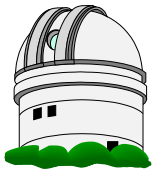
Hermes

the occasional newsletter Dec 2000

Edited by Mark Wiggin and published by the Shropshire Astronomical Society

* MEMBERS ARTICLES & IMAGES * NEWS AND VIEWS
* ADS & LETTERS * THE NIGHT SKY * THE INTERNET
* SEE US AT **http://www.astro.cf.ac.uk/sas/sasmain.html**



* SUBMIT ARTICLES TO **50 Forton Road, Newport, Shropshire. TF10 7JR**

mark.wiggin@blueyonder.co.uk **Tel. 01952 405211**

2000 – it's been quite a year!

2000 has been a fascinating year for Astronomy, and a great year for the Shropshire Astronomical Society:

- Our trip in April *'The Irish Connection'* to Dunsink Observatory in Dublin, the Leviathan of Parsonstown at Birr Castle, and Armagh Observatory was hugely enjoyable, and a great success. We were very fortunate to have a very experienced (and calm!) driver in Paul Sewell, to whom we are very grateful. Thank you Paul.

  The committee would also like to thank our president, Lembit Öpik, for all the help he gave us with introducing us to all the people we needed to contact to make the arrangements.

  We are looking at the possibility of organising another astronomical trip later in 2001, so if you have any suggestions, please get in touch.

- Lembit Öpik has been instrumental in convincing the government of the need to devote more resources to watching the skies for objects whose orbits intersect our own. This has been an impressive achievement, and should go a long way towards making the general public aware of the practical benefits of astronomy.

Lembit Öpik
S.A.S. President

After all, if something like the Tunguska Event of June 30th 1908 – when a meteorite exploded in a remote part of Siberia – were to occur in a densely populated area, millions of lives could be lost if no advance warning could be given.

- Turning to events closer to home, the Summer Barbecue was very well attended, and while the skies weren't as kind to us as they could have been, everyone had great fun trying to get their rocket to fly further than anyone else's! Many thanks to David Woodward for arranging this novel diversion – he should get an innovation award for his triangulation equipment! Thanks also to everyone involved with the barbecue, and in particular to Joy Clayton-Jones for all her hard work in the kitchen.

- A new entry-level telescope has been purchased and is available for loan to members, while the committee are still on the look-out for a telescope suitable for more serious work.

- We have been forging links with Shrewsbury School, who have regular Astronomy and Physics lectures which are usually on a Friday evening at 6.00pm. We shall be circulating their 2001 programme to members early in the New Year.

- We are setting up a Society Library, with the assistance of Springer-Verlag Publishing, who have donated some of their titles to the Society. We may also be running a competition on the web-site next year, sponsored by Springer-Verlag.

2000 has seen a steady growth in attendance at our observing meetings; thanks to all our members for making our Society a huge success!

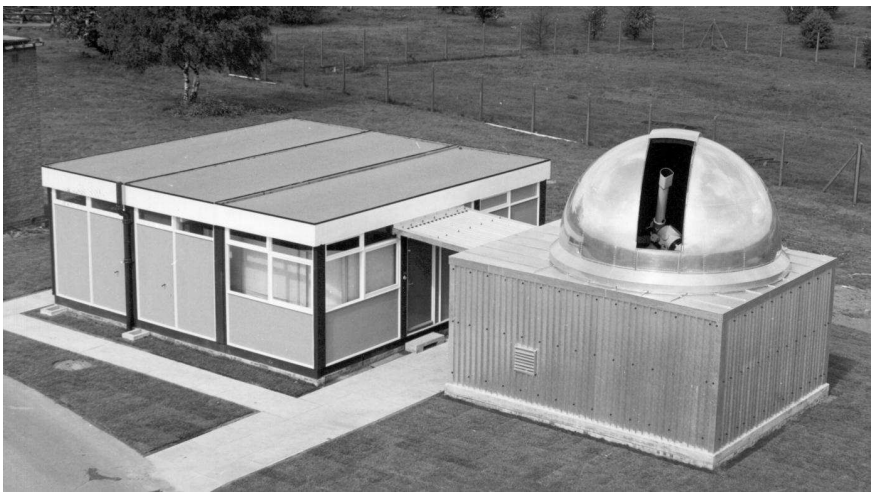
Mark Wiggin

Observations & Restorations

The Dome on Ball Hill – The RAE Observatory

Where is Ball Hill?

On the 16th October 1908 the eastern part of Farnborough Common, including Ball Hill, was the place from which the American, Samuel Franklin Cody took off to make the first powered flight from UK soil. He managed to pilot the fragile British Army Aircraft No.1 some 1390 feet before crashing. Whilst he walked away from the wreckage on that day he was to die some 5 years later on the morning of 7th August 1913 when the aircraft he was piloting struck the oak and pine trees on Ball Hill, killing him instantly.



