

I'm looking forward to seeing you all again on Wednesday, September 20<sup>th</sup>, when Rod Hine of Bradford Astronomy Society visits us once more to announce "Let There be Light" and start another successful season at Hebden Bridge. Last year's membership rose to a record 39 and there is no reason not to increase this again and build up the strength of our organisation. We will be able to continue to give the usual warm welcome to the enthusiasts who come to present such interesting programmes. You will see from your cards and Newsletter that we again have a quality line-up of speakers, some familiar, some new, to entice us to make the effort to get to the Information Centre each month between September and May. A new departure during the summer months has been the setting up of a Web page for the Society which should get us noticed more among the increasing number of people who are now 'online'. This has been set up by new member Laurence Hill from Littleborough, who must be wholeheartedly thanked by all of us for applying his expertise and keenness to the task. Another of our members whose work over several years for Hebden Bridge A.S. has been invaluable, is Ian Evans, our Treasurer, who is now enabled to take a well-earned rest from duty as, at the A.G.M, Keith Dean offered to take up the job of collecting and looking after our finances. Also not to be forgotten are Len Entwisle who, as usual, has done most of the preparation of this Newsletter and also those who have contributed material to make it interesting and possible.

John Singleton (Chairman)

### Editorial

Here is the 6th issue of our newsletter to keep you informed of what is happening in the near and not too distant future. Sincere thanks to our contributors for their valuable copy. The newsletter menu covers astronomy history, variable stars, telescopes and astro travel. For each issue we do require your help by written, typed, emailed etc. contributions from our members. Photos can be scanned and video 'frame grabbed' for you. Pen, pencil, emailed or floppy disk are all welcome.

Members should submit their material for the next issue either by mail, at the clubroom on meetings nights or by email to [len@ironhorse.source.co.uk](mailto:len@ironhorse.source.co.uk)

### ALGOL & PERSEUS - A YORKSHIRE TALE Melvyn Taylor (L.A.S.)

Algol, the famous Demon Star shows 1.3 magnitude dips in brightness as one star eclipses another component in the multiple system of stars which makes up the total light as seen by the naked eye. Whilst some historians believe the variations were seen by Arabic observers (or even Chinese) the discovery is normally attributed to G. Montanari, Professor at The University of Bologna in 1667.

John Goodricke and his friend Edward Pigott of York made original brightness estimates of its variations. In 1782 they noted the regular dimming and brought about the explanation of the partial eclipse of one star in orbit by another, darker star. Between eclipses the light assumes a near constant level and approximately mid-way in the deeper eclipses a secondary minimum occurs but this is not obvious with the naked-eye. The regular period of time interval of primary (faintest) minima, varies slightly, the result of dynamical interactions between the stars which alter the orbit. In Algol the recently accepted period is 2d 20h 48m 56.1s. Normally at a brightness of magnitude 2.1 the light takes about 5 hours in fading to 3.4 then in another 5 hours its usual state is attained. For visual observers the brightness changes are quite dramatic some 3 hours before and after the faintest phase.

John Goodricke was born 17 September 1764, he was a deaf mute from birth until his death in 1786. The family lived partly in England and in the low countries, notably Holland, but at some time settled in York. The Goodricke family in York lived in the Treasurer's house to the north of the Minster. Much of John's early education was done at a special school in Edinburgh which was run for the benefit of wealthy parents who wanted the best specialist education for their children. In 1778 he went to Warren Academy and learnt mathematics, natural philosophy including aspects of astronomy under a William Enfield.

Returning to York in 1781 he started writing his astronomical journals and during this time he became friends with Edward Piggott another young observer of variable stars. It seems Piggott's father owned a local observatory and together with Goodricke they made carefully timed observations of Algol which Montanari had seen at about magnitude 3.5 over one hundred years previously. Their independently made observations from November and December of 1782 suggested a number of common factors about the nature of the variability of the star. Its minimum brightness was always the same, the shape of the minimum light curve was symmetric and the duration between the fadings was constant.

The vogue among astronomical physicists for variability of stars seems to have been star spots, since those on the Sun had been known about from the early 1600s. However the two friends may have been influenced by the fairly novel idea of orbiting bodies as Uranus had only been discovered by William Herschel in 1781 and they saw in Algol a star being eclipsed by a darker body.

