes is called "collimation". Proper collimation is critical to a binocular's performance, and the user's viewing enjoyment. The brain can do a remarkable job of compensating for poor collimation, but has more trouble doing so on the night sky due to the much lower amount of visual information. For this reason, good collimation is especially critical for astronomical binoculars. Every Oberwerk binocular is thoroughly examined, tested, and collimated before shipping to our customers. But because collimation is occasionally lost due to rough handling during shipping, or from accidents (dropping the binocular), we are providing instructions for collimation here.

Surprisingly, collimation adjustment is easiest to perform in daylight. Collimation can be quickly be checked by viewing an object with distinct horizontal and vertical lines, such as a house, building, or fence, at least 100 yards away. It is best to do this outdoors, as viewing through a window can cause distortion from diffraction. Begin by focusing on the object. Alternate viewing with the left and right eyes by gently closing one eye at a time. Alternate eyes about once per second. Relax your eyes as you do this so they are not compensating for misalignment. Notice that the object will move somewhat as you alternate eyes, the same as if you were doing the blink test without looking through a binocular. A slight amount of horizontal movement (to the left with the left eye, and to the right with the right eye), is normal (same as doing the blink test on the target without the binocular). Excessive horizontal movement, or any amount of vertical movement (see pic at right), should be corrected.

To check vertical collimation, look at a distinct horizontal line, such as a roof line, gutter, or fence rail. Slowly move your eyes back from the binocular until they are about 4 inches away, while maintaining the view of the horizontal line in eyepieces. Let your eyes relax and focus more on the image at the eyepieces rather than through the binocular. Even a slight vertical miscollimation will now be readily shown as a difference in position of the horizontal line (see pic at right).

Now that we can determine collimation problems, how do we correct it? The secret is the porro prism adjustment setscrews hidden under the rubber armor close to the edge of the prism covers, as shown in the picture at the lower right. Note that models without rubber armor (20x80 Deluxe and 22x100) have setscrews in the same position, accessible through small holes in the binocular body. In either case, you'll need a rather narrow jewelers screwdriver to adjust the setscrews. For rubber-armored models, use the screwdriver to carefully lift the rubber covering to reveal the setscrews. If you don't stretch the rubber any more than necessary to reveal the setscrews, the rubber will snap back to original position when you are done. The setscrews may be rather difficult to move, and some downward pressure may be necessary to prevent stripping of the setscrew slot.

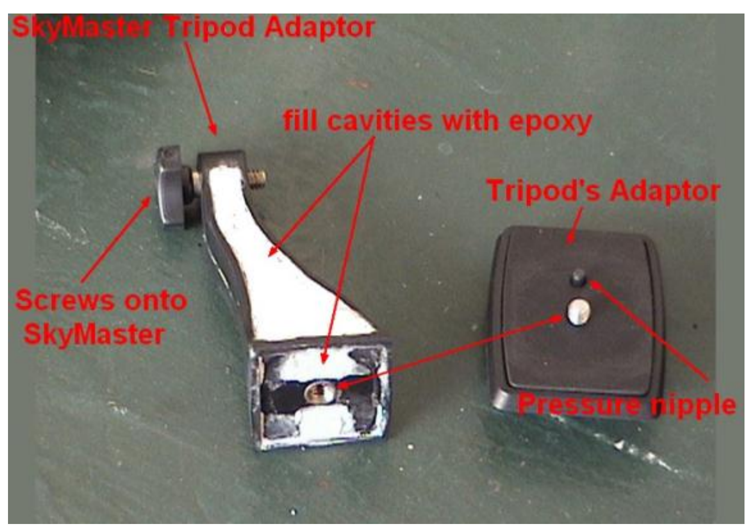
The setscrews move the image in the same direction as the screw. So when screwing the right setscrew inward (clockwise as viewed from above), the right image will move downward and also to the left. Unscrewing the right setscrew (counter-clockwise) moves the image upward and also to the right.

The left setscrew works in the same manner for the left image. Turning the setscrew clockwise moves the image in the left side down and to the right, counter-clockwise moves it up and to the left.

Typical minor miscollimation can usually be corrected by tightening just one setscrew. The key is to determine which side needs to move, and how much it needs to move. Make adjustments in very small increments, moving the setscrew as little as possible, and frequently checking progress by using the above visual tests. To correct for horizontal miscollimation, where excessive left-right difference exists between the left and right views, requires moving both setscrews. Move them both inward to push the images downward and toward each other. Make sure that you end up with perfect vertical alignment. A slight amount of left right movement between the two images is acceptable- in other words, the left image should be slightly to the left, and the right image, slightly to the right. Under no circumstances should the images cross over to the opposite direction- this will quickly cause a headache if viewing for any length of time.