These days, Ball Hill may be found within the bounds of the Defence Evaluation and Research Agency (DERA) headquarters at Farnborough. The Agency is an organisation made up of UK Ministry of Defence research establishments, who supply impartial technical advice, support to the Government and armed forces. DERA occupies the site that used to be the Royal Aircraft Establishment (RAE), the UK expert on many aspects of aeronautical engineering.

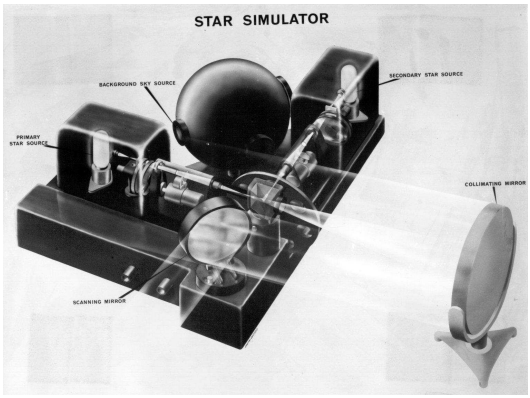
The need for a scope on the hill

In 1953 the Gassiott Committee of the Royal Society and RAE persuaded the Treasury to fund the British National Sounding Rocket project, the aim being to develop Britain's own high altitude rocket for scientific research. The first rocket of the Skylark series, initially a joint venture between the RAE, RPE Westcott and the Bristol Aircraft Corporation flew successfully from Woomera in South Australia on the 14th February 1957. Over the next two decades the Skylark turned out to be a highly reliable system, lofting payloads to altitudes greater than 200 miles on over 450 occasions. The payloads observed targets as diverse as X-ray sources, aurora and weather patterns.

Part of the work undertaken by the RAE during this time was development of the sensors to locate points of reference for ensuring payload orientation - the payloads were not initially stabilised. Using the Sun, the brightest object in the sky, as a fixed point was an obvious choice and a "sun-seeker" was already under development at RAE during the 1957-58 International Geophysical Year and a version developed by Elliott Space + Automation Ltd and the RAE was successfully flown in August 1964. The flight in 1964 involved two silicon cells to sense the Sun and a magnetometer to sense the direction of the earth's magnetic field. Using a small cylinder of compressed nitrogen and a set of nozzles, the tumbling payload was steadied within 30 seconds of freefall and a pointing accuracy of 5 arc minute attained.

The brightest stars and Moon, are many stellar magnitudes fainter making the task rather more difficult, but they are tightly defined reference points and widely available in the part of the sky not occulted by the Earth. Consequently, they provide a means to determine (and fix) the orientation of a payload in relation to the Earth even when in the Earth's shadow. Star sensors not only allowed night launches but also made a pointing accuracy of around 2" - equivalent to the angle subtended by a house at a distance of 250 miles - possible. At the time of the 1964 launch these were under consideration.

Consequently, a project was launched in the RAE Space Department to design, build and construct a device capable of detecting stars, even in the daytime. As part of that project a starlight simulator was entirely designed and built by the RAE Instrumentation and Electronic Engineering department. Construction took some time to achieve as it ambitiously attempted to simulate the colour characteristics of a star, atmospheric seeing effects, the influence of other stars in the field of view and the brightness and 'temperature' of the background sky. This level of complexity was, at that time, unprecedented and it was felt essential to compare real-time stellar images obtained with the simulator with those from real stars. So it became necessary to be able to view stars during working hours - weather permitting. The scope may also have played some role in the training of navigators to navigate by the stars.



It should be remembered by those of us living in an era of DVD players, microwave cookers and home PCs that technology at that time was rather more limited. Valve based technology was approaching its peak and quite sophisticated photo-multiplier tube devices were available, but transistors were only quite recent inventions. Yet despite this the star simulator was quite compact, could mimic a wide range of star types and was able to simulate stars from 2nd to 7th magnitude. While this was being built and used plans for a dome and scope next door to the simulator lab progressed.

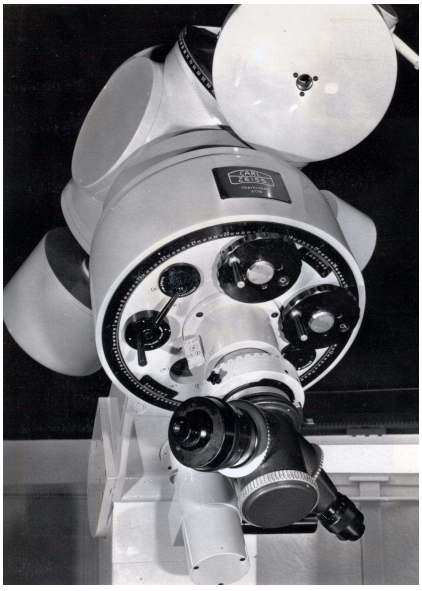
Eventually, after much work and with the concept proven, some of the development work was moved away from RAE. The last logged observation from the dome is for 1972 when the pointing accuracy was again checked. But by then substantial progress had been made, as in 1970 the Royal Observatory Edinburgh reported (reference 5) that an RAE assisted Skylark flight from Woomera had achieved its first stabilised Moon pointing scientific payload. Progress followed. In October 1971 the X-ray source Puppis X-1 was viewed for 1 minute with an accuracy greater of the order of 2 arc seconds by a team involving one Ken Pounds - later the head of PPARC. By 1976, stars sensors such as that from Marconi Space and Defence Systems worked on stars of 3rd magnitude (specifically Zeta Tauri) with a pointing accuracy better than 6 arc seconds.

