MACARTHUR ASTRONOMICAL SOCIETY

MAS Newsletter

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"A CAST OF THOUSANDS"

It was a great honour and privilege that our Society was invited to participate in the Macquarie University's Astronomy Open Night. We contributed two telescopes - the now well travelled TASCO 115mm and the rather stylish Celestron 200mm supplied and operated by Peter Druery.

Before the general public arrived, a settling in period was needed. A section of the car park was set aside for the astronomers and their 'scopes. With car boots opened and tripods erected, it was time for us to balance our counterweights and polar align ourselves.

Being the inexperienced one, it was greatly appreciated that I could call upon both Eric Brown and Peter to 'point me in the right direction.'

With the preliminaries out of the way, it was time to get to it.

The gates opened and a stampede of over 2,000 observers descended upon us. It was absolutely chaotic with queues stretching back 50 people long at each 'scope. I felt like I was serving Big Macs at MacDonalds at Inchime in the school holidays. It was even busier than the half-yearly clearance sale at David Jones.

I think Peter knew what to expect and came prepared with 2 deck chairs, in for the long haul. I myself had no idea what to expect but I knew my red beanie would keep my head warm.

Yes, we had Mums and Dads, old and young, couples and singles, 'a cast of thousands'.

So, what did we look at? Well, the moon was nicely placed and most 'scopes were on it. (Actually, the 'scopes were in the car park but were focussed on the moon). Hm. Peter had his 'scope arranged so that one could comfortably sit down, take the load off and gaze into craters, kept perfectly in place by electronic motor drive...how nice!

I had little kids jumping into the air and grabbing onto my counterweight like it was some kind of playground equipment and giving it a good yank...ouch! Where are the parents, I asked. Oh, yes, they're trying to look through the telescope.

Control was quickly restored, however, and I set my sights upon the brightest star I could find, hoping no-one would ask any questions, for the 'buggered if I know' routine would be most inappropriate. A more 'Sirius' reply would be needed - pun intended.

MACQUARIE OPEN NIGHT (Cont'd)

My answers were down pat, thanks to my able bodied research assistant, Andrew Dunne. The stock standard reply was as follows:

'We are looking at the star Sirius, a bright white star with white dwarf companion. It's about 8 light years away and is the brightest star of the night. Anything brighter is a planet, Venus or Jupiter. It's normally the first star of the night to appear.'

I used that routine for 2 hours straight, so it was a great relief that a kindly lady in her 90's said 'did you know that the First Fleet used that star to navigate to Australia, and one of the ships was named after it,'

"You beauty!" So for the next 2 hours it was 'Yu see that star up there? They called a boat after it." Anything brighter is a street light.

It was the only disappointment of a fantastic night when the clouds appeared as one giant wet blanket. But they soon cleared and Jupiter was shining through and all 'scopes were duly aimed. About 10 in all, plenty for all to see.

Peter had Jupiter placed and drew big crowds to look at this wonderful sight. He was very skilful at answering all questions astronomic and his patience must be admired.

The questions I got followed along these lines:

* If I buy a telescope, what would I see?
* The telescopes they are selling inside, which is the best one?

The only question I could answer easily and in less than 10 seconds was -"Excuse me sir, my litle boy wants t do wee wees. Where's the toilets?"

This night had it all, but the following must rate a mention.:

* To our President Phil Ainsworth who manned our exhibition table at the Trade Expo. Using his vast array of contacts, e promoted the Society for all its worth... just fantastic.
* To Andrew Dunne who enrolled new members, researched information, answered questions and provided me with steak sandwiches and coffee... a really big thank you.
* To Peter Druery for his experience, patience, and for making his excellent telescope available...just great.
* To the little boy who crash tackled my tripod and destroyed my polar alignment ...gee thanks.

In closing it was a night to remember. Everyone involved worked very hard and when packing up, a few indiscretions crept in, with Peter coming up with a classic. He invited Phil to look through his eyepiece as the Red Planet, Mars, was about to appear. Well, I wasn't Mars but a large red flash light which Peter held in front of the telescope, waving it around while doing a strange war dance. It will be a memory long remembered. And a great night was had by all. (Noel Sharpe)

P.S. Phil, you said you were taking the lamingtons home for the kids, but you and Peter ate them all. Didn't you?