Using the above techniques should allow you to obtain perfect collimation. The ultimate test is to view the night sky. Bright objects such as Jupiter should be well merged, with no double images. Perfect collimation will allow you to view for extended periods with no eyestrain or headaches.

Fixing the Tripod Adapter—Roger Hill



The other thing that you'll have to do is fix the tripod adapter. A workable, if not perfect, solution is to pick up some Epoxy Putty from Canadian Tire and fill in all the cavities.

Dave Surette noted that the adapter can be made even stiffer with the addition of some 2" finishing nails added to the mix. I believe that this is an excellent idea, and I wish I'd known about it before I did mine.

Either way, adding epoxy turns the adapter from a marketing gimmick to a useable accessory.

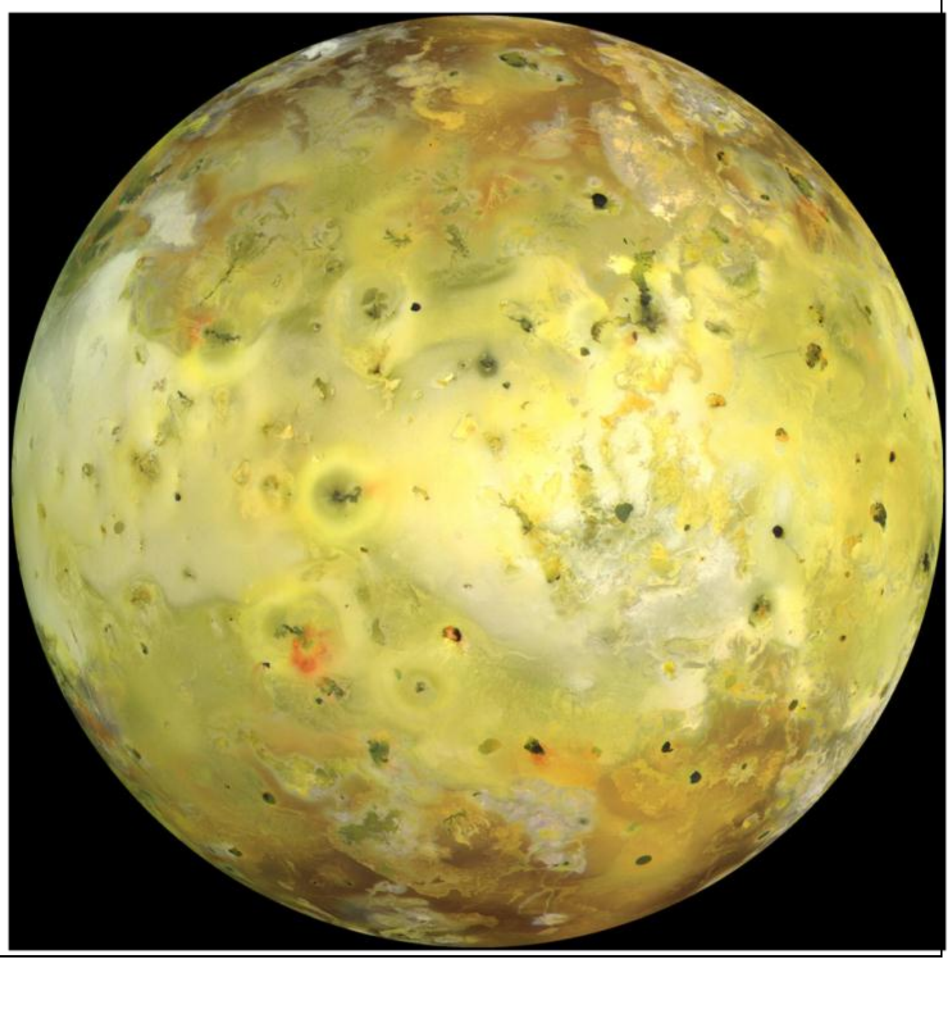
The most volcanically active place is out-of-this-world! By Dr. Ethan Siegel

Volcanoes are some of the most powerful and destructive natural phenomena, yet they're a vital part of shaping the planetary landscape of worlds small and large. Here on Earth, the largest of the rocky bodies in our Solar System, there's a tremendous source of heat coming from our planet's interior, from a mix of gravitational contraction and heavy, radioactive elements decaying. Our planet consistently outputs a tremendous amount of energy from this process, nearly three times the global power production from all sources of fuel. Because the surface-area-to-mass ratio of our planet (like all large rocky worlds) is small, that energy has a hard time escaping, building-up and releasing sporadically in catastrophic events: volcanoes and earthquakes!