The scope

In 1966, with the Cold War in full swing, an order for a telescope was placed with the Zeiss company of Oberkochen, Poland via Degenhardt & Co. Ltd. The system specified, and still in use today, is an F15, achromatic objective refractor of 6“ aperture which can be stopped down to 4” when necessary. The mount, driven by synchronous motors in Right Ascension at lunar, solar or stellar rate is of Coude configuration incorporating a system of optically flat mirrors that bring the image to focus at the eyepiece to be viewed from a single seat - or passed into prototype sensors. This aspect of the telescope was of great importance as the prototypes were of considerable weight and unwieldy making their use on (for example) a Newtonian reflector impossible.

The main objective lens, despite consisting of only two elements, provided good quality images of bright sources, displaying surprisingly little false colour, possibly as a result of unusual mirror coatings and a well defined figure. Even today the views it provides are better than those from Maksutovs of similar aperture. Certainly, the original mirror coatings were of a high quality as after 24 years sitting untended in a damp dome they still reflected around 70% of the light falling upon them. Indeed, when in 1999 David Hinds Ltd re-aluminised the mirrors, it was found that they had to be immersed in the aluminium stripping bath for 7 days before they were clean – as opposed to 24 hours for most mirrors. The precise nature of the coatings employed remains unclear.

The scope was mounted within the purpose built aluminium and steel observatory. The mount is isolated from the observatory floor and, like the simulator, stands upon a cube of concrete 1 metre across which is sunk into the building foundation. The building consists of both the dome and 3 small offices, one of which is currently (November 2000) used by the DERA Astronomical Society. The mount was secured to the block and orientated using bolts, the adjustment of which was carefully documented. The records report adjustments of 1/8th turn of a bolt and the subsequent re-testing of alignment by visual re-inspection of 8 reference stars. The alignment process took nearly a year (starting in July 1967) under the supervision of Mr Geoffrey Brown of the RAE Space Department. The final pointing accuracy achieved at that time was 2 minutes of arc with the main limitation being slight flaws in the vernier scales and manufacture of the eyepiece mount. Modern measurements suggest that this alignment was very accurate. The orientation and quality of the drive train mechanism is such that, even today, 80% of 75 second test exposures carried out using CCDs attached to the scope show a periodic error of less than 2 arc seconds. When used with the original setting circles (corrected slightly to allow for the elapsed time since it was set up) the brighter planets can be easily located during the daytime, including observing Venus visually when it was just 6 degrees from the Sun.



The current visual magnitude limits appear to be roughly 2.5 and 12th magnitude for day and night observing respectively whilst, when new, the limit was 4th and 14th magnitude respectively. These changes reflect today’s increased light pollution and the slight discolouration of the balsam between the objective lens elements. The dome, which is 3.7 metres across, is rotated by hand crank and the shutter similarly. It was built and designed from scratch by the RAE Technical Facilities drawing office and constructed by RAE.

Restoration

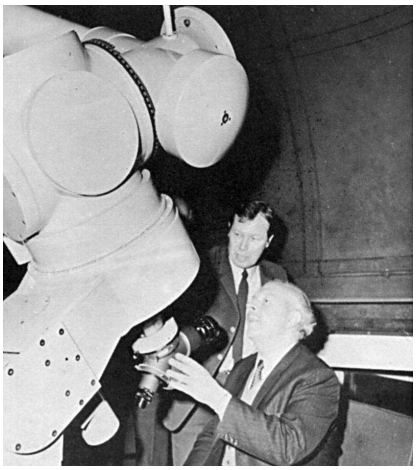
In 1972 the dome was closed down and subsequently was used as a storeroom for 24 years until the arrival of Hale-Bopp when the founder of DERA Astronomy Society (DAS), Phil Alner, sought and obtained the permission of DERA management to undertake the restoration of the facility. Happily, on entering the dome he discovered that someone had thoughtfully left an electric bar fire on when the building was closed. This had kept the worst of the damp (over the years the dome had sprung a few leaks) from damaging the equipment. The asbestos insulated power cable/flex to the fire was at the end of its life but the heating element still worked - sadly the name of the manufacturer is not recorded. Since then restoration work has progressed slowly, but

Past BAA President Patrick Moore using the telescope in November 1972 before giving a talk to the RAE Technical Society.

surely. The main lens has been taken out and cleaned and the mirrors re-aluminised. The handcontroller is being rebuilt to permit computer control of the slow motions and to replace old and failing potentiometers. The dome has been resealed and re-greased and plans are afoot for a computer network between the dome and the office, thereby permitting remote observing.