The 1783 May edition of the Philosophical Journal of the Royal Society contained several items from Goodricke's journals and a paper about the "Light Variation of the star Algol" appeared. A second piece followed up in the 1784 December edition and showed the star's period to be 2d 20h 49m 02.5s (2.8673901d).

The interest Goodricke had in clocks came to the fore by a paper in his journal titled "Of the Going of My Clock" in which he notes referring his clock to that of the Minster. There is the possibility that from a vantage of the Treasurer's House he may have used a view from a specific window. Soon after their finding re Algol were published the two observed  $\beta$  Lyrae,  $\delta$  Cephei and  $\eta$  Aquilae as short period variable stars.

In 1783 Goodricke was awarded the Gold Medal of the Royal Society for his remarkable work about the development of stellar processes and was made a fellow of the RS in February 1786.

On 20 April 1786 he died at the very young age of 22 years and was buried at Hunsingore near York.

Algol has had curious names in history, to the Hebrews it was Satan's Head, and some star maps have named it The Spectre's Head. Over the centuries it has been cast in a sinister and dangerous light.

The name Algol derives from the Arabic Al Ra's al Ghul or the Demon's Head, the head of Medusa which Perseus used in several of his infamous exploits. Perseus grew up on the island of Seriphus where he was found after being cast into the sea inside a wooden chest. This was the result of a prophecy which potentially had Perseus killing his grandfather the King of Argos. At the request of Polydectes King of Seriphus he was "conned" to slay the hideous Medusa the only one of the three Gorgons who was mortal, she was distinguishable from the other two by her head of snakes. Stheno and Eurayle had the privilege of immortality.

The three sisters it seemed had upset the gods through their excessive vanity and had been banished to distant shores where they sought out cunning retribution on anyone they could cast their spell on. The nature of the Gorgons was loathsome, skin like dragon scales, hands of brass and with a glance they turned anyone to stone. Using a sword, helmet which made him invisible and winged sandals given him by Athene, Hephaestus and Hermes he winged his way to the shores of Oceanus near the isles of Hesperides, found the monster Medusa asleep and slew it while looking at its reflection in the polished shield. The winged horse Pegasus and warrior Chrysaor sprang from the blood of the Gorgon. Perseus did other remarkable deeds like rescuing the princess Andromeda as she was chained to a rock as a sacrifice to the sea-creature Cetus.

Polydectes and his noblemen were the next to come to grief when Perseus got his own back for the near suicidal mission to slay the Gorgon by showing them the severed head. A caring lad, he found the titan Atlas holding up the heavens and to relieve him of this task turned him into the Atlas mountains of Morocco. In the picture drawings of Perseus on the old star charts he is portrayed with sword in one hand, the head in left hand, Algol is the left eye of Medusa.

Visual observation of naked eclipsing binaries, and Cepheids, is a field which the beginner may gain experience of variable star estimation. The main purpose of visual, photo-electric and CCD studies is to determine times of minima and maxima respectively. Changes in the rotation period may be deduced by listing times of minima over a few cycles. A diagram showing the difference between the observed time and the predicted one against the number of rotations (the cycle number ) may show up period changes which possibly indicate

physical and evolutionary aspects in these stellar roundabouts. This information can also be used to provide new predictions of minima.

Monitoring the periods of Algol type variables and revising the stars' elements is a very important assistance to those astronomers who use instrumental detectors (satellites) for theoretical studies and modelling of these objects. Scientific objectives in following eclipsing binaries not only involve variations of the orbital period but assessment of mass loss and exchange, and evaluating orbital elements and the physical properties of the stars involved.

In 1971 the Green Bank Radio Astronomy Observatory found Algol to be erratically variable and with strong flares. It was only in 1978 that light from the secondary star was found using a state of the art spectroscope on the 2.7m reflector at McDonald Observatory. Algol has also been found to be a triple system, the close pair having a distant third star orbiting them in a 1.86 year period. This third star was found spectroscopically. A fourth star has been suspected to comprise the overall system but doubt over its existence have been expressed. Data on the Algol system derived from many type of observations; visual, photographic, photo-electric photometry, high resolution spectroscopic, optical interferometry, radial velocity, x-ray and infra-red has revealed a much more detailed picture. The K2 secondary sub giant has an active surface showing both x-rays and radio and a thin of stream gas forming a transient disc around the B8 main sequence primary. The impacting region on the hot star is about 100,000ø K.