COONABARABRAN ASTROFEST

We have been advised that the Astrofest event, usually on in October near Siding Spring, Coonabarabran, has been cancelled this year.

PRESIDENT'S REPORT

Welcome to all old and new members. Many thanks to all of you who are making this society so successful.

We had a great night out at Macquarie University showing the public the wonders of the celestial sky. A sincere thank you to Noel and Peter who brought scopes and Andrew who worked diligently between the telescopes and the stall promoting our society. Let's see more of us at the next one.

I hope all those in the society enjoyed the Bargo Star Night with Sutherland.

I am sure you will agree we all enjoyed Phillip Young's talk on Interstellar Travel. This month we are fortunate to have another guest speaker, namely Morris Jones who will talk about Mars. (Not on Mars.)

Also congratulations Bob on a great Newsletter in May. The other societies have praised its quality and quantity. Many of the public enjoyed reading the articles and its general presentation.

Our sincere condolences go out to David McBean and family due to the recent loss of his grandfather.

COMING UP ARE:

* 15th July:- Bob Bee talking (what's new?) on measuring the distances to the stars and beyond.

* 19th August:- Peter Druery on reading star maps and using Planispheres.

* 16th September:- Speaker to be announced.

LIBRARIAN'S REPORT

Once again, thanks to those using the resources. Soon I will have more videos and some recent magazines as soon as I can obtain 'due date' forms and have everything catalogued.

THE SOLAR SYSTEM NEWS REPORT

It's fairly quiet on the planet scene except to say Jupiter is magnificent in the sky from about 8.00 pm.

We mourn the loss of Europe's latest rocket, the Ariana-5. It blew up with four satellites on board (only costing ten years work and the miserly sum of ten billion dollars.)

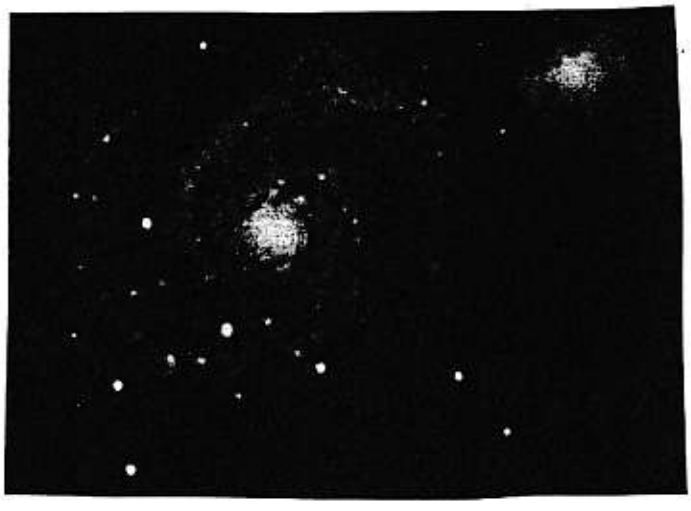
Comet Hyakutake is fading rapidly in the morning sky. Look with binoculars and it is still only a faint fuzzy ball. Comet Hale-Bopp will be more easily seen next year with the naked eye, hopefully. Currently, it is very difficult to pick up, even with a telescope.

Finally, I must mention our Australian hero, Andrew Thomas and his extremely successful shuttle mission. Dr Thomas was born and educated in Adelaide. He migrated to the USA to become an astronaut. While on the shuttle, he inflated a huge mirror like structure and performed many other scientific experiments. I believe he is not only a mission specialist but a pilot and will be co-piloting one of the next few shuttle missions this year.

