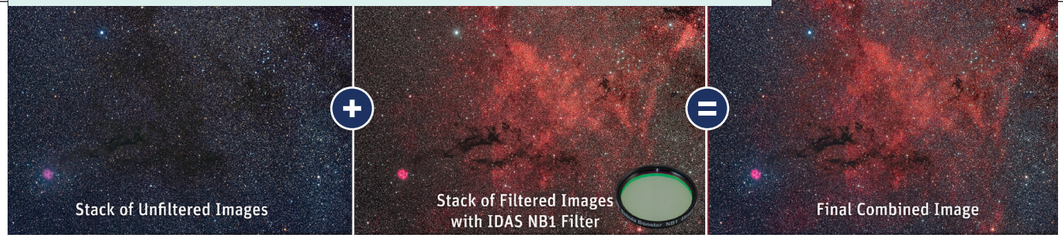
Filtering the Lion Nebula: Bringing out the rich reds and greens in and around the Lion Nebula (Sh2-132) in Cepheus required narrowband filters to isolate the light from the nebulosity. This is a stack of 48 sub-frames taken over two nights, with a Sharpstar 94mm EDPH refractor, a Canon Ra camera and IDAS filters.

Fun with filters

Story and images by Alan Dyer

Adding the right filter can make a big improvement to your astrophotos at a relatively modest cost. A revolution in camera filters over the last few years means there are many new options to tempt astrophotographers. Here's my guide to the filters I've found most useful, with emphasis on those that work well with DSLR and mirrorless cameras. However, these filters are also suitable for use with cooled astrophotography cameras of the "one-shot-colour" variety.

Best of both worlds: While a narrowband filter can bring out oodles of nebulosity, it can discolour stars. The final image combines a more natural unfiltered view with the filtered stack.



Enhancing nebulae with narrowbands

The greatest change in filter choice in recent years has come in this category: dual narrowband filters designed specifically for deep-sky imaging. These filters let through only narrow swaths of light centred on two bands: the red Hydrogen-alpha wavelength of 656.3 nanometres (nm) and the twin green Oxygen III wavelengths at 495.9 nm and 500.7 nm. They are available in two-inch (48mm) sizes for use with telescopes, but not in sizes big enough to fit in front of lenses.

Narrowband filters differ in the width of their bandpass, with the most affordable models (CAN $200 to $300) having the widest bandpasses, usually 15 nm to 30 nm wide. Narrowband filters offer excellent enhancement of nebulae and suppression of light pollution, much more so than broadband filters, discussed on the next page.

Examples of this class that I have tested include the Optolong L-eNhance and IDAS NB1, with the IDAS models less prone to halos around bright stars. I found this class of filter requires exposure times two to four times longer than with no filter, plus shooting as many "sub-frames" as the night will allow, for later stacking.

Even more selective in their transmission are filters such as the Optolong L-eXtreme and IDAS NBZ, with bandwidths as narrow as 7 nm to 10 nm. As bandwidth narrows, rejection of light pollution improves, making these ultra-narrow filters better suited for use in urban backyards, though only for recording emission nebulae. However, exposure times need to be even longer, and the cost is higher still, upward of CAN $400 or more for a two-inch filter.

Several companies such as Antlia have introduced even narrower 3 nm and 5 nm filters with dual passbands. The most costly models offer tri- or even quad-bandpasses to also take in the nebula emission lines for blue-green Hydrogen-beta (486.1 nm) and deep red Sulphur II (671.6 nm), all with sub-5 nm bandwidths, for CAN $1,000 or more! Some photographers find the high cost justifiable, reasoning that such filters can eliminate the time and cost of travelling to dark-sky sites.

As I shoot from my reasonably dark rural home, I prefer to use the less costly, wider dual-band filters, which allow me to take both filtered and unfiltered images during a session to combine later, as I show above. Doing so retains the natural star colours from the unfiltered shots, while bringing out the faintest wisps of nebulosity the filters help record.

For advice on buying the more specialized filters for monochrome astrophotography cameras, see Brian Ventrudo's filter guide in the September/October 2021 issue of *SkyNews*.