Both optical and radio observations confirm the separation of 0.0005 arc seconds and the third member a F type star in a 1.86 year orbit about 2.7 AU from the main pair. A summary of the known triple system in terms of Solar size and masses is as follows. Primary, spectrum B8V, size 2.9 times Sun, mass 3.7 Suns, surface temperature 13000øK the secondary K21V, size 3.5, mass 0.8, 4500øK and the third star F1V, size 1.4, mass 1.6, 7,000øK.

On 2000 September 15 a primary eclipses is predicted to be at 21 hours (Universal Time), and other times may be found by adding or subtracting multiples of its period.

In order to check an observed time of a primary minimum light estimates are made over as long as possible about every 10 to 15 minutes before and after the predicted time. Algol is located at right ascension (1950 epoch) 03h 04.9m declination +40ø 46'. It varies in visual magnitude from 2.1 to 3.4 in a period of 2.8673156 days. The secondary eclipse is only 0.07 magnitude in depth, and so only measurable by instrumental methods not with the human eye.

**A Diary Date for you:-**

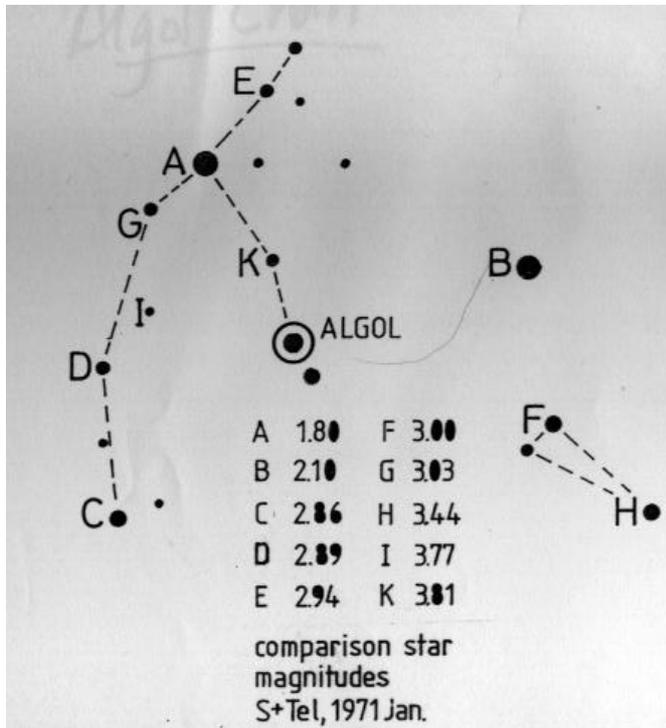
Oxenhope Star Party on Saturday October 21 st 2000 at 1900 hrs where members of Leeds, Bradford and Hebden Bridge Astronomical Societies gather for an evening of observing (hopefully with clear skies) but backed up with slides and talks between the clouds !! Its a good opportunity to look at others astro kit and find what suits you.

**FOR SALE** - 6 inch Newtonian Reflector f/8 Pier Mounted Altazimuth - With 1.25 " 17 mm focal length Kellner eyepiece and x 2 Barlow lens - £ 230

Phone Keith Higson on 01282 695004

## A CHART FOR ALGOL OBSERVERS by MD Taylor

The chart below may be useful in finding and following the brightness changes of Algol when it undergoes a minimum. It is based on that used by the BAA Variable Star Section.



### Cretan Capers - Moon free and no Minatours !! Len Entwisle (H.B.A.S.)

Late May, 2000 saw a group of five Yorkshire amateur astronomers heading south and east to the island of Crete. The aim of the holiday was not primarily for the pursuit of astronomy but to recover from workplace stress and indulge in an interest in ancient civilisations and their artefacts.

Our own choice of a small resort south and east of Aiyos Nikolaos turned out to be quite a good one. I had a pleasant surprise in discovering that the local bar across the road from the hotel had Murphy's Stout on draught !!

Our first evening had us leaving the hotel bar near midnight and exploring the upper limits of the hotel grounds in the dark. We did find that we would need one leg to be 6 inches shorter than the other to be comfortable on the steep hillside that the hotel occupied so looked elsewhere for a night time observing site.

