Armchair Astrophotography

I'm getting old! I can't bend down to peer through an eyepiece any more; and I can't see much there anyway. Also why are the nights when the stars are visible always so ruddy cold? What I want is to do my astrophotography from the comfort of a warm room with a cup of coffee at my elbow and a nice bright computer screen in front of me.

Fortunately, all this is possible. But you need some kit and some ingenuity.

First you need a telescope with some sort of computerised mount. I have a SkyWatcher 102 refractor on a SynScan Alt-Azimuth mount and it is this which I shall describe – but obviously other mounts will do the job equally well.

Second, you need a DSLR to fit onto your telescope. I have an old NIKON D50

Third you need a computer running some suitable software. I use Stellarium. I also use the SynScan app (available from SkyWatcher free) to actually control the telescope. Ignore advice to use any other software such as EQMOD or ASCOM. These are not necessary.

Fourthly you will need a suitable cable to connect your computer to the telescope outside and a USB extension cable to connect to your camera. You will also need some means of activating the shutter remotely – but more on that later.

The first thing to do is to focus your camera as accurately as you can. This can be done in daylight and once done the camera should be locked permanently in place. You must also tell both Stellarium and SynScan your location. You must also use the telescope configuration window in Stellarium to connect to your telescope. Now you are ready to start observing.

Aligning the telescope

Unfortunately, unless you possess a dedicated observatory with a fixed mount, the first thing you will have to do whenever you set up your telescope is to align it on at least one star. The most convenient start for winter observing is Sirius for two reasons: a) it is very bright and b) it is low on the horizon so you won't have to bend down too far to see it in the spotting scope and the viewfinder of the camera. So: bring up the alignment option in SynScan and select 'Brightest Star'. Synscan will prompt you for two stars. Enter Sirius as the first one and Aldebarran as the second. Now go outside and use the hand controller to slew the telescope onto Sirius. Centre it first in the spotting scope and then in the viewfinder as accurately as you can. Now go indoors quickly and click on the OK button to tell SynScan that the telescope is aligned on Sirius. In fact, assuming that your mount is level, this is all SynScan actually needs to fix the relation between Right Ascension/Declination coordinates and Alt/Azimuth coordinates.

SynScan will now slew the telescope to Aldebarran and you should see the reticle which represents the telescope in Stellarium slew onto Aldebarran. (It is SynScan which knows where the telescope is pointing and it conveys this information to Stellarium in RA/Dec coordinates.)

In the 'Brightest Star' alignment process, SynScan asks for two stars and gives you the opportunity to refine the alignment on the second star but you don't have to use this. Just click OK again. The alignment will be good enough. You can now use Stellarium to point your telescope at any object you are interested in simply by clicking on the object and then pressing Ctrl-1. (Stellarium sends the RA/Dec coordinates to SynScan which converts it to Alt/Azimuth coordinates and moves the telescope accordingly.)

Taking photos

The NIKON D50 does not have a socket for connecting a remote shutter release button. Instead it has an Infra-red sensor which is activated by a simple remote control available for less than £10. In order for you to be able to control the shutter from inside you must either be in visible sight of the front of the camera or you will have to do modify the remote control.

To do this you first need to peel back the thin plastic cover which is stuck onto the PCB from the bottom up. When you have peeled away half of it, two small screws will be revealed which when unscrewed will allow you to take the PCB out of the case.

Now the idea is to unsolder the IR LED and solder it back on to a long wire (making sure to solder it in the right way round). All you do then is to stick the LED to the telescope pointing towards the camera and, hopefully, you should be able to operate the shutter remotely from indoors.

The second thing to realise is that when the camera is connected to a USB port on your computer, the shutter is disabled. This means that, before pressing the remote you must disconnect the camera from your computer. You can either do this manually or, better, invest in a cheap USB expansion port with switches on the outputs like this one:

Since we shall always be using exposures of a couple of seconds or more, set the camera to Manual and Bulb exposure.

When you are ready to take an exposure, disconnect the camera from the computer, press the remote button once to open the shutter and once again to close it. Now reconnect the camera to the computer. In a short while you will be able to open the folders in the cameras memory chip and download the picture you have taken onto your computer.

Using a regular spotting scope

Even finding Sirius in my spotting scope is not that easy. Fitting some sort of gun sight to your telescope is an enormous help. I found that the field of view of my spotting scope was about 4 degrees – only twice as big as the image in the camera's viewfinder. I soldered a 20mm diameter keyring onto the top of a 30mm M3 bolt which I fastened into a hole drilled in the end of my spotting scope. I then constructed a holder which could be screwed onto the eyepiece of the spotting scope which supported a large washer of diameter 50 mm with a 10mm hole. By looking through the washer I can see a large field of view and it is easy to slew the telescope so that Sirius appears inside the key ring; then I can move to the spotting scope and the camera to perform the precise alignment.

