# Astronomical optical filters

Optical filters are frequently used in astronomy, mostly to enhance the appearance of objects.

## Ocular Filters

These small visual filters screw into the standard rear thread of 1.25” eyepieces. Their bigger brothers are used for those with 2” eyepieces.

**Lunar filter** – A neutral density filter used when observing the Moon to cut down the glare. It makes for much more comfortable and detailed viewing and prevents much of the loss of dark adaption that would otherwise ensue.
Example: Orion 13% Transmission Moon Filter

**Planetary filters** – These are Wratten filters (i.e coloured glass) intended to enhance visual features of planets. There are particularly good guides to their application at:
http://agenaastro.com/choosing-a-color-planetary-filter.html
http://www.telescopes.com/telescopes/howdifferentfilterscanbetteryourviewarticle.cfm
If you’ve got a really good planetary telescope, you would find such filters quite useful.

**Light Pollution Reduction filter** – This LPR filter does just what it says. For those observing sites where light pollution is a problem, especially from street lamps, it will block some of the troublesome back glare from the sky. These are interference filters, thin evaporated films on a glass substrate. The big advantage being that they are stackable on the same substrate to block several emission lines. Sometimes also known as an Ultra High Contrast (UHC) filter or a Skyglow filter. Inexpensive ones just block the light from narrow-band mercury fluorescent street lights (that dreadful green/blue light that makes people look ill). Better ones also block the emission lines of the low-pressure sodium (deep yellow) ones too. Note carefully, the light from high-pressure sodium (bright golden colour) and the modern white LED lights are broad-band and can’t really be blocked. A good LPR filter will noticeably render the background sky a lot darker, the downside is that all objects will be given a colour cast, often cyan.
Example: Lumicon filters (really good quality), Orion.

**Nebula filter** – This is an advanced form of LPR filter, but designed to mostly allow the important emission bands of deep-sky objects and block almost everything else. Very useful for nebulae, etc., but again at the cost of cyan coloured stars.
Like the LPR filter and all interference filters, these work best when the incident light is normal to the filter surface.
Example: Lumicon filters (really good quality), Orion.

**Solar Hydrogen-Alpha filter** – This a specialist very narrow-band filter for observing the Sun, don’t confuse with a broader-band H-alpha filter for deep-sky objects. They are a “must have” for serious solar observers and can produce spectacular results. Ordinary solar filters just cut down on the light to make it safe to view. You can see sunspots, but not a lot else. Narrow-band H-alpha filtering will show up moving prominences, filaments, granulation, sunspots, etc. It can give quite spectacular views. Higher standard filter systems use an

etalon and can be tuned to show specific features in great detail. Some solar filters need a separate energy reduction filter. Do ensure that you get a fully compatible system. A “pick-n-mix” approach could be dangerous to eyesight. Coranado produce special solar telescopes. Examples: Coranado (now part of Meade) and best of all Solarscope (on the Isle of Man!).

## Photographic Filters.

These are exclusively used for CCD camera imaging. Modern SLR CCD cameras have been adapted for astronomical imaging. Indeed, some manufacturers produce models specifically adapted for this purpose. Most serious CCD imagers use one of the several really good dedicated astronomical camera systems. These usually fit a monochromatic CCD chip, so as to gather maximum light and detail. Hence they are usually fitted with a Filter Wheel, either internal to the camera body, or as an external device, for colour imaging. Specialist software organises both camera and filter wheel (e.g. Maxim DL). Astronomers usually use the FITS format for such images and stack a number of short exposures together, rather than use one long exposure per colour. Photoshop has a FITS extension freely available. There are a number of freely available software applications to assist astroimagers, e.g RegiStax.

**Colour filters** – Used to populate a filter wheel. A standard set comprises LRGB filters. The Red, Green & Blue filters are combined to give full colour information. The Luminance filter gives brightness information, while blocking Infra Red (CCD cameras are very sensitive to this!) and Ultra Violet light. This glass is the same thickness as the others so focussing is undisturbed.
A special set of colour filters is required for photometric work, not usually a popular aspect of amateur astronomy.
Example: SBIG, Lumicon

**Narrow-band filters** – These are for the more specialist imager. They are band-pass, centred on H-alpha, H-beta, OIII, SII, etc., emission lines. Very useful for capturing the fine detail of deep-sky objects. For most amateurs, the inclusion of a deep-red H-alpha filter in the filter wheel will suffice. Note well: the H-alpha filter for deep-sky work is not the same as that used for solar viewing. It has a much broader bandwidth.
Example SBIG, Lumicon

**Spectrograph** – technically not a filter, more an accessory. Such a device will split starlight into a visible spectrum. Thus being able to classify the star. But the main use is to characterise local skies so that a flat-field may be properly compensated.
Example: SBIG