Two of the party decided to 'beast the body' with a trip to the Samaria Gorge so retired to bed early (but were kept awake by the Greek music and dancing). The remaining three enjoyed the bar facilities for a little while before heading down from the hotel to the little tracks across the main road. These lead through the vegetable plots and olive groves to the beach. Here we had a delightful session between 23.30 and 0200 hrs local time drinking in the night sky rather than the Amstels and Raki. Little kit other than binoculars was taken down with us as we enjoyed the unfamiliar angles that constellations such as Cygnus took. There

was a lot to take in in the deep south where Sagittarius was painfully obvious as a full constellation though it's often referred to as 'the teapot' I see it as Aladdin's Lamp ( must be my pantomime childhood coming out !!) A very bright patch of the Milky Way stood out at the teapots spout like some errant cloud , refusing to scud along.

The whole area of this constellation is a Messier shooting gallery with such items as the Lagoon Nebula , visible to the naked eye but superb in binoculars . This object, an emission nebula covering over a degree by half a degree of sky had NGC 6530 , a binocular cluster of mag 7 stars embedded within it . Further sweeping around gave M 25 a large open cluster about 1/2 degree across. More sweeping produced M24, a bright piece of Milky way , M 22 ( a globular cluster) etc , etc .

Scorpius showed the full curl of it's sting ending with the pair of stars Shaula and Lasath and Antares , the brightest star in the constellation shining steadily well up in the sky with its distinctive red tint. Three naked eye double stars pairs  $\omega$  1 and 2 ,  $\mu$  1 and 2 and  $\zeta$  1 and 2 were present and a little bit of binocular sweeping turned up such jewel boxes as NGC 6231 and M7 and M6 (bright open clusters). From the UK we seldom get chance to see either of these constellations except at very low altitude and through a great depth of atmosphere.

A visit to a village set in the mountains did allow us to locate what should be a 'cracking' observing site just off the mountain road between Aiyos Nikolaos and the village with a view to the North of the Aegean and with the Libyan Sea to the South . There are no lights and a lay - by on the crest of the ridge between the two seas. A pathway leads off some 50 metres from the road with small level areas off to either side of the path . This would only be accessible by use of a hire car (Perhaps next trip ?) . The roads are narrow , steep and twisting and the many roadside shrines are related to deaths and serious accidents so TAKE CARE .

Taking along 'The Observers Sky Atlas ' by E Karkoschka (Published by Springer (£ 15.50 ) I could with confidence identify what I was looking at . I would now add to , or substitute this with the genuinely 'small pocket sized 'Collins Gem Series book 'Stars' ( @ £ 4.99 ) used by A.R.P in the party. Both these books contain some useful charts to guide you in unfamiliar areas.

A short session with the PC and a planetarium program identifies when when such things as astronomical twilight occurs at both dusk and dawn. It is quickly appreciated that we have a longer and darker night when we head further south to places like Crete ( So different from the short summer nights we get 'oop north' )

A sunset delight we had from our room balcony in late May was to sit and watch Mars as it set in the constellation of Taurus as night approached.

The optical equipment brought by the party involved a selection of 35 mm cameras to both record the holiday (as they had a B setting you could also take astro time exposures ) .

The addition of a lightweight tripod allowed short time exposures of 20 to 30 seconds to be taken with a 28 , 35 or 50 mm lens . This gives some nice undriven constellation photos and can also record a silhouette of the landscape . You get both an astro record and an atmospheric holiday snapshot. Two of the party brought along small clockwork drives to take longer exposures than for undriven work . (These were once sold by BCF and were conversions of the old clockwork timepieces used to control when street gaslights were ignited). A few small pairs of binoculars were taken along , the largest being 10 x 50 s . A Sony video camera capable of operation at a claimed '0 lux' was used for some constellation imaging and also to record some of the party doing their Zorba the Greek bit !

With visits to Gournia , Knossos , Ierapatria , Feta Cheese, Greek salads, Raki paintstripper and draught Irish stout it was ( and is ) a great holiday destination !!