(Phil Ainsworth - President)

THE 25 BRIGHTEST STARS

	STAR	DESIGNATION	APP.MAG.	SP	DISTANCE l.y.
1.	Sirius	α Canis Majoris	-1.46	A1	8.7
2.	Canopus	α Carinae	-0.72	A9	74
3.	Rigil Kentaurus	α Centauri	-0.27	G2	4.3
4.	Arcturus	α Bootis	-0.04	K2	34
5.	Vega	α Lyrae	0.03	A0	25
6.	Capella	α Aurigae	0.08	G6	43
7.	Rigel	β Orianis	0.11	B8	910
8.	Procyon	α Canis Minoris	0.34	F5	11.4
9.	Achernar	α Eradani	0.49	B3	69
10.	Hadar	β Centauri	0.6	B1	320
11.	Betelgeuse	α Orionis	0.7	M2	310
12.	Altair	α Aquilae	0.77	A7	16
13.	Aldebaran	α Tauri	0.8	K5	60
14.	ACrux	α Crusis	0.83	B1	510
15.	Antares	α Scorpii	0.92	M1	520
16.	Spica	α Virginis	0.98	B1	220
17.	Pollux	β Geminorum	1.15	K0	35
18.	Fomalhaut	α Piscis Austrini	1.16	A3	22
19.	Deneb	α Cygni	1.25	A2	1500
20.	Mimosa	β Crusis	1.28	B0	490
21.	Regulus	α Leonis	1.34	A0	70
22.	Adhara	ε Canis Majoris	1.48	B2	570
23.	Castor	α Geminorum	1.60	A1	49
24.	Shaula	λ Scorpii	1.62	B1	330
25.	Bellatrix	γ Orionis	1.64	B2	470

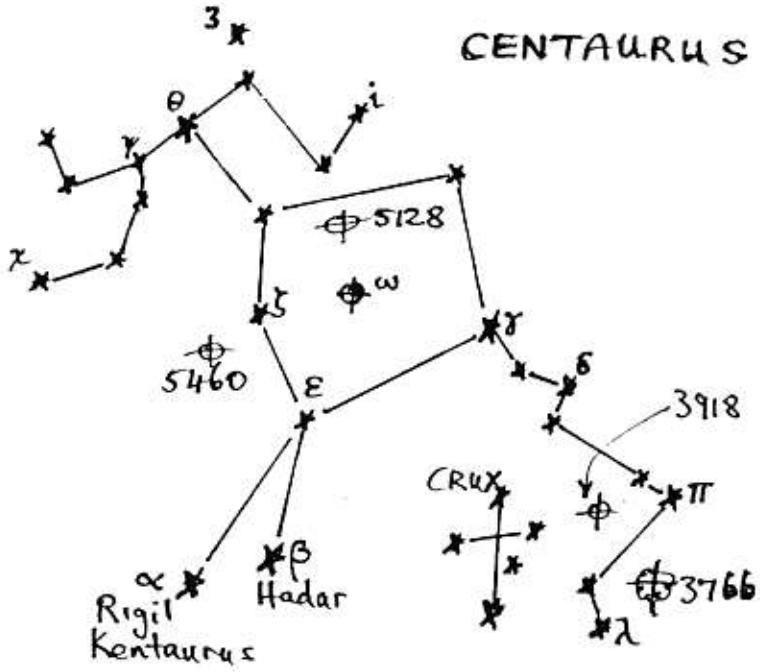


Courtesy of H.S.T.

CENTAURUS - THE CENTAUR

This constellation is named after the mythological creature which was half man-half horse. Of historical interest, the constellation is meant to represent the specific Centaur Chiron. Chiron was a scholarly type who taught many Greek gods and heroes (in his spare moments when he wasn't horsing around, I assume).

See the sketch of the constellation below. Note its position relative to the Southern Cross.



Centaurus is a large constellation, occupying a prominent part of the Milky Way, ranging from Declination -33deg to -63deg (ie about 30 deg. vertically) and Right Ascension 11hr to 15hr (1 hr = 15deg. therefore about 60deg horizontally).)

Its legs and belly effectively straddle the Southern Cross (Crux) so it should be relatively easy to locate.

Ask any amateur astronomer about Centaurus and they will quickly talk in depth about Alpha and Omega Centauri. After that, there would be a quick rush for the reference books. Fair enough! There's a lot of stars that make up Centaurus, and a large number of associated clusters, nebulae and galaxies. A veritable smorgasbord for the amateur astronomer.

