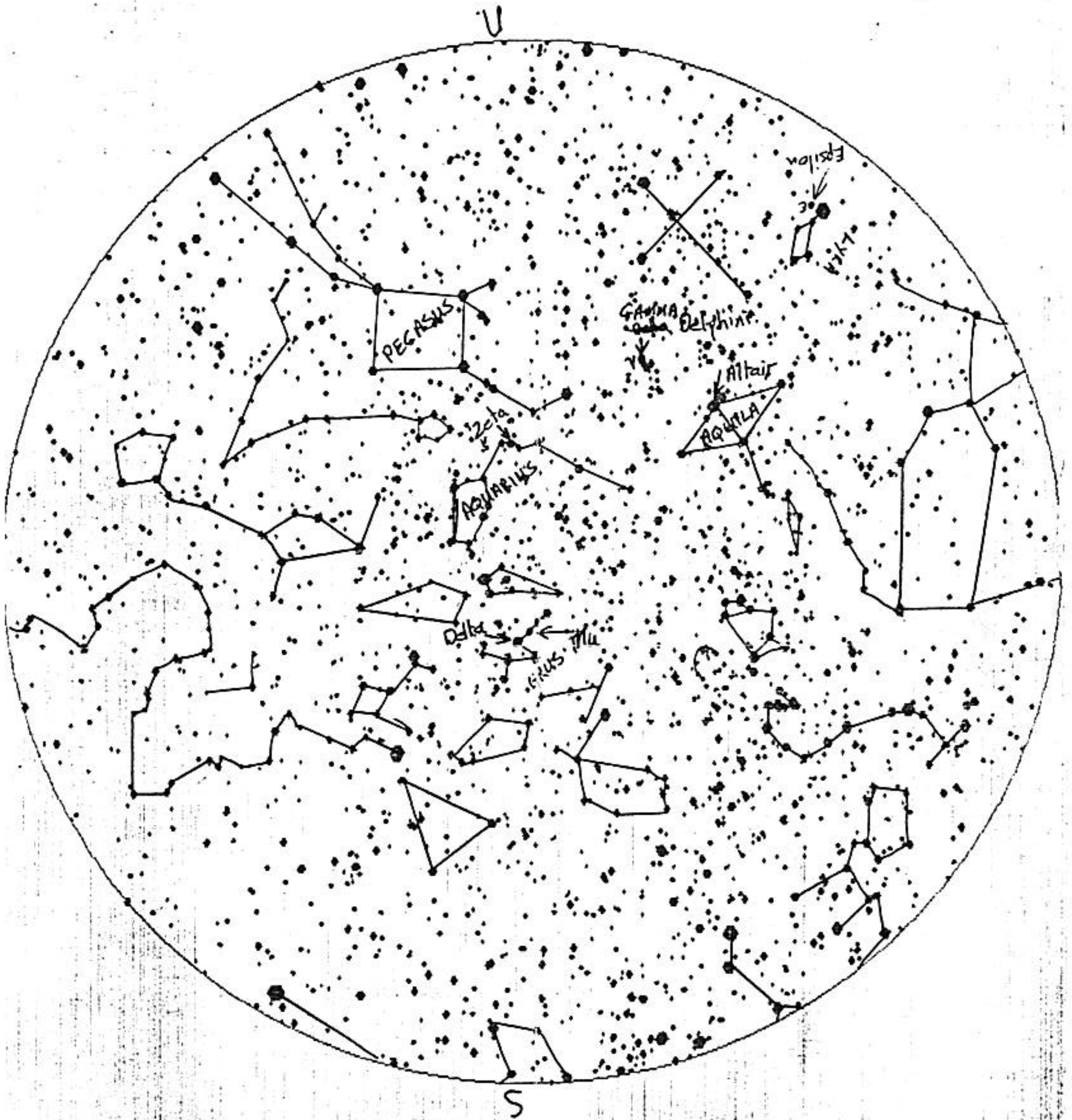
November 1990

Urania

Astronomical Society of Southern Africa
Pretoria Centre



WHATS UP DOC?