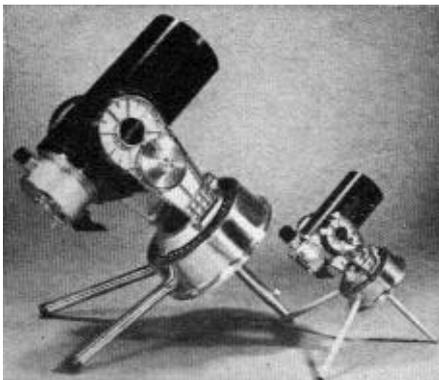
## THE QUESTAR - By Paul Yates

In the 1940s Lawrence Braymer wanted to build a telescope which would fulfil a number of criteria:-

- To have optics so fine, no amount of money, time or human effort could improve upon it.
- It should be easily portable and small enough to be used on a table where a person could sit in a relaxed position to observe and be able to have a writing surface at hand.
- Since he planned to take it on his travels, it should be packaged handsomely in a piece of leather luggage.
- Any necessary accessories were to be built in and should have finger tip controls within easy reach.
- The mechanical design must incorporate a means of putting the telescope into a polar equatorial position at a moments notice and without the need for a separate tripod.
- It should be versatile enough so it will be equally suitable for nature studies in the field.
- The design should be photovisual to record on film what can be seen.
- The instrument must be of rugged construction and vibration free.

In the 1940s when Maksutov published, in the Journal of the Optical Society of America, a paper on his mixed lens – mirror or catadioptric system, Lawrence Braymer had the means to fulfil his dreams. In 1946 development of what became the Questar started, and eight years later in 1954 the Questar came onto the telescope market.

In its development, the Questar took a couple of turns. It started off as a 5 inch scope but this was changed to 3.5 inches because factors such as size, weight and cost came together better at the reduced aperture. One of the original patents for the Questar was for a single fork design. However, it was found the single fork could not fulfil the strict stability criteria. Also, the use of double forks allowed the control box to rotate 360 degrees for ease of viewing.



Since its launch in 1954, the Questar 3.5 inch remained virtually unchanged up to the present day, except for very minor and cosmetic changes, a testimony to its great success. The brief history below is from old catalogues, personal contacts, and old ads in Sky and Telescope going back over thirty years.

### Some Questar facts and figures

In the early 60s Questar made three sets of optics for every set used, saying that only perfect optics were not good enough (perfect optics being those that resolved to the theoretical limit). It will focus down to 10 feet for nature viewing. It was the first scope used in a manned spacecraft, ( Gemini programme in March 1965 ).The central light baffling tube allows the scope to be aimed next to arc lights without halations and false images – it contains 19 internal light baffles.

**Robustness.** The following comments are from an American safari company, “in steaming tropics, sub zero cold, in blizzards, dust storms, Atlantic hurricanes, Pacific typhoons, we have dropped them, kicked them over, watched them blow over, seen them partially dismantled by foreign security guards, run over by airline luggage conveyors and temporarily confiscated --Questars can take it” !

It took 5 years to learn how to control the manufacture of the butter smooth slow motion controls. The driving wheel in the base is half the length of the telescope tube.

Questar only use the finest parts procurable, no single fastening or setscrew of a Questar could rust in tropical rains of New Guinea. No special care is needed when traveling, Questars are built to withstand severe climates of all kinds. Nickel Stainless Steel used for many parts, with outstanding resistance to rusting, pitting and corrosion. Will stay bright and untarnished for years.

The side arms and control box are die castings of corrosion-resistant aluminium alloy, tool room turned, milled, jig bored and reamed. Plastics are avoided like the plague, they are not temperature stable and they respond to heat, cold, dryness and dampness, with swelling and shrinking that will bind and cause backlash. (March 1978) /The base is cast complete, in aluminium with 7% silicon . It has great resistance to the acids of perspiration and corrosive salt water, it will retain its polish for years. The outside surface of the legs are ground to a tolerance of one ten thousandth of an inch. The star chart on the velvet lined dew cap and the moon map on the barrel are made of permanent anodized aluminium. (this may be silk screened now). Tested in a centrifuge for the space programme, it will stand 36 Gs axially in either direction. Questars are delivered in perfect alignment and never need re collimating.