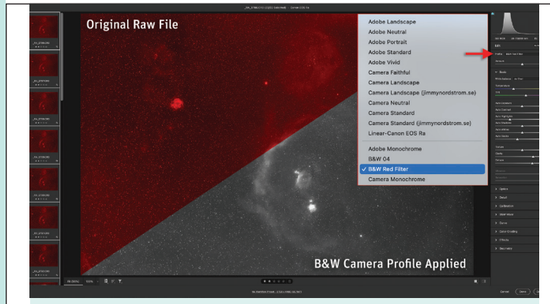
Fuzzy filters

With lenses and cameras getting ever sharper, it might seem odd to buy a filter to purposely spoil that sharpness. But adding a soft-focus diffusion filter can enhance nightscapes and constellation portraits by making bright stars pop out with more colour and with photogenic glows around them.

I've long used a Kenko Softon A filter, though it is now hard to find. A Pro-Mist filter from Tiffen (see tiffen.com/collections/shop-all/products/pro-mist-screw-in-filter), designed for glamour photography, will work well in a #2 or #3 strength. The Kase filter company offers their Starglow filter under the imprimatur of astrophotographer Alyn Wallace (see kasefilters.com/product/kase-wolverine-starglow-100mm-alyn-wallace-special-edition). While this filter is made specifically for softening stars, I find its effect a little strong.

However, with any such filter, the best practice is to shoot images with and without the filter. Blend the fuzzy-filter image onto the sharp version in a layer-based program such as Photoshop, using a Lighten blend mode. That way, you can choose how much fuzziness you want by adjusting the opacity of the filtered layer. To ensure the images align, you must shoot all of them with the camera on a sky tracker.

Layering in star glows: By themselves, diffusion filters produce too strong an effect. Layer their fuzzy-star images on top of unfiltered images using a Lighten blend mode.



Monochrome conversion: Even when set to a monochrome picture style, DSLRs and mirrorless cameras record colour images. When used with a Hydrogen-alpha filter, raw files must be converted to black and white in processing by applying a monochrome profile.

Hunter by moonlight: A Hydrogen-alpha filter recorded Orion's rich nebulosity, despite a waxing gibbous Moon. This is a stack of 24 four-minute frames with the red-sensitive Canon Ra.

Seeing red

All the other filters I describe are designed for colour cameras. A filter I've found fun to use produces a black-and-white image — or rather a deep red one that must be turned into black and white. A Hydrogen-alpha (Ha) filter lets through only the red light from hydrogen atoms and is normally used with monochrome cameras.

But paired with my factory-modified Canon EOS Ra camera, it can produce fine wide-field portraits of the sky in black and white, creating the celestial equivalent of images from the masters of black-and-white landscape photography.

The advantage of such a selective single-band filter (I use a 12nm Astronomik) is that it can be used under moonlight, provided the sky is very clear and the Moon isn't too close to the field of the camera.

However, Ha filters and any of the dual narrowband filters are best used with DSLR or mirrorless cameras that have been modified to record more of the deep red Ha wavelength. When I tried shooting through a narrowband filter with my stock Canon R6 camera, I got very murky results.

At least two suppliers in Canada will perform camera modifications: Astro Mod Canada (astromodcanada.com) and Night Sky Camera (nightskycamera.com).

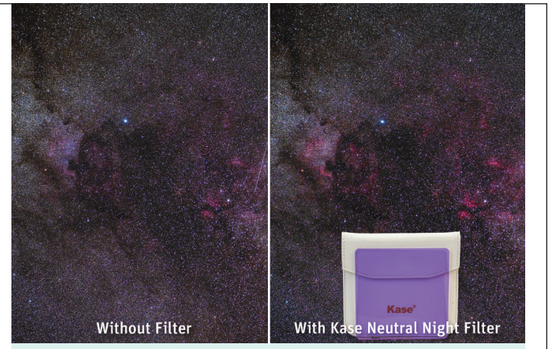
Beating back light pollution

The bane of all astrophotographers, light pollution, can be countered in part with the right filter. Broadband filters reject yellow and blue light, colours that are prominent in artificial lights, while transmitting wide bands of red and green light, the wavelengths emitted by glowing nebulae. Some brands label these as CLS filters, for "city light supression."

Freewell, Haida, Kase, K&F Concept, NiSi and Urth (search online) offer broadband filters to go over the front of lenses, making them suitable for nightscapes and constellation photography with all cameras.