Last month we looked at galaxies. These are some of the most difficult objects to observe especially from light polluted skies. This month lets try a couple of very easy double stars as well as an unusual event on Saturn.

Firstly we will look at the double double in Lyra. Epsilon Lyrae (RA 18 42.7 Dec +39 37) appears as an easy double with two components of about mag 4.5 separated by a large 208". This double star should be visible in any telescope. What is interesting about it is that each of the components is itself a very close double which can under good conditions be resolved in a 75mm telescope. Look for this star low in the north soon after sunset so that you can observe it while it is still relatively high in the sky.

Delphinius the Dolphin also contains an easy double. Gamma Delphini (RA 20 44.3 Dec +15 37) consists of two components of magnitudes 4.5 and 5.5 with a separation of 10.4 seconds. These stars are described as yellow and pale green but it might be interesting to hear from you what colours you see in the components. This double star should also be visible in any small telescope.

The last double we will look at this month is in Aquarius. Zeta Aquarii (RA 22 26.3 Dec -00 17) is somewhat more difficult and may require at least 150 mm to cleanly resolve the components. The two white components are magnitudes 4.42 and 4.59 and are separated by only 2 seconds of arc. To resolve such close components you must wait for good seeing when the star images are very steady and clean. Any turbulence in the atmosphere will interfere in attempts to resolve them. My own personal best with a 200mm telescope is a 1 arc second pair and to achieve this I had to examine the double on many occasions. For a number of nights I failed to resolve the stars and then one evening there they were separated as clearly as can be. Atmospheric seeing is critical for close pairs.

Now for Saturn. Once every Saturniun year the planets northern hemisphere is most directly pointed toward the sun in

parsecs. Getting back to the Orion Nebula, it is 300 parsecs away, quite close really. Whats that, you don't believe me when I say its close? Oh, well lets remedy that. The sun is situated about 3/4 of the way out from the centre of our galaxy. How big is this galaxy of ours. Lets look toward the galaxy centre in Sagittarius. What do we see in that region? The Lagoon Nebula and its neighbour the Triffid Nebula and slightly further away the Omega Nebula. Dozens of open clusters and other objects are situated in the milky way in this region. Surely we must be seeing virtually all the way to the centre of the galaxy to have so many fine objects in such close proximity in one area of the sky? No! The three mentioned are only 770, 670 and 1000 parsecs away respectively. The galactic centre is 10 000 parsecs from the earth. The furthest of these three is therefore only one tenth of the distance to the centre of the galaxy. In fact the furthest of the well known galactic objects is probably the Perseus double cluster and that is only 2250 parsecs away. Due to the amount of dust and gas in the galactic plane even the biggest optical telescopes can observe less than 20% of our galaxy. This galaxy is BIG!
But it is also small. Other galaxies are visable to even our small telescopes when we look out of the galactic plane away from the Milky Way. Distances to these galaxies are measured not in parsecs or even kiloparsecs but in Megaparsecs. Millions of fainter and still more distant galaxies are visable to larger telescopes. We are forced eventually to discard even the Megaparsec since it is too small. Ultimately we measure distance as the proportion of the speed of light at which an [illegible]ct is receding from us due to the expansion of the universe. The further we look the more we see. These are truly immeasureable distances and still there is no end in sight and there probably never will be.
Ed

DISTANCE OF WELL KNOWN GALACTIC OBJECTS

OBJECT	DISTANCE	CONS TELL ATION
NEBULAE		
ORION	0300	ORI
HORSEHEAD	0368	ORI
ROSETTE	1100	MON
ETA CARINA	1100	CAR
TRIFID	0670	SGR
LAGOON	0770	SGR
EAGLE	1400	SER
OMEGA	1000	SGR
VEIL	0400	CYG
CRAB	0280	TAU
OPEN CLUSTERS		
PER DOUBLE	2250	PER
PLEIDES	0126	TAU
HYADES	40	TAU
PRAESEPE	0158	CNC
JEWEL BOX	0300	CRU
BUTTERFLY	0570	SCO
WILD DUCK	1740	SCT
PLANETARY NEBULAE		
ESKIMO	0420	GEM
OWL	2290	UMA
RING	0660	LYR
DUMBBELL	0300	VUL
SATURN	0440	AQR
HELIX	0180	AQR
BUBBLE	0520	CAS

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EDITORIAL

In the working environment we all eventually come across the various theories regarding the motivation of people. I can recall from various courses words like survival, self actualisation and similar labels that try to fit people into boxes.

