

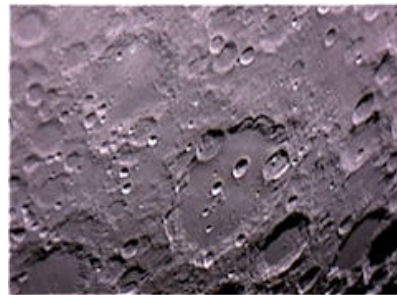


TRANSIT

The Newsletter of



5 March Julian Day 2453799



Lunar images by Jack Youdale taken with his new 8" Newtonian Lunar scope

top – Clavius bottom - Moon

Editorial

10th February meeting :

“Mining the Milky Way” by Dr Melvin Hoare of Leeds University. An excellent trip into the infra-red universe by a professional working at the cutting edge of this new space-based astronomy. His images were exciting and his explanations of some of his team’s discoveries were fascinating.

10th March Meeting :

“Radio Astronomy” by Bob Mullen

A special thanks :

To Rob Peeling for his generous provision of a digital projector and laptop at our monthly meetings.

Upcoming Lectures :

Information provided by John Crowther

27th April 2006 6pm. In conversation with... Professor Richard Dawkins and Lalla Ward, readings and questions regarding his excellent books. At the Life Conference and Banqueting Centre, Newcastle (next door to the Central Railway Station. Details www.newcastlesciencefestival.co.uk)

Letters to the Editor :

Any new observations, any comments on local or international astronomy, anything you want to share with your fellow members?

Dear Editor – sorry, nothing this month.

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"The large-scale homogeneity of the universe makes it very difficult to believe that the structure of the universe is determined by anything so peripheral as some complicated molecular structure on a minor planet orbiting a very average star in the outer suburbs of a fairly typical galaxy."

- Steven Hawking

Its all up there sonny!

From Ray Worthy

One of the greatest difficulties facing the successful running of a school astronomical club is the impossibility of being able to plan ahead for outside events. You simply cannot tell the pupils that we will meet the following Wednesday evening and be confident that the sky would be clear enough to use the telescopes.

Because of this, we employed the pyramid telephone call system. It worked like this. If and when I decided that the conditions were right, I would make just one telephone call to one boy. He would then undertake to call two or three others. By this simple method, in just a few minutes there would be enough pupils ready to fill a minibus. There would be a prearranged list of pick up points and off we would go. It was very flexible. One evening, there was to be a telescope event of the Astronomical Society when the members gathered for a mass observation. The site was out of town, away from the reflection of the urban and industrial lights. It was at a disused railway station. The track had long since been pulled up, but the station buildings were still there and in particular the long platform. We found the hard flat surface particularly suitable for setting up the telescopes. The boys, for they were all boys, were exceedingly keen, because they knew that there would be many brilliant instruments for them to look through, far surpassing anything we could afford. We did have several of our own, but these were no match for the Celestrons etc. of the richer members who willingly allowed the boys viewing time. Unfortunately for the boys, the weather forecast mentioned high winds for the night and, as you know, a strong wind produces vibration in a telescope that is made worse by the power of the magnification.

I did not hold out much hope for successful viewing and conveyed my doubts before we left school that overcast afternoon. However, the pyramid arrangement still stood and we went home. All through that evening there were calls from one boy or other asking if the event was on and each time, the answer was "No". However, late on, about ten o'clock, a call came, "It's clear and the wind is, going down".

He did not bother to say who he was. They rarely did; they were so excited. Well, the long and short of it was that, against my better judgement, I gave the signal. "Go for it!"

I got dressed and drove to the school to get the bus from the garage.

"Don't build your hopes up", I said to the noisy mob in the bus as we approached the station area. "The wind will have put off those with the big scopes. We will soon know if anyone is here because we'll see their cars in the car park. There had been a coal depot at the station. The railway had been elevated so that the wagons could be unloaded by gravity down into coal bunkers. As we entered the car park, we could see that in each of the walled partitions of the empty bunkers, there was a car neatly parked. There was no sign of any person.