Centaurus is one of those constellations uniquely visible from the Southern Hemisphere - almost. Checking the star chart of the Northern Hemisphere's sky, it would appear Centaurus's head and arms barely pop over the horizon for low latitudes in the Northern hemisphere. They certainly don't see Alpha and Omega Centauri - they're ours.

Referring to the sketch, here are some of the more prominent features of Centaurus, being more accessible to amateurs with binoculars or modest telescopes.

CENTAURUS (Cont'd)

* **Alpha (a) Centauri**: This star has names to burn. Known as Rigil Kentaurus - meaning 'foot of the centaur' - also as Toliman. Also, unofficially, as 'the first pointer star'.

It is the third brightest star in the sky, having a magnitude of -0.27. Binoculars and small telescopes will show that it is actually two stars - both yellows - of mag. -0.01 and +1.33. The brightest is a Class G2 star, the same as our Sun. The other is a Class K1.

The two stars orbit each other every 80 years. Alpha Centauri has the unique privilege of being the closest star to our Sun, at a distance of 4.23 l.y. Yes, you pedants, there is Proxima Centauri, an 11th magnitude red dwarf that is presently 0.1 l.y. closer. But, Proxima is associated with Alpha Centauri, though a significant distance from it. (0.1 l.y. in fact). It lies 2 deg away and is usually outside any telescopic view trained on Alpha. It is thought to take about 1 million years to orbit its companion. So, except in Trivia Nights, it is correct and safe to say that Alpha Centauri is the closest star.

* **Beta (b) Centauri**: Also known as Hadar and Agena or 'the second pointer star'. Though not called such, it is the hoof of Chiron's other front leg. Chiron must take big strides because Beta C. is 360 l.y. away (compared to Alpha's 4.23). Despite that, it is still the 10th brightest star in the sky, with an apparent mag of +.63.

Beta Centaurus is a single blue giant star of Class B1.

* **Gamma (c) Centauri**: It sits virtually on top of the Southern Cross. (This is an appropriate description as Gamma Centauri forms the Centaur's 'backside').

It comprises a close double of blue-white stars, giving an apparent mag. of +2.2. The double's components orbit every 85 years. They are so close that, unlike Alpha Centauri, you would need a telescope of at least 150mm aperture to separate them. As they orbit (and come 'closer' together), you would need larger apertures to separate them (say, 200mm) until about the year 2030 when they are apart again and a 150mm will do the trick.

Gamma Centauri is 330 l.y. away.

* **3 Centauri**.: (No Greek letter for this one.) This star is interesting for small telescopes which can divide it easily into two unrelated (ie they don't orbit each other) blue-white stars. The two stars are of mag. +4.6 and +6.1 and are 820 and 590 l.y. away respectively.

* **Omega (w) Centauri**: You run out of superlatives for this one. Unique to the Southern sky. The brightest and largest of the globular clusters. Beautiful in binoculars, glorious in a small telescope. It was originally named as a star on early charts, it was so prominent. BUT, it didn't get a Messier number. Charles didn't come south or he would have slapped a number on it faster than you could say 'zut pour'.

At 17,000 l.y away, it is one of the closest globular clusters and appears to the naked eye as a star of mag. +3.7, though it really occupies an area of the sky larger than the full moon.

Slightly elliptical in shape and approx. 65 l.y. across, the cluster is estimated to have between 10,000 and 1 million stars, mostly old red stars (the majority being red dwarfs).

Globular clusters have a special place in the architecture of galaxies and the universe generally. (We would need another separate article to discuss this.) And Omega Centauri is one of the best.

CENTAURUS (Cont'd)

Now we come to some New General Catalogue identified objects. Don't be put off by NGC numbers. It usually simply means an object other than a star. If you can see them (and it usually takes at least binoculars), they can be more interesting and rewarding than stars.

* **NGC3766**: This is near Lambda (l) Centauri, the hoof of the back leg. It is an open cluster of approx. 100 stars and is visible to the naked eye. It's only 5,500 l.y. away.

* **NGC3918:** It lies halfway between Delta (d) Crux and Pi (p) Centauri (the back leg's knee). It is also known as the Blue Planetary. It was discovered and named by John Herschel.