Some months ago I tried to apply these labels to my astronomy but none of the tried and tested theories seemed to fit. Maslow and his cronies evidently never studied an amateur astronomer. I will never be able to accurately define what motivates me to be an amateur astronomer. There is no doubt though that some very strong elements make up the driving force.

Perhaps the major one is awe. There is simply nothing as impressive in the universe as the universe. Together with awe there is a burning desire to learn more about this fascinating universe. I suppose I would like to know everything about everything and the Universe seems to be a good place to start. At times I also detect an inkling of the exploratory spirit in the back of my mind. I am sure that if I lived in the right time I would have been one of those pioneering chaps who first explored new lands. The new lands of our generation cannot be easily travelled but as compensation we can view them from a distance.

Together with these lofty motivators is a plain ordinary love of fiddling. Since I cannot afford a lovely big telescope with all of those fancy accessories, I am forced to make that which I want. Its really all quite satisfying. This leads me to the point I wish to make, from fiddling to awestruck, can there be another hobby which offers such a scope for satisfying those urges that drive us?

ED

Letters and contributions to:
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Contributions may also be handed to me at any of the monthly meetings or practical sessions.

FEEDBACK!
FEEDBACK!!!
FEEDBACK!!!!!!

A wonderful thing happened to me the other day. I received a letter. This event took me back to my youth for I again experienced that feeling that only schoolchildren can feel on te last day of school prior to a nice long break. This was no ordinary letter. I receive many of those. This one was a letter to the editor of Urania. It seems that Ian Macdougal has been preparing an article which could bevery useful. What it is you will have to see. Ian has a problem though. It seems that we hold our practicals on the one evening a month when he cannot attend. This will be taken up at the next committee meeting but before then I would appreciate hearing from others who have problems on specific nights. We might be able to find a night which suits everbody. I think we should stick to a Friday night but how do you feel.

exposure that was perfect last night will not necessarily be right for next week. At least the graph will help you understand your mistakes and this will assist you in obtaining the experience you need to judge the best exposures under prevailing conditions.

To make things even more complicated, not all films are created equal. You are all aware that films are made at different "speeds". Even films of the same speed, however, can vary greatly when used for astrophotography. The reason for this is reciprocity failure and the fact that different films suffer from this to different degrees. Film is manufactured to be given short exposures such as for family snaps. The manufacturers have not designed their films for us poor astrophotographers. The reciprocity rule states that an exposure of 1/100th of a second will give twice as bright an image as an exposure of 1/200 of a second. This rule breaks down for exposures exceeding about one minute for most films. Where a five minute exposure will result in a brightness of X, it may take a 17 minute exposure to obtain a brightness of 2X. Furthermore the three layers in a colour film may have different reciprocity failure rates. Scotch 1000 colour slide film has less reciprocity failure in the red layer of the film than in others. Any sky fog that appears is therefore red. It does however make the film useful for red emission nebula provided you do not allow the sky fog to come off the toe of the curve. I have found that in town a three minute exposure is the maximum I can allow with this film to ensure that I have no sky fog. The film would not be any use for **galaxies as they are basically blue** by nature and the film is not very blue-sensitive. The blue image takes too long to come off the toe of the curve compared to the red image. I have tried most of the superfast colour slide films and the best in my opinion is the Agfachrome RS1000 followed by the Scotch 1000.

Reciprocity failure is caused by a

number of factors and there are ways in which it can be reduced. We will look at some of the methods of sensitising film in a later article.

The last word about film should mention that while fast films allow short exposures, the slow films usually give better contrast. If you are serious about astrophotography, then do not totally ignore the slower films. One of the Sky and Telescopes showed really excellent photos taken with a hypersensitised Fujichrome RD50 film. Apart from the better contrast, the finer grain allows the recording of finer details and greater enlargement.

