A green laser pointer - why every astronomer should have one

Willie Koorts

One of the latest gadgets rapidly entering the astronomy world is the green laser pointer. Once you have one, it is amazing how many uses you find for it and soon you wonder how you ever managed without one. The most obvious use is to point out celestial objects in the night sky, but other useful applications include telescope polar alignment, as a finder and an aid with astrophotography.

Why green?

For use as a sky-pointer, the beam must be visible to enable an audience to see which object is being pointed out. The beam of the common red laser is not visible for one main reason – red light is scattered very little by the atmosphere because of its longer wavelength; the same reason why the sunset is red. Since blue light is scattered most (the reason why the sky is blue), one would think that a blue laser would work best. Blue laser pointers are commercially available and have been successfully employed as star pointers. However, they are very expensive compared to green lasers and therefore less attractive. Although less scattering occurs with green lasers, they have the advantage that they produce their light at around the wavelength where the sensitivity of our eyes peak and thus appear quite bright. Common green lasers operates at 532 nm and the sensitivity of the human eye peaks around 555 nm (green/yellow).

How bright?

The biggest complaint people had, particularly with early green lasers when used as star-pointers, was that only people close to the person doing the pointing could see the beam. From light-polluted city skies or when the moon lights up the sky, the beam soon becomes invisible. This problem is now solved with the appearance of high power green lasers at affordable prices.

Lasers are divided onto two main classes: Class IIIa (<5 mW) and Class IIIb (5-500 mW). The reason for the separation of classes at 5 mW is that Class IIIa lasers are safe to use as presentation pointers. Class IIIb lasers are too bright for this purpose and can cause eye damage when used without suitable eye protection.

Due to variations introduced during the relatively complicated manufacturing process of green lasers, the output power varies somewhat between individual production lasers. A green laser marked "<5 mW" will thus generally produce around 3 mW of actual laser power only. Practice showed that the use of these weak lasers as star-pointers is very limited or totally unsuitable.

Some green lasers are marketed to guarantee 5 mW laser power. These are often class IIIa lasers that have

been hand-selected and/or tuned to produce at the 5 mW limit. Other units are adjusted to increase their output to the 5-7 mW range. Terms like "OEM Modified" are often used here. Questions about reduced life-span arise if the modifications exceeds the design specifications of the laser diode. These lasers have been used with relative success to point out celestial objects to smaller groups, with reduced effectiveness in bright sky conditions.

Powerful green lasers with outputs of 15 to 125 mW are available now. Even the weakest of these models work extremely well as star-pointers. In fact, the other extreme can be reached with too powerful lasers, spoiling one's dark-adaptation, particularly when accidentally shining the laser into a nearby tree or building.

Manufacturers and prices

A few advertisements by local companies have prices starting at around R1300 but the class or output power is not clear, making them difficult to compare properly.

A number of suppliers can be found on the Internet. The most prominent ones are listed in Table 1. Note that shipping to South Africa adds about $20.

Supplier's website	Green laser pointers available
www.greenlasers.co.uk	This site has good information on how lasers work and instructions on how to modify them yourselves. Prices are around $79 for a 5 mW green laser.
www.laserglow.com	They offer a 35 mW for $339
www.greenlaserbeam.com	<5 mW for $80 15 mW for $200 95 mW for $500
www.z-bolt.com	<5 mW for $49 True 5 mW for $89 30 mW for $199
www.wickedlasers.com	15 mW for $99.99 35 mW for $159.99 55 mW for $209.99 75 mW for $259.99 95 mW for $369.99 125 mW for $499.99 (20 mW blue laser for $2499.99)

Table 1 A list of the most prominent suppliers of green lasers available on the Internet.

Caution

Although there is no law prohibiting the use of powerful green lasers in South Africa, they must always be used responsibly. They are illegal in the UK and an incident in America almost caused them to be outlawed there too, when the young daughter of an amateur was pointing it at a passenger plane at close range. Being shortly after 9/11, fears of blinding the pilot or eye damage to passengers were expressed. You should always handle them as you would treat a loaded firearm and not let children play with them.