### Questar Features

3.5” f15 Maksutov optical system

Switch in 1.6x Barlow

Built in switchable finder (4-12 degree field depending on eyepiece)

Optical tolerances to bring all views, (built in finder, high power and nearly doubling of the power with the barlow lens) in focus, and deliver them to the same eyepiece with just the turn of a knob.

Eg 24mm eyepiece, finder x4, field 12 degrees, mag x50 and x80

8mm eyepiece, finder x12, field 6 degrees, mag x160 and x260

Screw on off axis solar filter

Switchable solar filter for finder

AC RA drive (modern versions have a DC battery drive)

Adjustable table top equatorial tripod with screw in legs

Buttery smooth slow motions in both axis

### **AND IN PRACTISE .....**

Earlier this year I was lucky enough to obtain a second hand Questar. This legendary 3.5 inch Maksutov-Cassegrain had been an object of my dreams for over thirty years. I contacted the manufacturers in the US to find out the history of my particular telescope. I found out that it was manufactured in August 1980 and was originally sold in America. So far, it has never been returned for a service so has had no attention since it’s production.

OK, so much for the theory, but what is the little beauty like to use. The quick answer is that it is superb. For once, a telescope that deserves it’s reputation. Mechanically, it really is as near perfect as you’ll get, everything moves and operates to the degree that it’s simply a

pleasure to operate – it really is that good. Optically, it just couldn't be bettered for its size. No aberrations at all are visible, even under the harshest test I have managed. The star images look perfect, even when the seeing conditions are not !! I subjected the double-double in Lyra (I should say one component of it) to a magnification of above x600 and the image did not break down. The tube is so well baffled that if the gibbous moon is placed immediately outside the field of view, you have no idea when looking through the eyepiece - the field is as dark as a moonless night. The contrast on the moon and planets is wonderful, showing detail you would expect from a larger scope in terms of resolution.

For a portable scope, an observatory in a box, I have not seen its equal. The snag, and there always is one, is that quality doesn't come cheap. At over \$3000 in the States, you may consider it's not the best value in the world ! If you are lucky enough to come across a used one, very rare in the UK, I suggest you take a close look at it. I warn you, if you use one for a night or two, you're going to want to hang onto it.

Paul Yates August 2000

### I'M NOT GOING TO THE ECLIPSE NEXT JUNE , BUT .....

I had planned a trip to the next total eclipse in June 2001, but I am no longer going. This is because of a number of factors. I am concerned that Zimbabwe is not the safest place in the world to go to. No, I'm not concerned at being waylaid on the way to the eclipse track (though at the present time this would be a possibility). My concern is more that participants may be unable to venture out into the bush at night to observe, being restricted to staying around the hotel in Harare. This would be a tragedy for me, as so many of the southern sky delights can be seen from that locality – of equal attraction to me as the eclipse itself. Also, after the arrival of Gaynor to the family circle on July 7<sup>th</sup>, I began to feel terribly guilty about spending so much money on a lone holiday. (I call them scientific expeditions to appease the wife)

Now, it so happens, that in June next year, Mars is at opposition – as it is every two years. Around June 22<sup>nd</sup> it will be at magnitude  $-2.4$  and  $20.79$  arc seconds apparent diameter. Great news for planetary buffs, but not so good news if observing from our latitude. Home in Oakworth, it will only skirt about 10 degrees above the horizon – if the weather is kind enough to see it. Even then, it is likely at that altitude the seeing is so bad the view will be poor whatever telescope one can muster. Now from southern Greece for example, the prospects are rather better. At this location, Mars will attain an altitude of around 27 degrees with much better prospects of good seeing, and it is almost certainly to be clear every night. The planet will be located in Sagittarius, virtually above Scorpius which will be completely visible, unlike back home where it can never be seen in all its glory. This is a great shame, as the Sagittarius area with Scorpius nearby with its surplus of bright deep sky objects and wonderful milky way vistas is a real treat. I bet you can guess what is coming next !

Absolutely correct, on June 17<sup>th</sup> next year the recently enlarged Yates family is off to Stoupa in southern Greece – for two weeks. The accommodation we have chosen is away from the village center, and we have been warned that as it is so dark we will need torches to find our way back home at night, ah, bliss ! For our two week stay, Mars is never fainter than  $-2.2$  and never smaller than  $20.57$  arc seconds.