We all breathed a sigh of relief.

" Someone's here. " I said, " they must be up on the platform."

I suppose a good description of our arrival was that we exploded on to the scene. The sliding bus door opened with a bang. Out came the telescopes and in the light from the headlamps of the bus, the boys laid out their white sheets. These sheets were laid beneath the erecting telescopes and tripods so that any nut or bolt which went astray could be retrieved.

One boy, an eleven year old gangling youth, and I remember his name as though it were yesterday, began to wander around the parked cars.

He began to call me with increasing consternation and increasing volume.

"Sir! Sir! SIR!", he shouted, " SIR!"

There was no alternative; I had to go over to see the cause of his excitement. "At least" I thought, " He must have discovered a dead body." A body it was, or rather two of them. A young man was desperately struggling to pull up his trousers. A young woman, as naked as the day she was born, (I cannot think what they had been doing) was winding the window down.

The young lad was transfixed; his eyes sticking out like chapel hat pegs.

" The stars are up there sonny! That's where you should be looking"

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Back to the Moon

From NASA

ALBUQUERQUE, New Mexico – NASA is fleshing out details of launch vehicles, robotic and human exploration systems that can enable a sustained back to the Moon effort, including possible establishment of an Antarctic-like lunar outpost.

"The first step to Mars and beyond is getting back to the Moon," said Scott Horowitz, NASA Associate Administrator for the Exploration Systems Mission Directorate at the Space Technology & Applications International Forum (STAIF) held here this week.

Horowitz outlined aspects of the space agency's Exploration Systems Architecture Study (ESAS), noting that a new study is underway on what future astronauts can carry out once replanted on the Moon.

Mega-booster

NASA is on course to pick a single industrial developer in August of the Crew Exploration Vehicle—a spacecraft slightly larger than that used in the Apollo program to haul astronauts to the Moon in the 1960s to the early 1970s, Horowitz said.

Progress is being made too on designing a Crew Launch Vehicle, Horowitz reported, as well as a mega-cargo carrier that has the growth potential to toss over 300,000 pounds into low Earth orbit—more than the Saturn 5 booster utilized in the Apollo Moon program.

The two launchers are both borrowing heavily from solid rocket booster and external tank work honed within the space shuttle program. The shuttle is due to be retired in 2010. Also on tap for use in the two launchers is incorporating a Saturn 5-era J-2 upper stage engine—a motor capable of being started in flight and restarted anytime, Horowitz explained.

More capable lunar lander

Horowitz said that conceptual looks at a four-person lunar lander have been done. Those initial studies of the vehicle show that it must be far more capable than the two-person Apollo lunar lander. For one, he said, a 21st century Moon lander must permit crews to put down anywhere on the lunar surface—and that means hauling lots of fuel in lots of tanks.

"The goal is four people at up to 7 days a shot," Horowitz said. An airlock on the lunar lander would permit ease of access to and from the lunar surface, he said.

The lunar dust "is a real problem"... "one of the big issues that we have to deal with," Horowitz advised. Spacesuits used on Apollo were pretty much trashed within a few days, he said, as tiny, razor-sharp dust particles jammed suit joints.

Find the light...touch the ice

NASA needs maps. Any back to the Moon campaign by humans will be helped by output from robotic lunar orbiters and landers.

For example, NASA's Lunar Reconnaissance Orbiter (LRO) is being readied for a late 2008 liftoff. It will chart the lunar landscape, not only to identify obstacles and safe-to-land spots, but also sensor sweep the terrain and gauge it for usable resources.

LRO is being specially equipped to probe the poles of the Moon.

Also on the agenda are automated landers to "find the light and touch the ice." That is, help characterize what's lurking within permanently darkened craters...and better determine what parts of the Moon may be always—or nearly all the time—bathed in sunlight.

"We know that there's hydrogen there...but there is a huge debate as to what that hydrogen is locked up with," Horowitz said. "If there is water there, that's a big deal...a huge impact on how we do exploration."

If water is found on the Moon, "the whole story changes," Horowitz said.