Yet volcanoes occur on worlds that you might never expect, like the tiny moon Io, orbiting Jupiter. With just 1.5% the mass of Earth despite being more than one quarter of the Earth's diameter, Io seems like an unlikely candidate for volcanoes, as 4.5 billion years is more than enough time for it to have cooled and become stable. Yet Io is anything but stable, as an abundance of volcanic eruptions were predicted before we ever got a chance to view it up close. When the Voyager 1 spacecraft visited, it found no impact craters on Io, but instead hundreds of volcanic calderas, including actual eruptions with plumes 300 kilometers high! Subsequently, Voyager 2, Galileo, and a myriad of telescope observations found that these eruptions change rapidly on Io's surface.

Where does the energy for all this come from? From the combined tidal forces exerted by Jupiter and the outer Jovian moons. On Earth, the gravity from the Sun and Moon causes the ocean tides to raise-and-lower by one-to-two meters, on average, far too small to cause any heating. Io has no oceans, yet the tidal forces acting on it cause the world itself to stretch and bend by an astonishing **100 meters** at a time! This causes not only cracking and fissures, but also heats up the interior of the planet, the same way that rapidly bending a piece of metal back-and-forth causes it to heat up internally. When a path to the surface opens up, that internal heat escapes through quiescent lava flows and catastrophic volcanic eruptions! The hottest spots on Io's surface reach 1,200 °C (2,000 °F); compared to the average surface temperature of 110 Kelvin (-163 °C / -261 °F), Io is home to the most extreme temperature differences from location-to-location outside of the Sun.

Just by orbiting where it does, Io gets distorted, heats up, and erupts, making it the most volcanically active world in the entire Solar System! Other moons around gas giants have spectacular eruptions, too (like Enceladus around Saturn), but no world has its surface shaped by volcanic activity quite like Jupiter's innermost moon, Io!



Io. Image credit: NASA / JPL-Caltech, via the Galileo spacecraft.