Current Use

The observatory on the hill is now used by the DAS for visual, CCD and astrophotographic observations of the planets, Moon, Sun and even deep-sky objects. The scope has proved itself to be of fine quality visually and is used mainly for planetary and lunar observing. Double stars and detail within small high surface brightness planetary nebulae have also been observed, but the limiting magnitude visually using the scope in this light polluted area makes objects like NGC2158 or NGC404 quite difficult.



Past BAA President Dr V Barocas visits the observatory January 1972.

The objective is small by today's standards and the 3 mirrors, discoloured balsam and plate scale make observing faint objects difficult, but the mount is excellent and accurately set up thereby permitting lunchtime viewing sessions of planets by society members or guests.

The two-element objective lens means that the near infra-red component of starlight is poorly focussed which necessitates the use of an infrared blocker when observing with some forms of CCD camera (notably those employing Texas chips). This has led to the Sony chip based Starlight Xpress cameras being the camera type of choice for this scope. Occasionally, the DAS play host to members from other astronomical societies and invites visitors to come to the dome to observe – weather permitting. Interested parties should contact the DAS Chairman Phil Alner at DERA.

Conclusion

For many people it is probably something of a surprise to discover that a small telescope played an important role in securing some of the first UK X-ray astronomy observations. It is even more surprising to hear that, 33 years on, the telescope and its dome still stands unobtrusively on a hill overlooking Farnborough where, happily, it has once again returned to productive life. Long may it last.

Acknowledgements

I would like to thank Jim Buswell of DERA and John Harlow of the British Interplanetary Society for their help in locating information on the Skylark rockets. I would also like to thank Phil Alner of the DAS for his help regarding the illustrations and DERA history.

Grant Privett

The FAS Convention 2000 – Rutherford Appleton Laboratory, Oxfordshire

This was a new venue for the yearly convention and was relatively easy to get to, even though the driving time was two hours from Wellington. We had to smile to ourselves as we went through security and received instructions to assemble outside if an alarm went off, but *remain inside* if a klaxon sounded – presumably because of the nuclear research station nearby!!

Dr. R. Harrison of the RAL spoke first, and his talk on the SOHO mission was excellent, taking us to the depths of the Sun's activities and solar physics. His presentation was very professional but also light-humoured with smiley faces of the Sun and an ultra-violet image of the surface which looked like Mickey Mouse…

'Kuiper Belt Objects' was the subject of the next talk by Dr. Bob Owens, followed by Nik Szymanek who thrilled us with his 'pretty pictures' (his words) from his CCD image collection. He had just returned from La Palma that morning, where he'd been adding to his collection.

After lunch, Professor Phil Charles of Southampton University took us 'Towards the Event Horizon' with his talk on Black Holes – fascinating stuff.

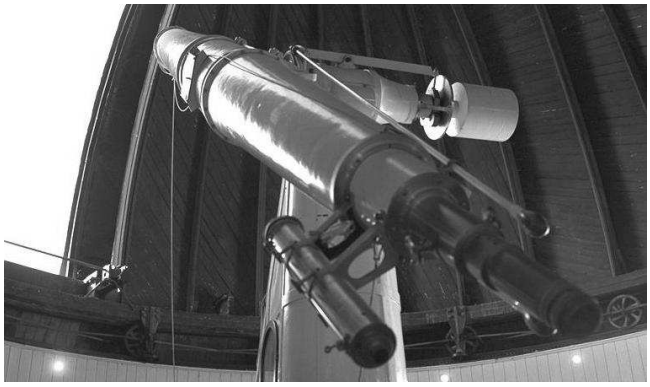
The final talk was from Professor Mike Edmund of the University of Cardiff, who was dressed up as Sir Isaac Newton. He provided a wonderfully humorous insight into the thinking of the great man, together with his professional jealousies.

I was immensely impressed with the amount of preparation that had gone into making this such a successful day. I highly recommend this event, and for a mere £4 in advance, £5 on the door, it won't break the bank!

Jackie Dodds

Visitations – Here are a few pictures from our visit to Ireland in April

Dunsink Observatory with SASmobile.