Antarctic-like outpost

NASA's story for the Moon may well lead to a lunar outpost—infrastructure that can be utilized by international teams for scientific and exploration pursuits.

"In my mind, I kind of relate back to here on Earth...going to Antarctica," Horowitz told *SPACE.com*. Once crews have gone back to the Moon, they will learn to survive there in sortie mode. Finding locales on the Moon with usable resources—such as water ice—would be home base from which crews can then branch out to other parts of the Moon, he said.

"We do see an outpost of some sort," Horowitz said. "We just don't know what it looks like yet."

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Gemini

If you head outside around 10:30 p.m. this week and look straight up over your head, you'll be looking directly at Gemini, the Heavenly Twins.

The heads of the Twins are the bright stars Pollux (yellowish) and Castor (white; a bit dimmer than Pollux).

The Twins were the sons of Zeus and Leda and brothers of that Helen whose face launched a thousand ships and caused the Trojan War. Ancient mariners regarded Pollux and Castor as the patrons of seafarers and in Elizabethan times they were also considered the protectors of all at sea. The expression "By Jimminy" is a popular corruption of the swearing by the ancients by these patrons, as in "by Gemini." The brothers have figured in scores of ancient folk tales. They were adventurers, warriors, and famous navigators.

The stars that compose their arms and bodies are fainter than those in their heads and feet. A second magnitude star known as Alhena marks one of Pollux' feet. In places where light pollution hides many of the fainter stars only Pollux, Castor and Alhena may be visible, forming a long wedge with its point aimed straight at Orion, the Mighty Hunter.

Castor is actually a system of six stars, forming one of the most remarkable examples of a multiple star in the heavens.

Pollux too, may have faint companions, though we now know that none of them are physically related to this bright star. Zeta Geminorum is a pulsating Cepheid star, its brightness changing nearly a full magnitude down from 4.4 and back in about 10 days. Propus is a complex system, a visual binary of magnitudes 3.3 and 6.5, with a period of about 500 years; the brighter member is a semi-regular variable, with an average period of 233 days. Additionally, an unseen companion star also periodically eclipses this star at intervals of 2,983 days.

Just above and to the right of Propus lies number 35 in Charles Messier's catalogue. Located just off the trailing foot of Castor, M35 can just be seen with the unaided eye on dark transparent nights. In low-power binoculars it may look like a dim, fairly large unresolved interstellar cloud, but look again. Even through light-polluted suburban skies, 7x glasses reveal at least a half dozen of the cluster's brightest stars against the whitish glow of about 200 fainter ones.

M35 has been described as a "splendid specimen" whose stars appear in curving rows, reminding one of the bursting of a skyrocket. – "one of the greatest objects in the heavens; a superb object that appears as big as the Moon and fills the eyepiece with a glitter of bright stars from centre to edge."

Also located less than half a degree southwest from M35 is an unusual object that has brought a brief surge of excitement to countless numbers of amateurs over the years. In a 6-inch telescope, it's a faint, circular cloud of light, which initially appears to the uninitiated as a possible new comet. The object, in fact, is the faint open star cluster NGC 2158.

The compilers of many of the more popular star atlases had to draw a cutoff line as to what deep sky objects to include, and not to include. Unfortunately, NGC 2158 fell just below the cut-off in most cases, which is why it is usually not mentioned and why many amateur astronomers have grown up knowing nothing of it.

If you get a chance to train a telescope on M35 and come across this small, faint patch of nebulosity a short distance away at least you won't be making the "comet mistake" that so many others have made.

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Exiles from the Milky Way

From Space.com

Astronomers last year spotted a star leaving the Milky Way Galaxy. Later one or two more were detected. And today, researchers announced the discovery of yet two more outbound stars.

With so many outcasts on record, astronomers now see them as a new class of astronomical object, intergalactic stars exiled from their home galaxies.

The two newfound exiles are racing out of the galaxy at more than a million miles an hour, fast enough that the galaxy's gravity will never reel them back in.