I've tested broadband filters from several companies and found they all produce similar, though subtle, results. On nightscapes with prominent horizon glows from nearby towns, they do help reduce the discolouration from light pollution. But I've never found they make as dramatic a difference as the advertising might lead you to believe.

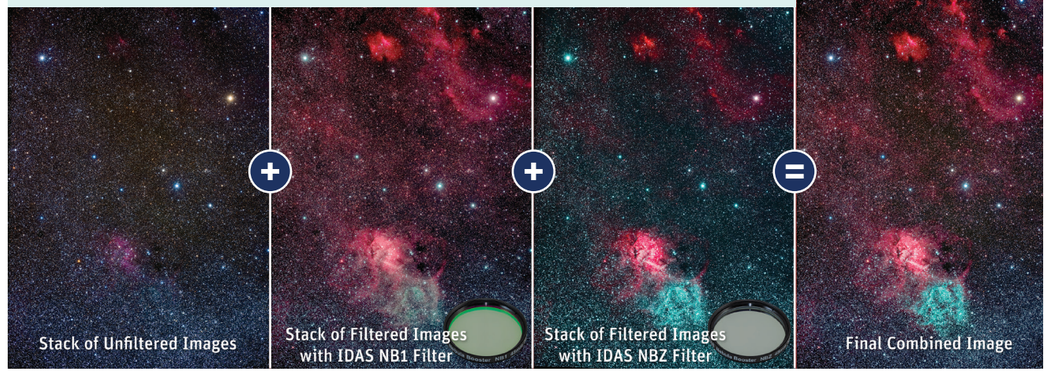
Where such broadband filters do help is enhancing the visibility of red nebulae along the Milky Way when shooting from sites that are relatively dark. Broadband filters can also suppress unsightly sky gradients in wide-angle tracker shots.



Broadband subtlety: Light pollution rejection filters (a Kase Neutral Night is shown) can enhance red nebulae, even with a stock (unmodified) camera, a Canon R6 in this example.

While a bit more selective in its transmission bands, the L-Pro filter from Optolong falls into the broadband class as well. However, it is available only in sizes suitable for use with telescopes, or in formats that clip into camera bodies, a choice I find does not always work well, as I describe next.

A multi-filter Lion: A narrowband filter, the IDAS NB1, recorded the red Hydrogen-alpha nebulosity well, but it took the even narrower IDAS NBZ to bring out the Lion's Oxygen III cyan tones.



Where do filters go?

The easiest place to put a filter is over the front of a lens. This is the only choice for soft-focus starglow filters and the best choice for broadband filters. A filter in front of a lens does not shift the focus point of the lens or change its optical performance.

Some broadband filters are available in units that clip into the bodies of DSLR or mirrorless cameras. This sounds attractive, as the one filter can then be used with any lens or telescope attached to the camera. But that position shifts the focus point of the optics. The thicker the filter glass, the greater the focus shift.

With some wide-angle lenses, I've found that focus shift can introduce horrible lens aberrations at the corners of the frame. I would not recommend "clip-ins" for wide-angle nightscape shooting. Clip-ins do work well with longer focal length lenses and telescopes.

Many telescope-to-camera adapters offer threads to screw in two-inch (or 48mm) filters. As I like to swap filters in and out during a session, I've purchased filter drawers that make it easy to change filters without having to remove the camera; just refocus it.

The shallower lens-mount-to-sensor distance of mirrorless cameras makes it possible to add such a filter drawer into the imaging path, while maintaining the standard 55 mm distance between telescope and sensor that most astrophoto scopes require.

While filters can be confusing to choose, and a challenge to place into the light path, the payoff can be much better astrophotos, whether taken from a dark site or, as can now be done, shot from light-polluted backyards. ✶

Filter Formats

Front-mounted filters: Filters for lenses come as screw-on models in various diameters, or as square filters (aimed right) to slide into holders adaptable to several filter thread sizes.

Clip-in filters: Because they insert into a camera body, these filters will fit only specific cameras, but they will work with a range of lenses or telescopes.

Filter drawer convenience: This filter drawer from AstroHutech.store works with mirrorless cameras. It goes between the usual T-ring and the camera body, facilitating filter changes.