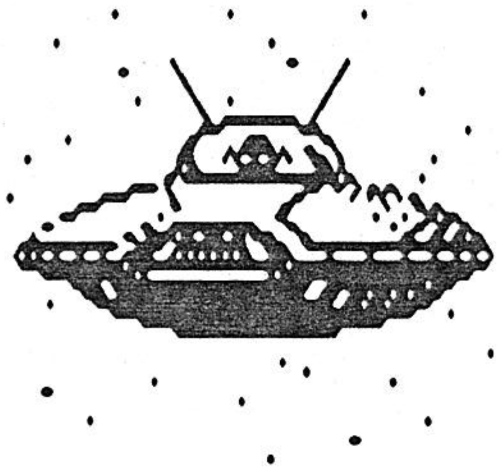
much the same fashion as happens to the earth. This northern summer on Saturn sometimes results in great white spots appearing in the equatorial regions of the planet. One such spot has indeed now appeared. Remember that these spots seem to appear with intervals of at least 29 years and they are thus quite rare. You may in fact not have another opportunity to see one in your lifetime. This one should be visible in a telescope of 150 mm aperture. In my 200 mm I cannot clearly make out the edges of the spot but see only an unusually bright zone in the equatorial regions just above the rings of Saturn. See if you can spot this bright area.

YOU. Yes You.

Where is your contribution to Urania. No it doesnt matter that youve only been a member for a month. Who is better to comment on the needs and perceptions of an amateur amateur astronomer than you? Put pen to paper and write. Write what? Anything. How do you feel about astronomy, What would you like to see in the monthly program. You can even write about why you do not want to contribute to Urania. Anything is welcome.

How far?

We as amateur astronomers have our favourite objects that we view again and again. When we examine for example the Orion Nebula we might know that it is about 900 light years away. Light, travelling at slightly less than 300 000 kilometers per second, has taken 900



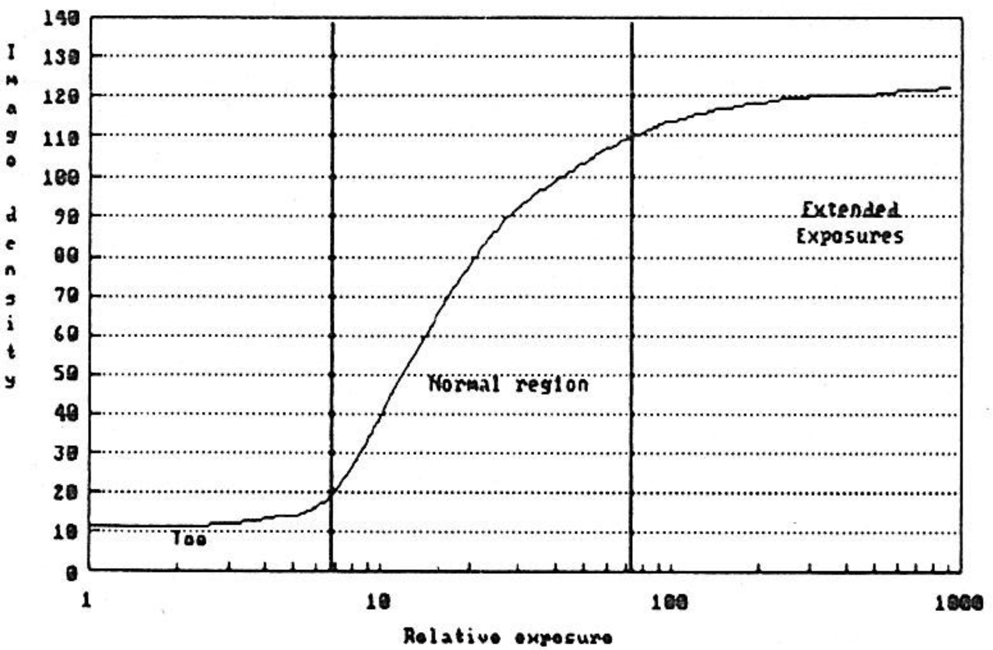
years to get here. But how far is that really. Its no good converting this distance to kilometers for our minds cannot deal with numbers on that scale. One kilometer is easy and we know how far 100 kilometers is. Even the 1000 odd kilometers to the Cape coast are within our grasp and we might even be able to comprehend the 10 000 kilometers to some distant land. But how far is a billion kilometers?? And that is not even one light year!
Just for interest sake the Orion Nebula is 8500000000000000 kilometers away (give or take a couple of billion). No the keyboard did not get stuck.
Lets try another perspective. Lets firts get rid of the light year since modern astronomers use another measurement. A parsec is the distance at which the earths orbit around the sun would subtend an angle of one arc second. It is equal to 3,26 light years. One Kiloparsec is equal to 1000 parsecs and one Megaparsec is equal to one million