"These stars literally are castaways," said Warren Brown of the Harvard-Smithsonian Center for Astrophysics. "They have been thrown out of their home galaxy and set adrift in an ocean of intergalactic space."

Brown told *SPACE.com* that the same thing likely occurs in other galaxies, so intergalactic space is probably filled with wanderers.

Lots of them

Brown's team found the first outcast last year. Two other intergalactic vagabonds were spotted by European astronomers; one of those may have come from another nearby galaxy called the Large Magellanic Cloud.

There might be a thousand Milky Way exiles-to-be lurking inside the galaxy and on outbound tracks. The galaxy contains about 100 billion stars, so finding the outcasts is no easy task. Knowing what to look for is the key.

To leave the galaxy, a star must somehow be accelerated outward. Here's what astronomers figure can happen: A two-star system, called a binary, rounds the center of the galaxy where it is tugged apart by the tremendous gravity of the central supermassive black hole. One of the stars is captured, while the other is shot outward as if from a slingshot.

The scenario has been modelled on a computer. Finding the fast-moving stars is evidence that it actually happens.

"Discovering these two new exiled stars was neither lucky nor random," said Margaret Geller of the Smithsonian Astrophysical Observatory, a co-author on a paper about the work that's been submitted to *Astrophysical Journal Letters*. "We made a targeted search for them. By understanding their origin, we knew where to find them."

The researchers figure a star is flung from the galactic centre every 100,000 years or so.

Brown said other galaxies with massive black holes probably shoot stars out, too, and future observatories might spot them.

Speed demons

The speeds of the stars were measured using the Doppler technique, in which light is analyzed for the same shifts that occur in the sound of an ambulance siren when it is moving toward or away from you. Because the actual physical movement of the stars was not observed, the speed estimates are minimums. The stars might be moving faster.

In a couple of year, after enough time has passed to detect the proper motion of such faraway objects, their exact speed might be pinned down, Brown said in a telephone interview.

One of the newfound exiles is moving in the direction of the constellation Ursa Major at about 1.25 million mph with respect to the galaxy. It is 240,000 light-years away. The other is headed toward the constellation Cancer, outbound at 1.43 million miles per hour and 180,000 light-years away.

The main plane of the Milky Way Galaxy, where most of its stars reside, is about 100,000 light-years wide. Our solar system is in one of the outer spiral arms, roughly 26,000 light-years from the central black hole.

Both of the newfound outcasts are outside the galaxy's main plane but have yet to leave the halo, a bigger sphere of the Milky Way's influence that is perhaps 300,000 light-years in diameter. But they will leave, Brown said.

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M74. The Ghost Galaxy

from Michael Roe

Over the past year I have observed the M74 galaxy a few times. First a few facts. It was first discovered by Pierre Mechain of France in late September 1780. His friend Charles Messier determined its position and included it in his catalogue of Nebulae on 18th October 1780 as Messier 74. Before 1850 Lord Rosse, using his huge 72 inch telescope in Ireland, discovered that M74 had a spiral structure. Modern images reveal M74 as a lovely spiral galaxy.

I first actually saw M74 for myself using my 8 inch Celestron Schmidt Cassegrain on 15th December 2004. I had failed on the 9th December because the extreme faintness of this galaxy was unexpected. It looks about 6' across, a barely visible fuzz blending into the darkness. Sometimes in good dark skies it looks a little larger with an oval centre and a faint star on its edge.

The M74 galaxy is in Pisces at 01h 36.7m +15° 47' near a line of four faint stars and a triangle of stars. Locating its exact position it is essential and that's why I have named it the Ghost Galaxy, like a ghost its visibility is almost at the limits of what can be seen, an elusive spectral form. The magnitude of M74 has been described as +10.2 or +9.4. I suspect that all American figures for all galaxies are brighter than English figures. I judge its magnitude to be between +10.5 and +11.0, nearly at the limit for nebulae using my 8 inch telescope, many other galaxies are much easier to observe I find.