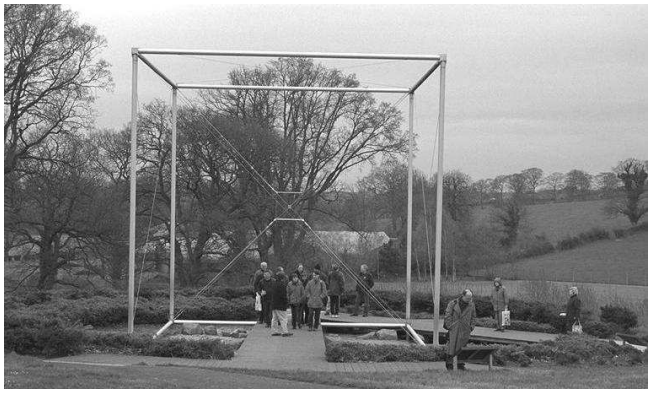
James South equatorial refractor 12" x 19' focal length, set up in 1868 on a Thomas Grubb mounting.

Leviathan of Parsonstown, Birr Castle, Demesne. Note winding gear, bottom right.

The lower gallery carrying the observing trolley halfway up the track on the inclined 'ladders'. For demonstration purposes only, the telescope and observing platforms are computer controlled.

Simon Clayton-Jones and David Woodward in viewing cradle.

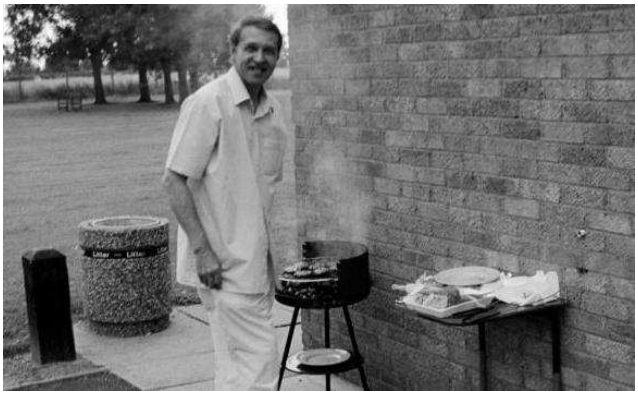
Armagh Observatory.



Armagh Observatory Astropark. Members walk through a Hypercube to experience relative distances to objects outside the solar system at a logarithmic scale.

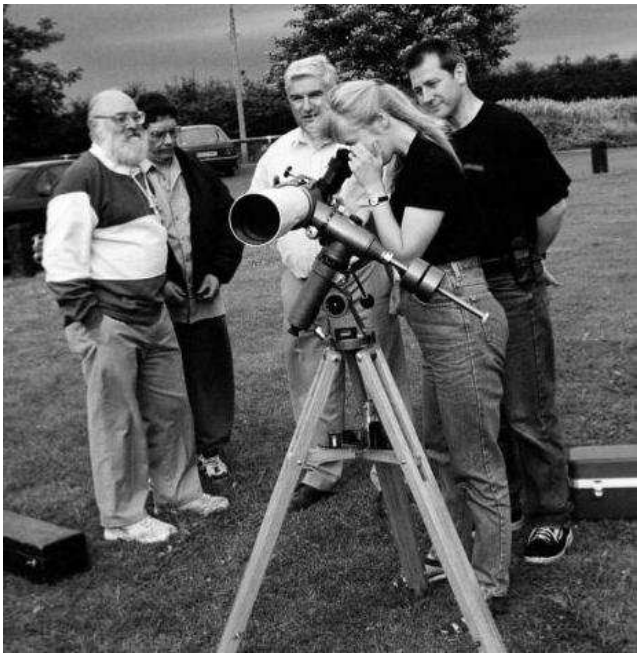
Photographs courtesy David Woodward

Recreations – Society Barbecue in August

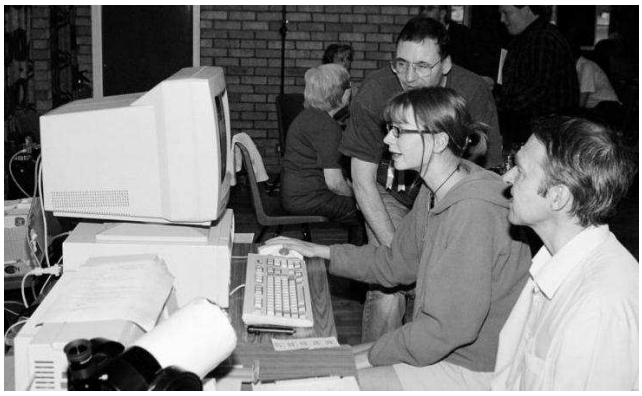


Head Cook Victor Pushon

Simon Clayton-Jones and Mark Wiggin resolve their disagreement over the cosmological constant…