The moon is new during our visit (remember the total eclipse !) so it will be good to see some of the more southerly deep sky objects. Oh yes, I nearly forgot, my Questar is coming on the trip too !!

Paul Yates      August 2000

### A GRAND DAY OUT

When ?      *Saturday November 11 th*

Where ?      *Centenary House, North Street, Leeds*

*The Leeds Astromeeet is a one-day convention for amateur astronomers held every year in November by the Leeds Astronomical Society . As usual we have five high quality speakers to entertain us once again:-*

*Dr. Allan Chapman (Oxford University)*

*"John Harrison and the Longitude: What REALLY happened"*

*Pam Spence (Editor, "Astronomy Now," President, FAS) - "Recipe for a Solar System"*

*Jonathan Shanklin (Director, BAA Comets Section; British Antarctic Survey)  
"Comets"*

*Professor Ken Pounds (Leicester University) "Recent developments in X-ray Astronomy with the Newton Observatory"*

*Dr. Andrew Newsam (Liverpool John Moores University) The Liverpool (Robotic) Telescope, La Palma"*

*Trade stands so far confirmed:-*

*Earth & Sky / Fieldview Norfolk/ Chris Marriott - SkyMap Pro (Astronomical software)/ British Astronomical Association/ TL Optics/ Stockport Binoculars & Telescopes/ Martin Lunn (books, etc.), York*

*The charge for the day will probably be £ 5.00 and the 'in house' catering is both good and cheap*

**John Singleton (Chairman)**

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**Nelson**

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**Bingley**

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**COMING SOON ON WEDNESDAY NIGHTS AT HEBDEN BRIDGE :-**

**September 20 th.** Rod Hine ( Bradford A.S. ) “Let there be Light “

Rod traces the history of man’s understanding of light and particularly the role of astronomical discoveries that lead to that understanding. Without recourse to mathematics the basic principles of astronomical instruments and the wave/particle duality of light will be covered . Actual demonstrations will be used.

**October 18 th** Richard Sargent ( Chester A.S.) “ Russell Porter - Arctic Explorer , Artist and Telescope Maker” tells the tale of this key figure in amateur telescope making . Training in architecture, his summers involved Arctic exploration with Peary. At times an astronomer, museum collector, surveyor and an artist to eight expeditions he took part in. He ended up with major contribution to the 200” Palomar telescope in California.

**October 25 th** Members Evening where slides, prints & video are viewed and Astro kit demonstrations etc take place . Everyone’s contribution is welcome.

**November 15 th** Dr Jeremy Lloyd-Evans ( University of Leeds ) “ A Particle Detector Bigger than Lancashire” where our Leeds Cosmic Ray researcher tells us about plans and activity for a super detector.

**December 13 th** Len Entwisle ( Hebden Bridge A.S. ) “ Binoculars and Binocular Astronomy” A binocular astronomy workshop - An investigation of the mystery of the Opera Glass, Roof & Porro Prism , BAK4 and BAK7, the eye and the exit pupil. Please bring your own Binoculars along if you can. There may be an opportunity to view from the car park or somewhere a little darker later.

**January 10 th** David Ratledge ( Bolton A.S. ) “ Observing the Caldwell Objects” takes us on a guided tour of Patrick Caldwell Moore’s addition to the world of deep sky object target lists.

**February 7 th** Tony O’ Sullivan ( Salford A.S. ) “ Deep Sky Observing ” One of Salford’s stalwart deep sky observers takes us on a n evening of entertainment with faint fuzzies , globulars , planetary nebulae and distant spirals

**March 7 th** Professor John Dyson ( University of Leeds ) “ Active Galaxies ” - Our Leeds theoretician takes us on another voyage into contemporary thought on a new theme.

**April 4 th** David Sinden F.R.A.S. “ Massive Optics ” - The famous optical craftsman from the Geordie part of the world tells us of his contribution to many large telescopes across the worlds observatories when he worked for Grubb Parsons.

**May 2 nd** Andrew Batters ( Harrogate A. S. ) “ Satellite Observing ” tells us how to go about watching these man made satellites orbits and path predictions and attendant phenomena.

**May 9 th** Annual General Meeting & Members Evening

**Where to find Jupiter and Saturn @ 2200 hrs on October 1 st 2000.  
It is a great time to look at Saturn with the rings wide open !**