So, the big question is how did Mechain and Messier discover and observe M74 with only refracting telescopes at 2 to 2.5 inches aperture? Messier observed from the city of Paris, obviously had little light pollution in 1780. Perhaps they used very low magnifications. I observed M74 at x 50, mostly x 80 and at x 220. The nucleus shows as small and bright in photographs but visually I find it almost invisible, the oval central brightening 2' by 4' is the nearest I have seen.

All the past observers have mentioned M74's faintness. Mechain said it was very difficult to observe. In 1831 John Herschel using a better telescope said it was extremely faint, 5' in diameter with a brighter mass of 1' in the centre. Later in 1828 he believed it to be partially resolved into stars and called it a Globular Cluster, so did Dreyer in 1860. With possibly a few foreground stars and M74's condensations gave this impression.

M74 must be one of the faintest galaxies in Messier's catalogue, it had two supernovas in 2002 and 2003, a rather better rate of supernovas than our galaxy with only one in 1604, the next one??

The distance of M74 is about 35,000,000 Light Years, its diameter is 95,000 Light Years and a full diameter of 10.2' x 9.5', its other catalogue name is NGC 628.

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Most science fiction has alien intelligences which treat humans as approximate equals, either as friends or foes. It is assumed that A-I will either be friends, anxious to communicate and trade, or enemies who will fight and kill, or possibly enslave, the human race. There is another and more humiliating possibility - alien intelligences so superior to us and so indifferent to us as to be almost unaware of us. They do not even covet the surface of the planet where we live - they live in the stratosphere. We do not know whether they evolved here or elsewhere - will never know. Our mightiest engineering formations they regard as coral formations, i.e., seldom noticed and considered of no importance. We aren't even nuisances to them. And they are no threat to us, except that their engineering might occasionally disturb our habitat, as the grading done for a highway disturbs gopher holes. Some few of them might study us casually - or might not.

- Robert A. Heinlein, "Grumbles from the Grave"

Lying In The Long Grass.

from Ray Worthy.

Lying in the long grass, staring at the sky
A little boy is thinking of the mysteries so high.

The fear of Hitler's air force keeps the sky so clear and dark
No glim of earthly light is seen from the long grass in the park.

What are these points of light I see? I know each one's a star.
But that word tells me nothing about what they really are.

I'm also told they're like our Sun, these tiny points of stars
With families attending them, like Venus, Earth and Mars.

So does that mean that other folks are living there all free?
And does that mean that someone else is staring down at me?

Can I count them? No I can't. There's so much work to do.
In between my finger and thumb, I've counted thirty two.

I've been told about the atom, and how it's mainly space.
With tiny points all buzzing round the centre in a race.

So what is it I'm looking at? Is there a pattern here for us?
Can it be each point of light is an atom's nucleus?

Are the planets moving round with all their heavenly beauty
Playing their part in the scheme of things and doing the electron's duty?

So what is it I'm looking at? Let's give this line a nod.
I'm looking at the insides of the body of our God.

Hang on! Hang on! Just half a mo! That strange idea has risks.
The cyclopedia tells us all the stars are grouped in disks.

OK then! Give this a whirl. This theory might be good.
The galaxies are corpuscles flowing in God's blood.

The student in the long grass, staring at the sky
Still he's filled with wonder at the mysteries on high.

He's read his books so diligently and filled himself with knowledge.
He's studied this. he's studied that. He's been to school and college.

He's lying there and pondering; the answers still to figure.
His brain is filled with postulates (The words are now much bigger!)

There's constant cosmological and stellar evolution
There's fermions and nucleons and of course there's light pollution.

He goes to Cambridge; studies hard. Sits at the feet of Hoyle.
Element manufacture set everyone on boil.

And now the topic's shifted ground. Excitement there is great.
The question of the moment. "Big Bang" or "Steady State"

Hoyle, with Gold and Bondi said they'd explained old Hubble
Vacuum's not a vacuum. It's an energy soup a-bubble.

New formed matter turning up in space to intercede
Caused accelerating galaxies to continually up their speed

Hoyle's opponent Martin Ryle , with his radio array.
He put his aerials on rails and finally won the day.