Image processing—Michael Covington

How I use DeepSkyStacker

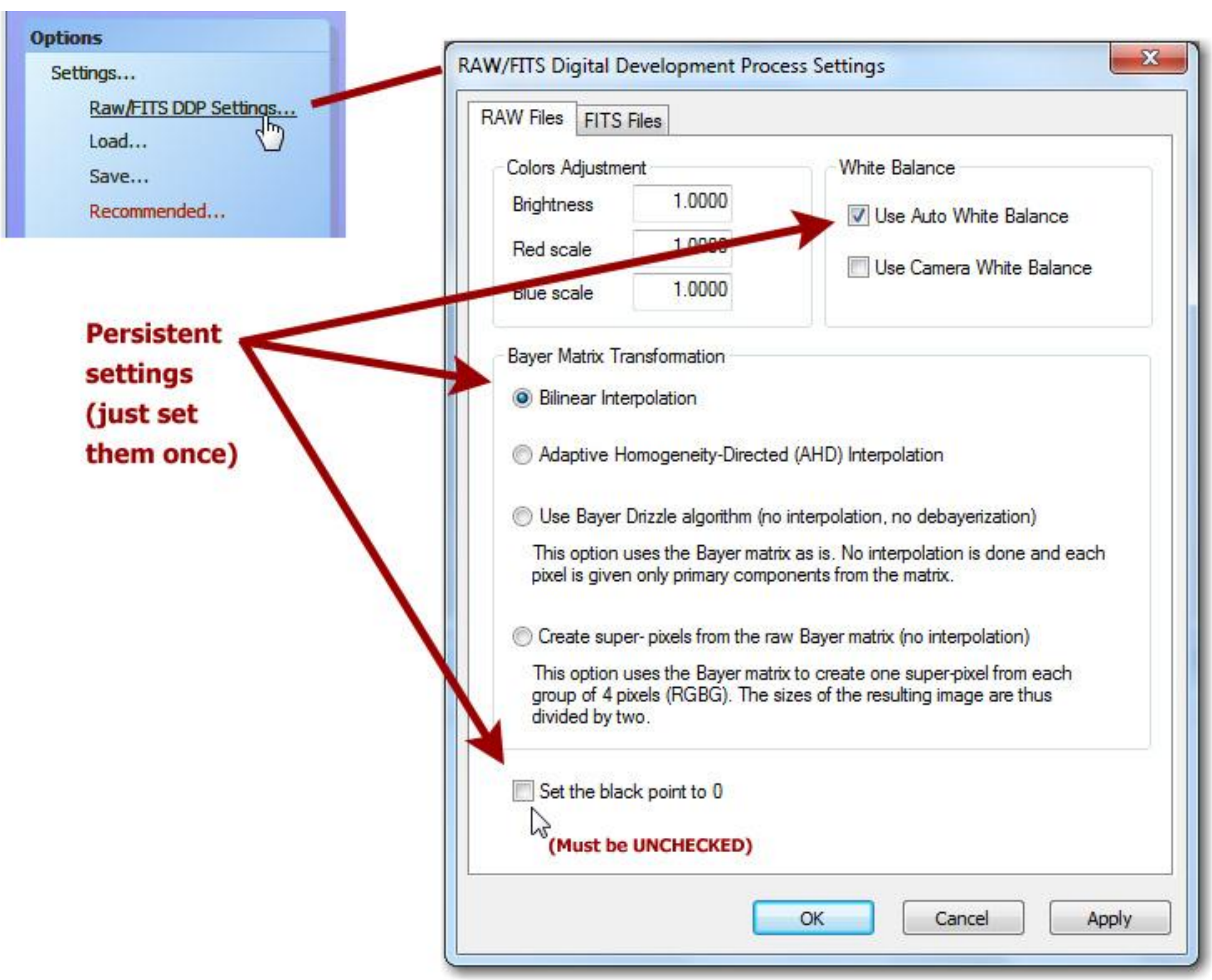
Although I still recommend MaxIm DL, Nebulosity, and other software tools, I've switched to DeepSkyStacker for nearly all my deep-sky work. It is free, easy-to-use-and reliable. Whereas MaxIm DL enables you to do *anything* with a digital image, DeepSkyStacker guides you through the *normal* way of processing an image, with plenty of safeguards to keep sleepy astronomers from making mistakes.

You can get the release version of DeepSkyStacker here. However, if you have a newer-model (2010 or later) DSLR, you probably need the "beta version," which is actually quite stable and is available here. (Using the old version with a new camera will give you incomplete or misshapen pictures.)

DeepSkyStacker has its own Wiki, here, as well as a Yahoo discussion group. What follows is a quick run-through of how I use it. I'm always working with raw (.CRW, .CR2) images from Canon DSLRs, and I always have dark frames and usually have flats and flat darks.

Note that if you have flats, you also need flat darks. You do not need bias frames in DSLR work provided you make the settings described here.

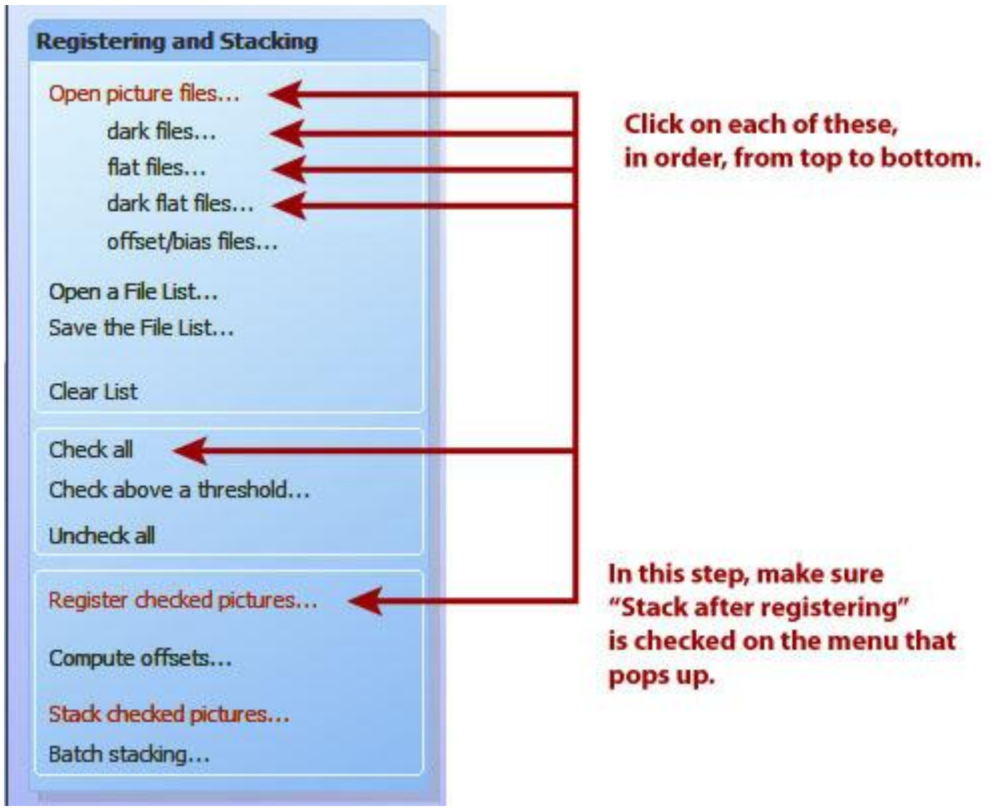
The first time you run DeepSkyStacker, you should make three important settings, which will stick once you've used them for a processing run (but not if you just set them and exit):