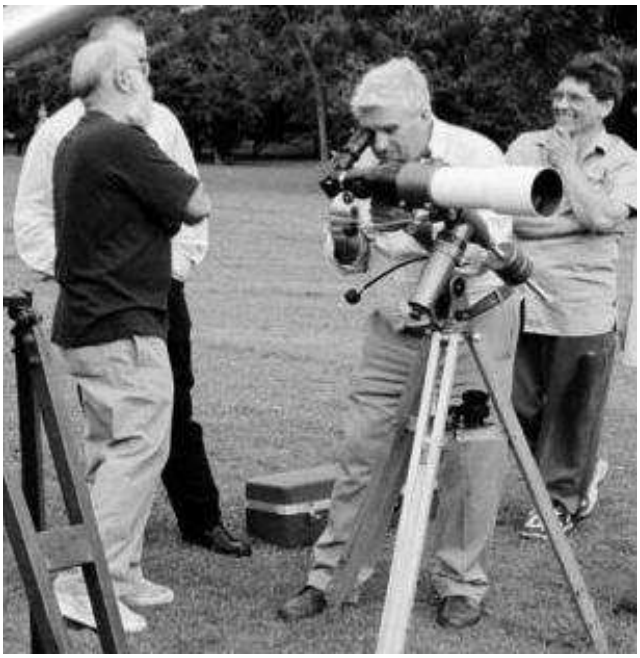


Getting ready for some serious observing



Surfing the net

Awfully close to that rocket

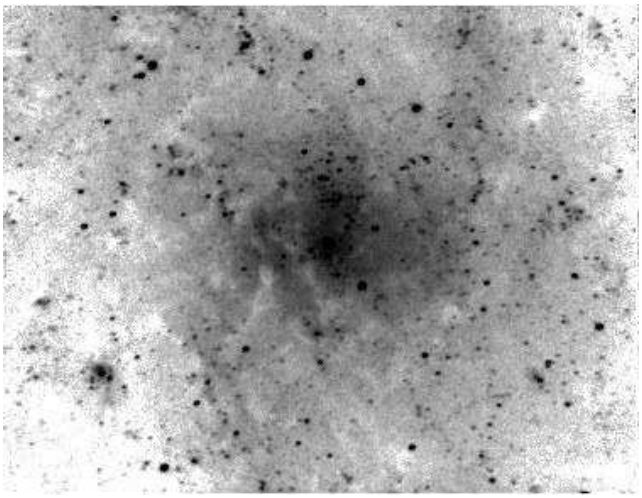


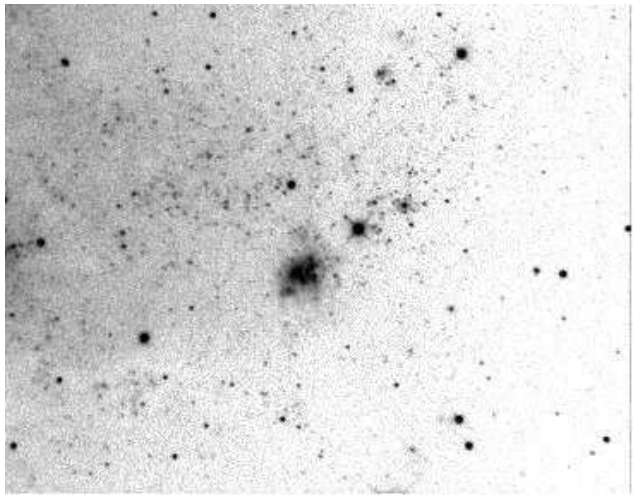
Getting ready for some more serious observing

How to measure distances using triangulation – providing you can see where it' s landed!

Photos courtesy of Nigel Thomas

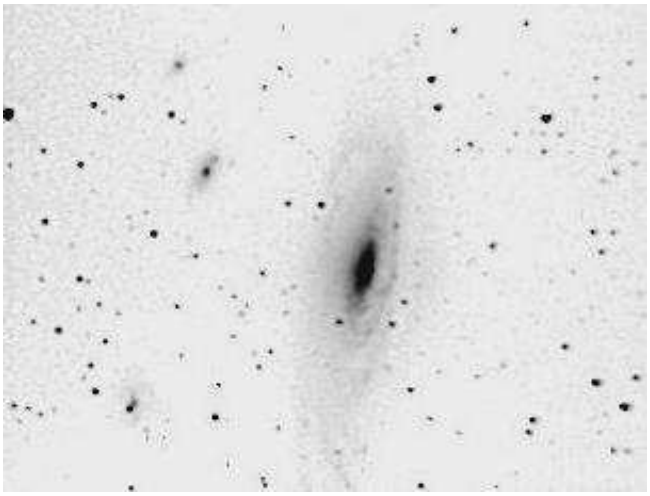
Observations – Members' pix



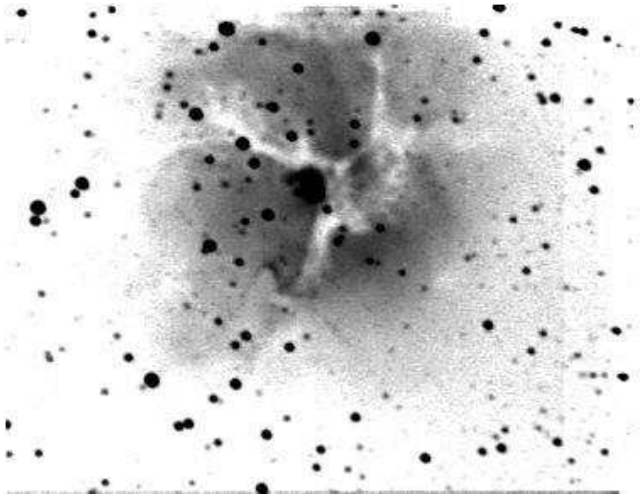


Images above by Grant Privett 16/11/2000 using a HAG Clanfield 24"