NGC3918 is an example of a planetary nebula, 2600 l.y. away and is mag. +8. A reasonable telescope should be able to discern the central +11 mag. star, the remnant of the explosion that sent most of the star's outer material hurtling into space as a spherical shell.

If you can see the nebula, it is similar in appearance to the planet Uranus, though larger in apparent diameter.

* **NGC5128:** A well known astronomical object, particularly to radio astronomers. Called Centaurus A, about 15 million l.y. away, it is an intense radio source. Visually, it is a beautiful elliptically shaped galaxy with a dark band of gas and dust circling it, but a long-exposure photograph is required to capture its true beauty. Technically, it is described as an 'irregular galaxy' as it does not fit any standard description or shape.

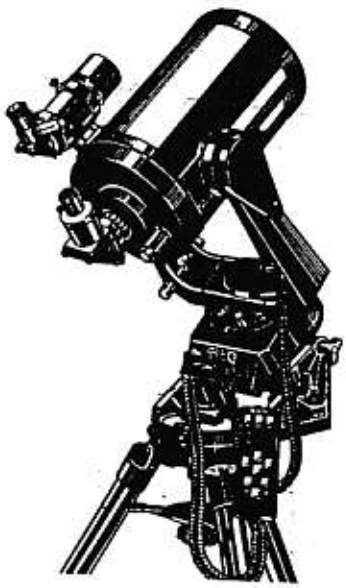
However, on a clear night in a dark sky, binoculars can see the object, while 100mm or larger telescopes can see its outline and dust lane. Have a go!

* **NGC5460**: It lies to the left of the Centaur's horse chest and is about 1600 l.y. away. At +6 mag. though not particularly significant in nature, it is a nice open cluster of about 40 stars and viewable by small telescopes and binoculars. Add it to your viewing collection.

So there we have Centaurus. If you have a pair of binoculars or a telescope of any size, there is plenty to look at. Even if you don't, it's a good constellation to try to identify to help you find your way around the sky.

Good seeing!

(Bob Bee)

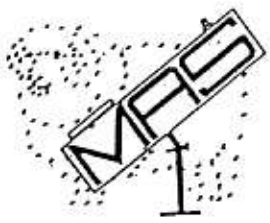


THE 25 NEAREST STARS

	STAR NAME	CONSTELLATION	SPECT. CLASS	APP.MAG.	DIST. l.y.
1a	Proxima Centauri	Centaurus	dM5e	11.0	4.2
1b	Alpha Centauri A,B	Centaurus	G2,K1	-0.01,1.33	4.3
2	Barnard's Star	Ophiuchus	dM3	9.5	6.0
3	Wolf 359	Leo	dM5e	13.5	7.7
4	Lalande 21185	Ursa Major	dM2	7.5	8.2
5	Sirius A,B	Canis Major	A1,dA5	-1.44,8.67	8.7
6	Luyten 726-8 A,B	Cetus	M6e,dM6e	13.0,12.5	8.7
7	Ross 154	Sagittarius	dM4e	10.45	9.4
8	Ross 248	Andromeda	dM5e	12.29	10.3
9	Epsilon Eridani	Eridanus	K2e	3.73	10.7
10	Luyten 789-6	Aquarius	dM7e	12.2	10.8
11	Ross 128	Virgo	dM4	11.1	10.9
12	61 Cygni A,B	Cygnus	K4e,K5e	5.22,6.03	11.1
13	Procyon A,B	Canis major	F5,dF	0.37,10.7	11.2
14	Epsilon Indi	Indus	K5	4.68	11.4
15	Struve 2398 A,B	Draco	dM3,dM3	8.90,9.69	11.5
16	Groombridge 34 A,B	Andromeda	M2,M5	8.08,11.0	11.7
17	Tau Ceti	Cetus	G8	3.5	11.8
18	Lacaille 9352	Pisces Aust.	dM1e	7.39	11.9
19	Luytens=BD+5 1668	Canis Major	dM4	9.92	12.3
20	CD-39 1668	Microscopium	M0	6.69	12.5
21	Kapteyn's Star	Pictor	dM0	8.9	12.7
22	Kreuger 60 A,B	Cepheus	dM3,dM4	9.8,11.3	12.9
23	Ross 614 A	Monoceros	dM5	11.1	13.1
24	BD -12 4523	Ophiuchus	dM4	10.1	13.3
25	Van Maanen's	Pisces	dF5	12.3	13.8

Legend: A,B are the components of a binary or triple star
d (as prefix) = dwarf star
e (as suffix) = emission spectrum.