It's a good idea to make sure these settings really did stick; I've had one or two unexplained instances of one of them resetting to default, probably through a mistake of my own rather than a program bug.

(*Hint:* If you will be content with a picture that has 1/4 as many pixels as the original, such as 4 megapixels from a 16-megapixel camera, choose "superpixel mode" instead of bilinear de-Bayerization. You will get a picture 1/4 as big as the original, but it will be devoid of color noise and will have greater color accuracy and smoothness. Remember that 4 megapixels will make a sharp 24×36-inch print.)

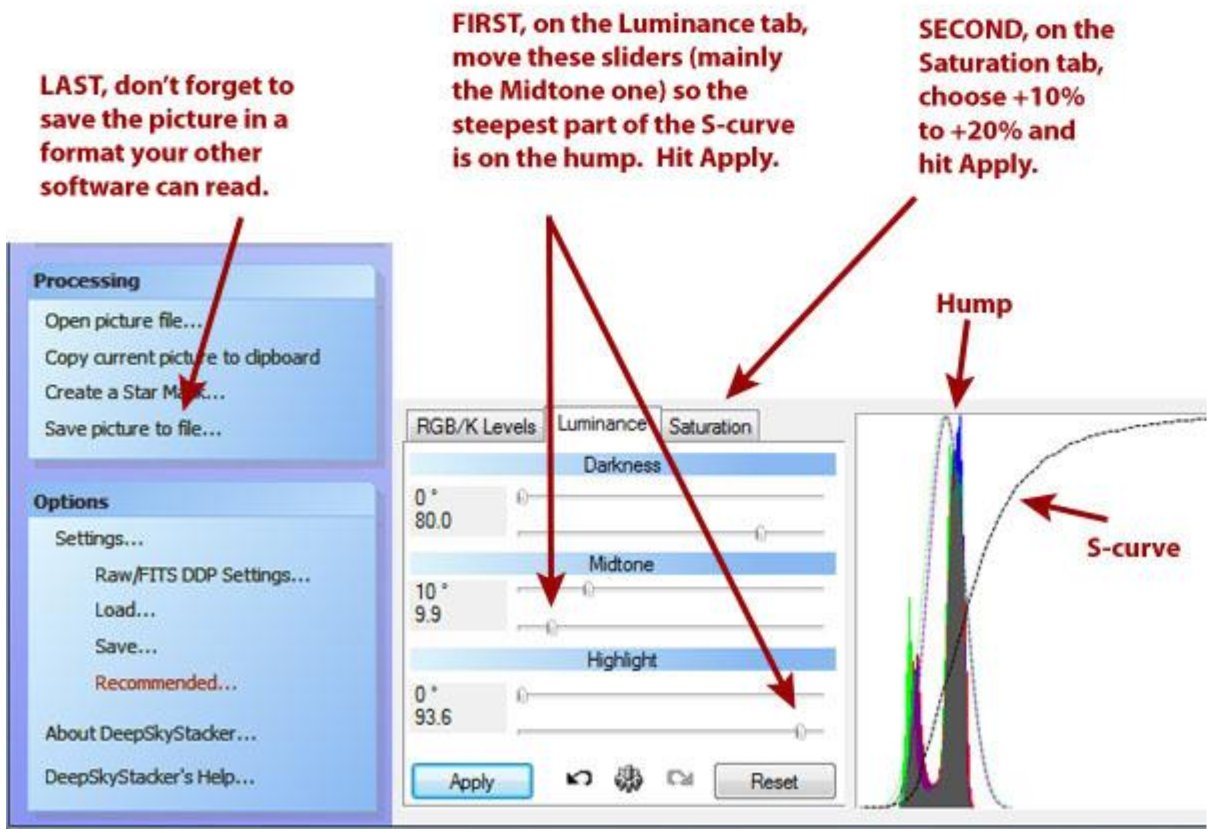
Then, in any single processing run, all you do is this:



You will want to check the stacking parameters, too. The defaults will work but may not be optimal. I like to use kappa-sigma image combining for the images and for all types of calibration frames (which means you probably need to select it in four places).

As soon as stacking finishes, your picture is stored as **Autosave.tif** in the same folder as the image files. It's a 32-bit floating-point (rational) TIFF, and you may prefer to open it with PixInsight or 64-bit Photoshop and take it from there. *Note: It will not open in 32-bit Photoshop; you'll get a misleading out-of-memory error.* If you have a 32-bit operating system, proceed with the following steps and save as a 16-bit TIFF.

I usually do some adjusting of the gamma correction (S-curve) and color saturation in DeepSkyStacker:



In principle, all the contrast and brightness adjustment can be done in DeepSkyStacker, outputting the finished product, but I choose not to do so. You can't resize a picture in DeepSkyStacker.

The "Save picture to file" button gives you the ability to save in formats other than 32-bit TIFF. If you don't have PixInsight or 64-bit Photoshop, you'll probably want to have DeepSkyStacker save in a more widely used format, such as 16-bit TIFF, which other software will understand. But I'm using Photoshop CS3 or later under 64-bit Windows, so I go with 32-bit and open the file in Photoshop, then do the following:

(1) Adjust levels. The Auto Levels and Auto Color commands often do the trick, or nearly so. Then I hit Ctrl-L and move the three sliders as needed. The middle slider may have to go to the left or the right; try both, and don't get stuck thinking it always goes the same way.

(2) Image, Mode, 16 bits, so that more Photoshop functionality will be available.

(3) Reduce noise. The noise reducer is under Filters, Noise. Reducing color noise is especially important. If your version of Photoshop doesn't have this filter, there's a third-party product called Neat Image that does much the same job.

(4) Crop and resize the image as needed.

(5) Image, Mode, 8 bits, and save as JPG. But I also keep a 16-bit TIFF in case further editing is needed.

Dark-frame subtraction in the camera?

The following is about a subtle mathematical point that Sander Pool raised on the DeepSkyStacker mailing list. At first I didn't understand him; as I said, it's subtle. I thank him for taking the time to clarify it.

Whenever a DSLR takes an exposure longer than about 1 second, it's desirable to subtract a matching **dark frame** from it. That is a matching exposure taken with the lens cap on and/or the shutter closed. The reason is that all of the sensor pixels have a small amount of electrical leakage that makes them give nonzero readings even when there is no light. Some of them have quite a bit of leakage, and that's why a long-exposure picture often seems to be peppered with brightly-colored specks.

Most DSLRs will take and subtract a dark frame for you automatically. They call it **long-exposure noise reduction** and it's a menu setting. Take your 5-minute exposure, and then the shutter closes and the camera takes another 5-minute exposure, performs the subtraction, and stores the result in the raw and JPEG files.

Astrophotographers often do it a different way. We do **batch dark-frame subtraction**, where we take a series of exposures (usually many of the same celestial object), then a matching set of dark frames, and we do the subtraction with software. The software first combines all the dark frames into one averaged one, then applies it to all the images.

This has two obvious practical advantages. You can save time by taking the dark frames in a batch, at the end of the session, rather than in between exposures. My camera often finishes up the dark frames, under automatic control, with the lens cap on, while I'm taking down the other equipment or even during the ride home. And the other advantage is that if the software is smart enough, and one of the dark frames happens to have been hit by a cosmic ray (causing a non-reproducible bright spot), it can recognize the bright spot as deviant and throw it away automatically.