Another reason for holding on tightly is, because of the very precise alignment of crystals inside the unit, a green laser is easily damaged when bumped or dropped. If you ever take one apart, be aware that the laser diode emits strong infra-red radiation which you cannot see and can cause eye damage.

The intensity of the beam can be compared to the brightness of Sirius. This 15-second, f/2.6 exposure registered stars down to magnitude 7. The laser was kept on for the full exposure time.

Testing a 15 mW "Wicked Laser"

A few months ago, I got a 15 mW green laser as a gift, the baby model from wickedlasers.com which I since tested under all sorts of conditions. Because I regularly do star-parties, sometimes involving big groups, one of the first things I wanted to determine was from how far away the beam is visible. I found that even under near full moon conditions, the beam could be clearly seen from more than 30 metres away, totally adequate for a large group. Since the beam of the 15 mW laser is claimed to have a range of about 8 km, parallax is not a problem – the beam is perceived by everybody to "end" at the object being pointed out, as if actually "touching" it.

I tried out mine in conditions raging from windy and damp to the clean, clear skies of the Karoo where there is less material to scatter the laser light. The beam was found to be equally visible and very easy to see throughout.

In an attempt to give an impression of what the beam looks like against the starry background, I took time exposure pictures and assembled them into a website. Another test compared a 15 mW Wicked Laser to a 7 mW Z-Bolt unit. The difference was quite remarkable and is best shown in pictures of these two being operated side-by-side. See www.saao.ac.za/~wpk/laser/ for more pictures.

Battery life is quite reasonable. It uses two AAA cells (alkalines are recommended) giving about three hours of use. Note that

for some reason, the batteries seem to fit the "wrong way around" to what we are used to with torches, so always check the instructions of your unit before powering it up for the first time.

Other uses

A green laser works extremely well as a finder in various ways. By either permanently mounting or just hand holding it into a groove which is parallel to the optical axis of your telescope, the beam becomes a visible pointer of where the telescope is pointing. This also works in reverse on GOTO mounts or other telescopes, if you want to see (naked-eye or with binoculars) where in the sky is the object currently in the eyepiece. Since the beam is visible in binoculars, you can very quickly direct someone where to aim their binoculars to find a particular object.

I found it invaluable when recently doing the polar alignment of an equatorial mount. I first used the laser to draw a "line" to check the N-S alignment of the polar axis and finally to confirm with binoculars that the mount was pointing at Sigma Octantis.

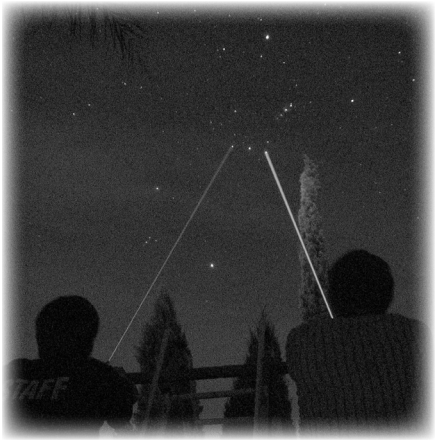
It is always hard to set up a camera-shot at night because of the difficulty of seeing exactly where the camera is pointing and the edges of the field of view, particularly with digital cameras. Because the spot and also the beam of the 15 mW registers in the LCD display of my digital camera, it is easy to "paint" the field of view to determine the camera's aim. Care is obviously needed when you have people in the shot, not to shine the laser in their eyes.

Conclusion

To be useful for star-pointing, avoid green lasers with output powers of less then 5 mW. The most useful lasers seem to be in the 7 to 30 mW range, with the ideal around 15 mW. A laser much brighter than this is an overkill and may cause loss of dark adoption.

For the brighter green lasers, Z-Bolt and Wicked Lasers offer the best value for money in terms of Rand per mW. You can get another 5% off on a Wicked Laser if you buy it via a registered owner's weblink, like www.saao.ac.za/~wpk/laser/

Overall, the green laser is an extremely versatile gadget for which I am still inventing new uses all the time. ☆



A side-by-side comparison between a 7 mW Z-Bolt laser (left) and a 15 mW Wicked Laser clearly shows the difference in brightness.