Note: Due to minor discrepancies in multiple sources used, these values of Spectral Class, App. Mag. and Distance may be treated as 'best average'.



OH, BE A FINE GIRL, KISS ME RIGHT NOW SWEETHEART.

A star's temperature can be directly inferred from its colour. An exact scientific analysis of the star's light spectrum, using a spectroscope, will give highly accurate temperature values. However, for general purposes, our experiences on Earth give us an idea of how stars' colours change with temperature.

Heat a lump of iron and it will progressively glow a dull red, then a bright red, then orange, yellow and finally, when hot enough, a blinding white. Stars are the same, even though not made of iron.

So, the coolest stars are red and as they are hotter (their surface temperatures), they go through a sequence of orange, yellow-white, white, blue-white and the hottest are blue.

The subject of star spectral classes, luminosities, sizes and masses is a very complex and integrated one. This article deals only in simple terms with Spectral Classes (Colour) and Luminosity Classes (Size-brightness). For further details (which, by the way, are fascinating and rewarding if you can follow the physics), refer to any reasonable astronomy encyclopaedia or reference book.

So, where does the *sexist title* of this article come in?

In order to identify the type of star in terms of its surface temperature, astronomers used letters for progressive ranges of temperatures, starting, naturally, with A. However, as knowledge grew, letters had to be suppressed or added and the sequence of letters changed to its current non-sequential form: O B A F G K M R N S.

In order to remember the order of letters (equal to the progressive order of temperatures from hot to cool), some wit devised the mnemonic:

O Be A Fine Girl Kiss Me Right Now Sweetheart. (Yes - astronomers <u>are</u> human.)

Usually, the R N & S are omitted as they are sub-branches of the K and M classes. We are left with the less insistent **OBAFGKM.**

Further, each Spectral Class of star can be sub-divided into ten sub-classes. Types O are identified by suffixes 1-5, then a-e. Types B to M have sub-classes designated 0-9.