But the question was: **Apart from those two points, is there any advantage to doing things one way or the other? Which is best?**

The obvious appeal of in-camera dark-frame subtraction is that it's automatic, and you can be sure the dark frame is a good match to the image. It is taken immediately afterward, with the sensor at the same temperature and all the settings the same.

With that in mind, I asserted that *it makes no difference* which method you use, as long as the numbers of frames are the same and (in the batch method) the dark frames are combined with simple averaging.

Not exactly. Here's the subtle part.

Usually, we take multiple exposures of the same celestial object and then **align and stack** the images. That is, we allow for variations in telescope tracking by having the software align the images before combining them.

Consider now a situation where there are 3 image frames and 3 dark frames, and consider the pixel at location (x,y) in the finished picture.

If alignment has been done, pixel (x,y) in the finished picture corresponds to three different pixel positions in the original images. Call them (x_1,y_1), (x_2,y_2), and (x_3,y_3).

Now then. If the dark-frame subtraction was done in the camera, then each of these image pixels, (x_1,y_1), (x_2,y_2), and (x_3,y_3), was corrected against the corresponding position in *one* dark frame. But if the dark-frame subtraction was done as a batch, then each of them was corrected against *the average of all the dark frames* in that particular pixel position. And that should be a much more accurate estimate of the actual leakage value at that point in the image, because it smooths out random fluctuation.

So the batch method wins — but *only if you are aligning images before stacking them*. If the images are already perfectly aligned, so that each pixel in the finished picture corresponds to the same pixel position in all of the input frames, then the techniques are equivalent, because averages are averages.

I think the practical difference will be small and will be most evident when the number of dark frames is moderately small (like 3 to 6). Maybe someone will do an experiment and give us some actual results.

We are listening—
Diane Ackerman (1948—)

I
As our metal eyes wake
to absolute night,
where whispers fly
from the beginning of time,
we cup our ears to the heavens.
We are listening
on the volcanic rim of Flagstaff
and in the fields beyond Boston
in a great array that blooms
like coral from the desert floor,
on highwire webs patrolled
by computer spiders in Puerto Rico.
we are listening for a sound
beyond us, beyond sound,
searching for a lighthouse
in the breakwaters of our uncertainty,
an electronic murmur,
a bright, fragile I am.
Small as tree frogs
staking out one end
of an endless swamp,
we are listening
through the longest night
we imagine, which dawns
between the life and times of stars.
II
Our voice trembles
with its own electric,
we who mood like iguanas,
we who breathe sleep
for a third of our lives,
we who heat food
to the steaminess of fresh prey,
then feast with such
good manners it grows cold.
In mind gardens
and on real verandas
we are listening,
rapt among the Persian lilacs
and the crickets,
while radio telescopes
roll their heads, as if in anguish.
With our scurrying minds
and our lidless will
and our lank, floppy bodies
and our galloping yens
and our deep, cosmic loneliness
and our starboard hearts
where love careens,
we are listening,
the small bipeds

The Star—
Jane Taylor (1783-1824)

Twinkle, twinkle, little star,
How I wonder what you are,
Up above the world so high,
Like a diamond in the sky.

When the blazing sun is set,
And the grass with dew is wet,
Then you show your little light,
Twinkle, twinkle, all the night

Then the traveler in the dark
Thanks you for your tiny spark,
He could not see where to go
If you did not twinkle so.

In the dark blue sky you keep,
And often through my curtains peep,
For you never shut your eye
Till the sun is in the sky.

As your bright and tiny spark
Lights the traveler in the dark,
Though I know not what you are,
Twinkle, twinkle, little star.

What you missed in November.

The November meeting was another good one., and not just because of the main speaker, either. New President Gary Colwell did a good job of trying to get the meeting moving along at a brisk pace; there was lots of interesting information and the usual begging by some Board members for help in the things they're trying to do for the Centre.