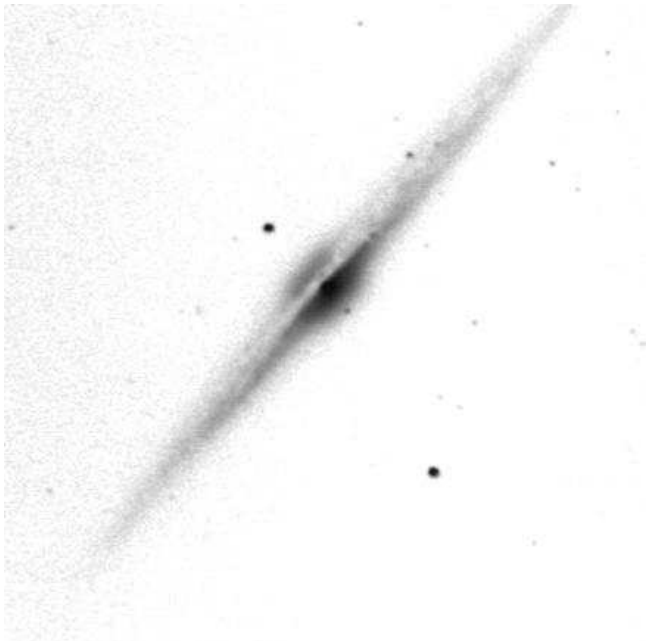
Images below by Kev Wildgoose, 16" F4.5 Newtonian using the Starlight Xpress MX916 CCD camera