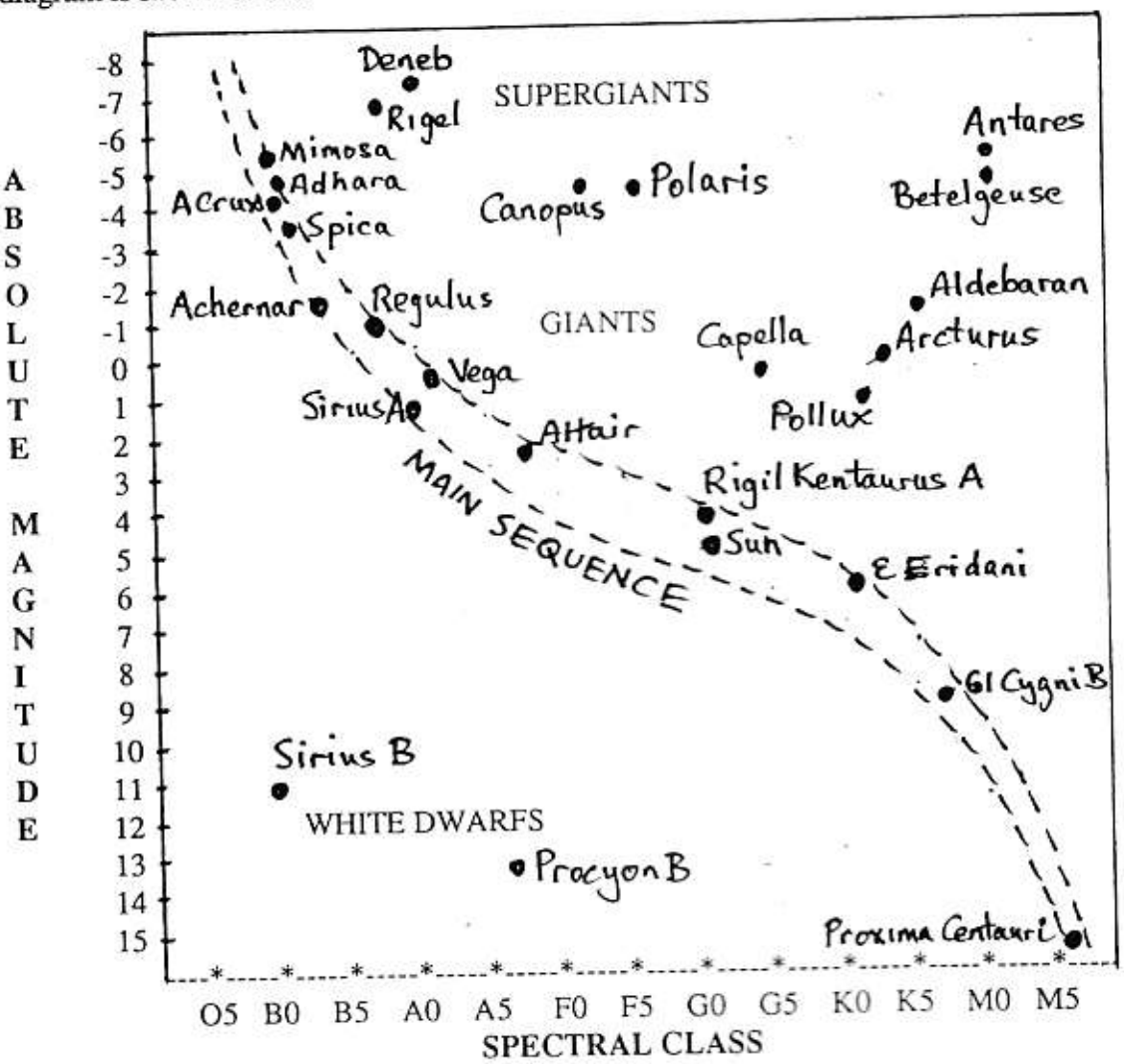
For example, our Sun is a Class G2 star with a surface temperature of 5,500 deg.C. A G8 star (such as Tau Ceti) would be slightly cooler.

In the following table, the colour and temperature ranges for each spectral class are shown.

TYPE	COLOUR	TEMPERATURE RANGE (DEG C)
O	Blue	40,000 - 25,000
B	Blue	25,000 - 11,000
A	Blue White	11,000 - 7,500
F	White	7,500 - 6,000
G	Yellow -white	6,000 - 5,000
K	Orange	5,000 - 3,500
M	Red	3,500 - 3,000

OBAFGKMRNS (Cont'd)

In 1911 - 1913, two astronomers turned the science on its head. Ejnar Hertzsprung (Danish) and Henry Russell (American) charted stars' luminosities (or absolute brightness) against their Spectral Classes (Colour). This chart is now an important tool for astronomers and gives a clear picture of the relationship between star types, temperatures and their life cycles. It is commonly referred to as a **H-R (Hertzsprung-Russell) Diagram**. A sample H-R diagram is shown below.



All the stars that are in stable, hydrogen burning middle age (like our Sun) lie in a clearly visible band down the graph from top left to bottom right, known as **the Main Sequence.**

A star on this band is called a **Main Sequence star**. Generally, the position of a star on this Main Sequence is a consequence of its mass. The largest mass stars are at the top and the least massive at the bottom.

There is a link between a star's mass and its luminosity. Thus, there is another classification of stars - their Luminosity Class - that also describes their size (or mass).

OBAFGKMRNS (Con'd)

The following table describes the Luminosity Classes and corresponding sizes of stars:

LUMINOSITY CLASSES OF STARS

CLASS	TYPE/SIZE
Ia	Bright Supergiant
Iab	Less Bright Supergiant
Ib	Supergiant
II	Bright Giant
III	Giant
IV	Subgiant
V	Main Sequence
VI	Subdwarf
VII	White Dwarf

For example, Altair is a Class A7 V, a Blue-White Main Sequence star, while Betelgeuse is Class M2 Iab, a Red (less bright) Supergiant.