He pin-pointed radio sources with discoveries so heady,
Until he proved that Hoyle was wrong and the Universe not steady.

Poor old Fred. He took the huff and said the proof was not enough
Retired hurt with new invention and tinkered with his first intention

Our young man's let down, misled, His idol did betray.
The object of his worship had now got feet of clay

Where to go now? What to do? Panic almost frantic.
Investigates positions across the broad Atlantic

Wilson and Penzias flying pigeons from their horn
Put the cap on steady state, leaving Fred Hoyle so forlorn

Their accidental finding brought his theory to its knees
Finding fossil radiation at a temp of three degrees.

Murray Gell-Man flying high, brilliantly made his mark
Breaking down the proton into quark and quark and quark.

Alpher, Bethe, Gamow, (I couldn't find a "Delta .)
Everett with his many worlds, ideas all helter-skelter.

Josephson with his junction and Wheeler I suppose
Dyson, Glazer, Baade, -- and Higgs and Bell and Bose.

But standing head and shoulders over all these mentioned here
Iridescent Richard Feynman with his diagrams so clear.

Not a chance of standing out in this company divine,
Our hero steadily plods along, quietly toeing the line.

Meanwhile, back in Cambridge, "Black Holes" are making sense.
Event horizons gather round small points immensely dense.

Penrose and Stephen Hawking find their calculations click
and Jocelyn Bell with Hewish finds a star which makes a tick.

Disillusioned old professor, his ideas all ahoop.
Every argument he'd put down had met its Waterloo
instead of shining brightly, his colour was always grey.
Nobel Prizes gone astray. Some one else had won the day.

We need new mathematics to support each new position
For every thought put forward shows counter-intuition.

We live in three dimensions: at a pinch we live in four.
But now we work in nine or ten, or maybe even more.

To cap it all new thoughts take wing,
And points aren't points, They're bits of string

Lying in the long grass the professor so morose
Have we got there? No siree. We're not even close.

If that's the case we pause and think and possibly we pray
Some new born Newton may arise and show us all the way.

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Most Stars are Singles

By Robert Naeye

January 27, 2006 | Astronomers have known since the 1700s that a significant fraction of stars belong to binary or multiple systems. But what is that fraction? Given the observed fact that most solar-size and larger stars reside in binaries, many astronomers have concluded that more than half of our galaxy's stars belong to multiple-star systems.

But a new study by Charles Lada (Harvard-Smithsonian Center for Astrophysics) shows that conventional wisdom is almost certainly wrong. The problem, says Lada, is that astronomers have neglected to consider our galaxy's most common stellar denizens: red dwarfs (spectral type *M*). These low-mass, low-luminosity stars make up more than 70 percent of all the stars in the Milky Way.

Lada cites surveys from groups led by Geoff Marcy (University of California, Berkeley), Neil Reid (Space Telescope Science Institute), Xavier Delfosse (Astrophysical Laboratory of Grenoble, France), and others that find that the single-star fraction among red dwarfs is very high. And because red dwarfs are the dominant population of stars, single stars must account for upwards of two-thirds of all stellar systems in the galaxy Lada concludes in his paper, which has been submitted to *Astrophysical Journal Letters*.

"By assembling these pieces of the puzzle, the picture that emerged was the complete opposite of what most astronomers have believed," says Lada.

These results are consistent with the findings of the ongoing RECONS study at Georgia State University, which surveys the Sun's local neighborhood. The RECONS study has found that only 43 of the 171 primary red dwarfs within 10 parsecs (32.6 light-years) of the Sun have either another red dwarf or brown dwarf as a companion. "This is a lower limit, of course, because we're still uncovering companions," says RECONS team leader Todd Henry. "But we've known that the binary fraction of red dwarfs is much lower than the fraction for more massive stars."

Studies like these have important ramifications for theories of star and planet formation, since planets probably have an easier time forming around single stars than they do in binary systems. In fact, a low-mass planet was announced earlier this week around a solitary red dwarf.