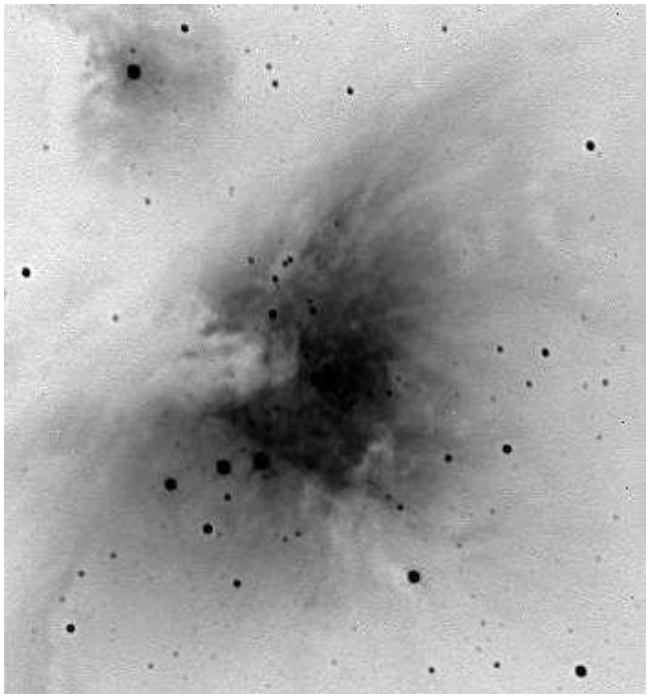
NGC7331



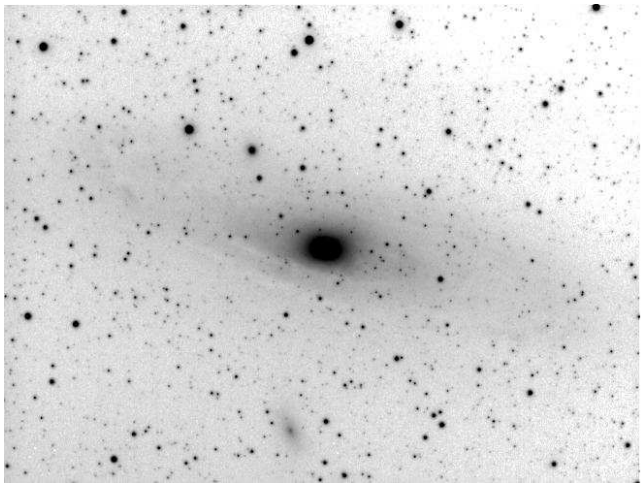
M20



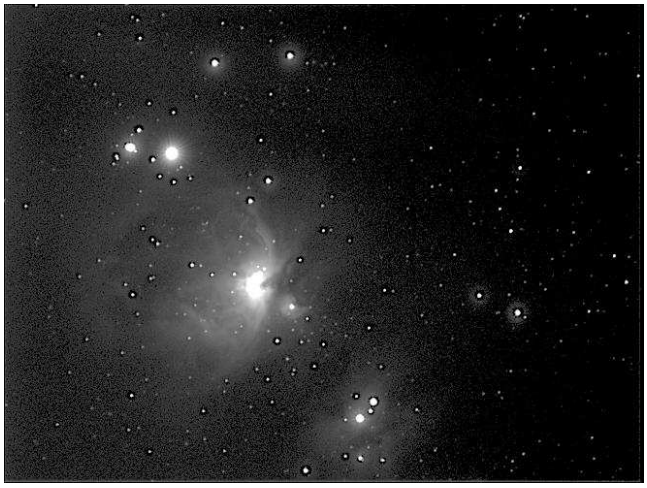
NGC4565



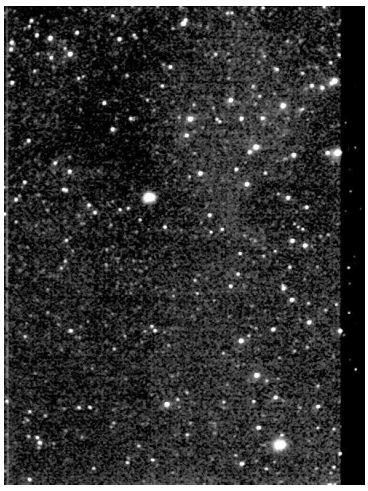
M42



Picture 1 **M31**



Picture 2 **M42**



Picture 3 **NGC7000**

Deep sky imaging for less than twenty pounds

Ccd cameras have been a great boon to amateur astronomers, mainly because they are about 50 times more efficient than photographic film, but a major drawback is their small size (some 40 times smaller than 35 mm film), so on a normal telescope, the amount of sky they cover is quite restricted – no problem for faint galaxies etc but not for the brighter and more familiar nebulae such as the Orion or Andromeda.

To get the image to fit on a ccd chip, we have to use telescopes with much smaller focal lengths (some 150mm or so). There are no telescopes that fit the bill but ordinary telephoto lenses might. The ccd camera I am using can be fitted to the industry standard m42 thread, so I obtained some second hand lenses for testing. Beware, what might be a perfectly good lens for conventional photography can produce poor results with a ccd – especially one with small pixels. The best ones I found were East-German Carl Zeiss and I managed to pick up a f2.8 50mm lens for a fiver and an f3.5 135 mm lens for twenty.

The results, I think, are pretty good. The M31 image shows stars down to mag 16 (you would need a telescope of about 24 inches in diameter to see these visually).

So the telescope (sic) I used for these pictures cost only £20! However, the camera costs about £900 and I used my Meade lx200 as the telescope mount. However a second hand polaris mount would have done just as well, and can be picked up for as little as £250. Also the camera's cooler was not working so a cheaper ccd design would be possible.

To sum up, I have managed to extend the range of images I can now take with a very small additional financial outlay.

Picture 1 M31 Andromeda nebula (also includes addendant m32 and m110), 7 one-minute exposes added together, camera Starlight Xpress HX-516
135 mm telephoto at f3.5

Picture 2 M42 Orion nebula, 10 one-minute exposures added together, camera Starlight Xpress HX-516
135 mm telephoto at f3.5

Picture 3 NGC7000 North American nebula
3 (4 second!) exposures added together (undriven), camera Starlight Xpress HX-516
50 mm standard lens at f2.8

All images taken from Newport Shropshire

Simon Clayton-Jones

THE SOCIETY WEB PAGES

As many of you know, the SAS website – **http://www.astro.cf.ac.uk/sas/sasmain.htm** – has been in existence for 6 years, a long time by WWW standards. During that time they have grown quite a bit. We started with membership details and a picture or two (the net was rather less speedy then) but the pages grew like topsy. We now have web pages showing contact details, the forthcoming society programme, the latest pictures, masses of links and a huge collection of images/photographs by the membership – the most recently added of which includes a montage created from pictures taken at last year's society barbecue. It's worth having a look just to see Kev Wildgoose's Saturn pictures.

The pages are usually updated every month or so and we are keen to have contributions from all our members. If you have a drawing, a photograph or an image (even if its just a photo of moonlight on water or your telescope or a drawing with binoculars of The Pleiades) please let us have a copy for the pages. Don't be shy. Photographs taken at meetings are particularly welcome. Also, if you have your own web pages and would like us to put a link to them on the society 'links' page please let Grant Privett (the webmaster) know on 01252 811665 or g.privett@virgin.net. All comments regarding the layout of the pages would be gratefully received.