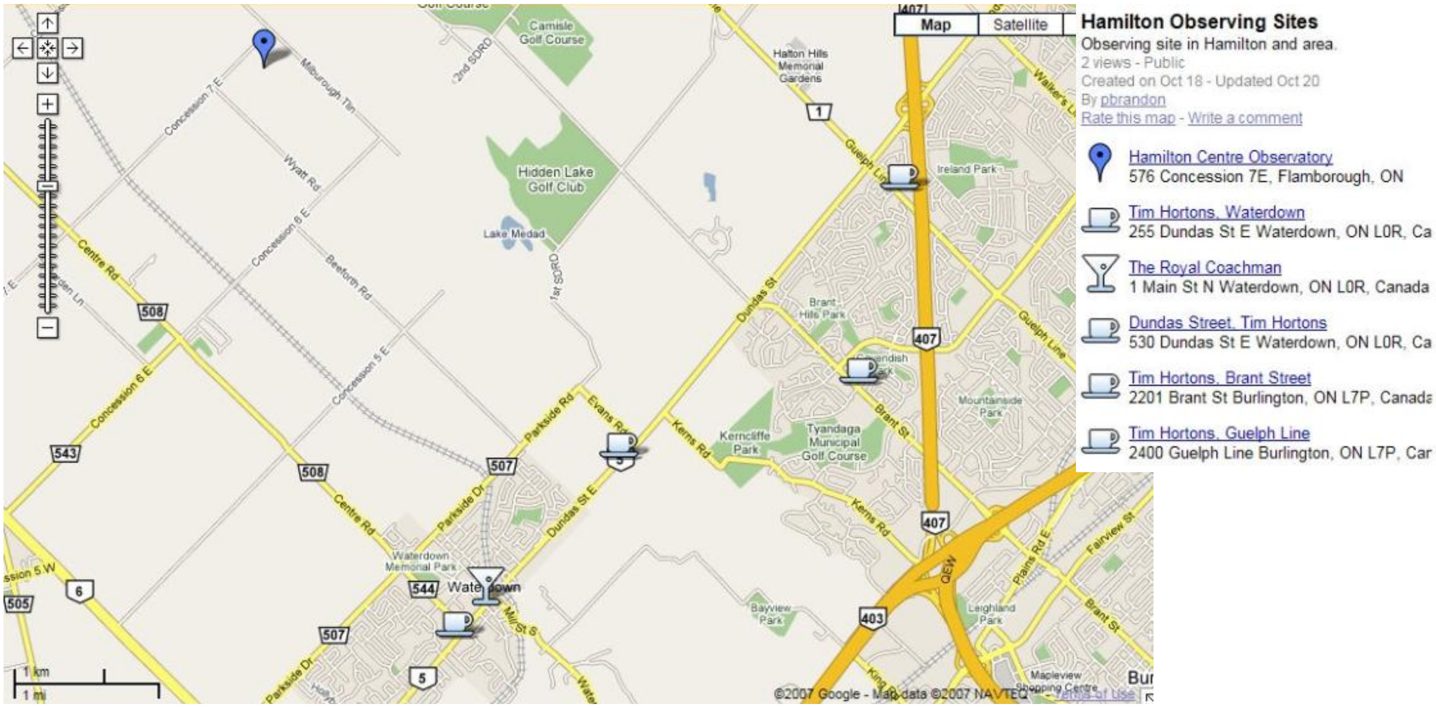
Let me add something about that last comment. The Board members do their best to plan events and speakers around the perceived interests of the membership. The problem is that we could use some more "do-ers", or at least some feedback.

Anyway, back to our regularly scheduled précis of the last meeting.

Gary Bennet talked about "**What's Your Idea of Astronomy Fun?**", following up on last months article, and got some feedback. Colin Haig brought us the latest from National Office, and there were some reports by the Board members.

The star of the show, though, was Murray Romisher and his MalinCam. A MallinCam is a device that takes images using a very sensitive surveillance camera, stores them, and then stacks together a certain number of them for display on a video screen.

Should we get one for the Observatory for Public Outreach? Let us know!



576 Concession 7 East, Flamborough ON
N43° 23' 27" W79° 55' 20"

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2266 Lakeshore Rd. W.
Oakville, Ontario
L6L 1G86L 1G8

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Gary Bennett, Membership Director / AstroCATS Chairman
Jason Blane, Observatory Director
Roger Hill, Orbit Editor
Bill Legitt, Treasurer
Mark Pickett, Outreach Director / National Council
Shawn Preston, IT Director
Dave Surette, Secretary
Andy Blanchard, Past President / AstroCATS Co-Chairman

Calendar for December, 2013

Mon	Tue	Wed	Thu	Fri	Sat	Sun
						01
02	03	04	05 • 8pm» Public Monthly Meeting • 8pm» Public Monthly Meeting	06	07	08
09	10	11	12 • 8pm» RASC Board Meeting	13	14	15
16	17	18	19	20	21	22
23	24	25	26	27	28	29
30	31					