But the news isn't all bad for binary-star planets. At the American Astronomical Society meeting earlier this month, Henry and his Georgia State colleague Deepak Raghavan found that 29 of 131 stars known to host at least one exoplanet also have a stellar companion. Theoretical models by Alan Boss (Carnegie Institution of Washington) suggest that a distant stellar companion's gravity can actually induce planet birth around a star by triggering the coalescence of dense gas clumps within a protoplanetary disk. The clumps quickly collapse to form gas-giant planets. Jack Lissauer (NASA/Ames Research Center) presented his group's findings that Earth-size planets can form in wide orbits around two stars in a tight binary and in close orbits around one of the two stars in a widely separated binary.

"The take-home message is that half of all wide binary-star systems can harbor planets because the separation is great enough to permit both the formation and the subsequent stability of the resulting planetary orbits," says Marcy, coleader of the team that has discovered more than half of the 170-plus known exoplanets. "There are surely tens of billions of Sun-like stars in the galaxy that can easily harbor planets."

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Transit Tailpieces

Custom Telescopes UK.

Glen Oliver, a long-time member of the Society, can supply telescopes and accessories of all kinds. He operates from Hartlepool and has a website, **<http://homepage.ntlworld.com/glen.oliver/custom.htm>**
e-mail glen.oliver@ntlworld.com.

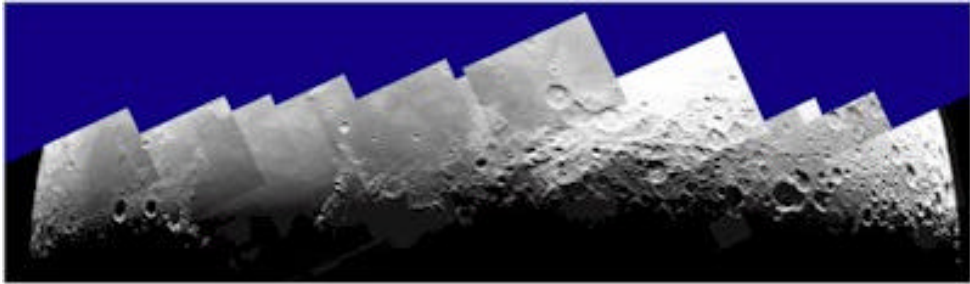
Support local businessmen! Glen tells me that he now has an Astronomy and Space books page on his website

Transit Adverts If you wish to let members know what you want to sell or what you are looking for, please send an advert for the magazine.

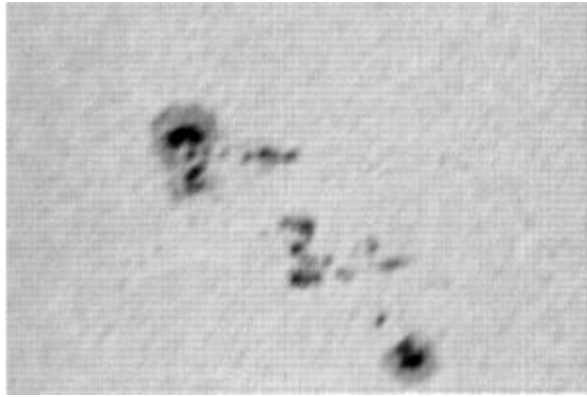
CaDAS Website Don't forget to visit our very own website at **www.wynyard-planetarium.net**.

For sale – Helios 240mm reflector with tripod, eyepieces, Barlow etc. Sensible offers considered. Please contact Graham Johnson at the Carlton Outdoor Centre on 01642 712229

Articles Please send contributions for the newsletter to Bob Mullen, 18 Chandlers Ridge, Nunthorpe, Middlesbrough, TS7 0JL, 01642 324939 (**b2mullen@hotmail.com**)
Copy deadline date is the 25th of each month.



Mosaic of the Moon's terminator from Rob Peeling



Sunspots by Rob Peeling



Saturn by Jack Youdale with 12" Dall Kirkham Cassegrain