FILMS FOR ASTROPHOTOGRAPHY.

One of the most important considerations in astrophotography is which film to use. In order to reach any conclusion regarding films it is necessary to know how they work.
Films do not respond to light in a linear manner. Instead they respond in the manner indicated on the graph.
Note that the relative exposure axis of the graph uses a logarithmic scale. That is to say that the "toe" end of the graph is stretched out while the "extended exposure" part is compressed. In addition I have perhaps slightly overemphasized the curve to demonstrate certain points. Note also that the curve does not start at 0. This represents the inherent image density with which any film starts off, the so called chemical fog. Different films will have slightly different curves and each film therefore has its own characteristics.

When taking a family snapshot using a normal exposure of say 1/125 of a second the black parts of the image provide lets say about 5 units of relative exposure and therefore only move the image density a litte further up on the toe of the curve. A bright area however provides much more relative exposure (say 80 units) during the same 1/125 second period and therefore provides much greater image density on the negative. The graph in this case represents normal negative film but positive slides have a similar inverse curve.

EFFECT OF EXPOSURE OF FILM TO LIGHT



Now lets see how this affects astrophotography. When photographing an object such as a star or nebula, the contrast is much lower than for the normal family snap especially in the light polluted areas that we live in. Lets use for example a sky background with a brightness factor of 3 and nebulosity with a brightness factor of 8.

Exp time	Relative Density		Image Density		Difference in density (Contrast)
	Back gnd	Neb ula	Back gnd	Neb ula	
1	3	8	13	18	5
2	6	16	17	67	50
5	15	40	64	100	36
10	30	80	92	112	20

Notice that for too short an exposure i.e. 1, neither the sky background or the nebula image will move off the toe of the graph and they will have a relative density of 3 and 8 respectively. The difference in image density will only be about 5. The image will therefore not stand out on the film. For a very long exposure (10) both will have moved off the toe of the graph to a relative exposure of 92 and 112. The difference in image density will then be about 20. The best exposure which has the highest contrast is the second one. In this case the sky background has only just started to move off the toe while the nebula image has had the benefit of the sharpest part of the curve and we have a resulting contrast of 50, which is not even closely approached by any of the other exposures. What does this tell us.
Firstly, the longest exposure does not necessarily give the best image. In the longer exposures the image has been washed out by the sk background or sky fog. The bes image is the one which only jus begins to show sky fog. It is als obvious that the darker the sky, th longer the exposure that can b taken while still keeping the sky fo on the toe of the graph an allowing the nebula image to clim higher on the curve. In bad ligh pollution where the contras between the nebula and sky is ver small, it is impossible to photograp faint objects since the sky glo starts to come off the toe very soo after the nebula image does an contrast on the film is very difficul to obtain.

Louis Barendse once commented tha for a certain film with a specifi exposure, he obtained good result from his home in Queenswoo When he used the same film an the same exposure times under ver dark skies from a different locatio there was almost no image on th film. What in fact happened wa that from town the additional ligh pollution helped push the relativ exposure of the nebula off the to and onto the steepest part of th curve where the best image densit resulted. At the dark site the tota relative exposure (light pollution an nebula image) was not enough t push the image off the toe and h had basically the same situatio shown in the table with a 1 tim unit exposure. Both sky backgroun and nebula image were still on th toe and there was thus very litt contrast.

This all sounds great in theory bu unfortunately there is no little mete on the camera which tells you tha the sky background is coming o the toe. In addition the sky is n always equally bright and th