Another minor problem with my spotting scope is that, on a dark night, the graticule is completely invisible. This problem is easily remedied by drilling a 6mm hole in the eyepiece of the spotting scope, taking care to avoid damaging either the eyepiece lenses (be warned – there will be two, spaced a few mm apart) or the fine wires of the graticule. Push a red LED into the hole and connect it to a suitable battery and series resistor. (I actually modified a cheap key ring LED torch which contains all the necessary components including a push button switch.)

Using a WebCam as a spotting scope.

The final refinement of my armchair setup is to use a webcam as a spotting scope.

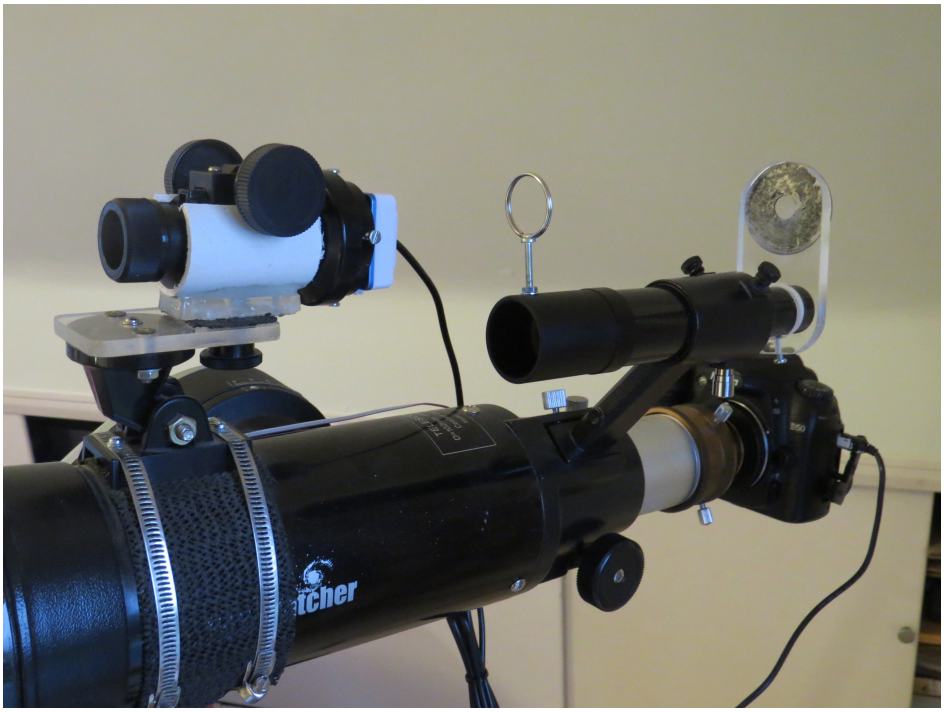
The webcam I used was one advertised as 'digital eyepiece' shown opposite. It is fitted with a 1¼“ diameter tube and does not have a lens. (Webcams with a lens have far too wide a field of view.)

I discovered that its sensor was only 2.9 mm wide. Now the sensor on the D50 is 23.7 mm wide. In other words, if the webcam spotting scope was to have a field of view equal to or greater than that of the camera, it would have to have a lens whose focal length was at least 8 times shorter than the focal length of my telescope. Now the focal length of my scope is 500 mm so I needed to look for a lens whose focal length was no greater than 60 mm and preferably quite a bit shorter. This is a bit of a problem because the objective lenses of most small spotting scopes have focal lengths of 100 mm or more. 30-50 mm achromatic lenses are quite hard to come by. (Edmund optics do a range of quite cheap lenses.)

Eventually I found what I needed inside the eyepiece of an old pair of binoculars. Typically these have a pair of lenses each of focal length about 20 – 30 mm. By Sellotaping one of these lenses to the end of bit of plastic tubing (like an old felt tip pen case) and by adapting various bits of kit such as an old telescope focusing rack and a pan and tilt head from a cheap tripod I was able to mount it on the body of my telescope and get it satisfactorily aligned. (Somebody needs to design one of these properly and market it!)

Now with a simple webcam monitor program I can see what I am taking a photograph of. (At least, I can see a few of the brightest stars in the field of view. To be honest, you can't see very much

but Sirius is easy to see so, having lined up on Sirius with my 'keyring' gunsight, I don't bother with accurate alignment outside, I retire indoors and complete the alignment using the webcam scope.)



This is the complete kit of parts showing the gunsights on the spotting scope and the webcam spotting scope mounted on a tilt head

And here is the result of my first armchair astronomy session.

J O Linton

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