Like all good rules, there are exceptions. While most stars are found on the Main Sequence, there are some faint stars below and to the left of it, and some very bright stars above and to the right of it. These stars are not 'middle aged' but in the late stages of their life cycle.

The top right stars are big and bloated, highly luminous, but cooling with age, giving cool spectral classes.

At the bottom left, we have the white dwarfs, immensely dense but hot small stars, the remnant of a former Red Giant.

So we can see that in a given Spectral Class, there will be a range of star types, from dwarf to supergiant. A Spectral Class by itself is an indication only of the star's surface temperature.

Once the principles of Spectral Class, Luminosity Class and the H-R Diagram are grasped (even in the most basic manner), the story of the birth, life and death of stars can be explored. This leads to an understanding of the mechanisms of novas, supernovas, white dwarfs, neutron stars and even the ubiquitous black holes.

But let's leave them for some future articles.

(Bob Bee)

MAS QUIZ NO.1

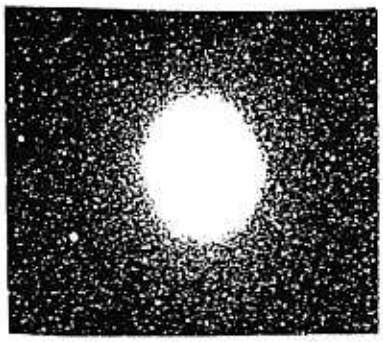


Fig.1

1. What is the object in Figure 1?
   a) Globular Cluster M13 in Hercules
   b) Supernova SN1987A
   c) Omega Centauri
   d) Halley's Comet from face on.

2. What is a Quark?
   a) A quasar with attitude
   b) the fundamental particle that forms all hadrons
   c) a male quail
   d) a character from Deep Space 9.

3. What is a Red Dwarf?
   a) Mars
   b) a dim red star at the lower end of the Main Sequence
   c) a sunburnt vertically challenged person
   d) the remnant of a red supergiant star.

4. What is a light year?
   a) 0.307 parsecs
   b) 9.46 million million km
   c) about 1/8th the distance to Sirius
   d) all of the above

5. The Oort Cloud is:
   a) A cluster of galaxies in the Oort constellation
   b) the large blue spot on Neptune
   c) a segment of the Small Magellanic Cloud
   d) the origin of stellar cometary material.

6. What is Io?
   a) An Egyptian goddess
   b) The closest Galilean satellite to Jupiter
   c) the second largest known asteroid
   d) the number ten mis-spelt.

7. What is 'Albedo'?
   a) the reflecting power of a non-radiating celestial body
   b) the northern Martian polar cap
   c) the fifth moon of Uranus
   d) Spanish for 'full moon'.

8. What is 'accretion disc'?
   a) a portion of Saturn's rings
   b) a round flat object thrown by a native of Crete
   c) a disc of material orbiting and falling into a black hole
   d) the ring of lava at the base of a Martian volcano

9. What is the Cassini Division?
   a) a famous group of Italian soldiers
   b) the chief division of Saturn's rings
   c) a 3200km long rift on Mars
   d) the terminator on Mercury

10. Is the Hubble Constant:
   a) the fixed orbital height of the Space Telescope
   b) 9.8 metres/sec/sec
   c) the rate at which the velocity of recession of galaxies increases with distance
   d) B****d if I know.

11. What is parhelion?
   a) an isotope of helium found in the Sun's core
   b) an atmospheric effect in which luminous spots appear on each side of the Sun
   c) the apparent shift of a nearby object against a more distant background
   d) the nearest point to the Sun in the orbit of a body revolving around it.

12. A supernova is:
   a) a collision of two galaxies
   b) a really great Holden
   c) a star that explodes close to the end of its life
   d) a diffuse gas cloud giving birth to new stars.

(ANSWERS IN NEXT NEWSLETTER)