Starscan

Johnson Space Center Astronomical Society

JSCAS is an association of amateur astronomers dedicated to the study and enjoyment of astronomy. Membership is open to anyone wishing to learn about astronomy.

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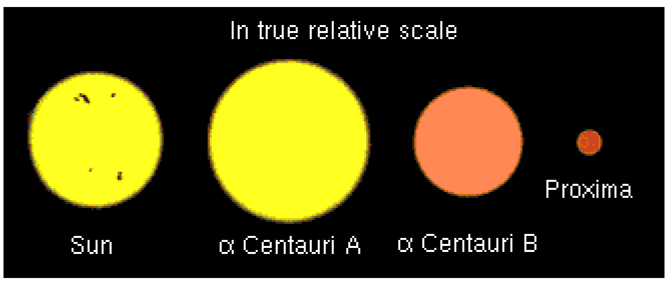
Alpha Centauri-A Candidate for Terrestrial Planets And Intelligent Life?



Alpha Centauri is a special star - not only because it is the closest stellar system to the sun but also because it is one of the relatively few places in the Milky Way Galaxy that may offer terrestrial life conditions. If humanity looks for intelligent life elsewhere, then Alpha Centauri is an excellent candidate. Visible only from latitudes south of about 25° the star we call Alpha Centauri lies 4.35 light-years from the Sun. But it is actually a triple star system. The two brightest components Alpha Centauri A and B form a binary. They orbit each other in 80 years with a mean separation of 23 astronomical units (1 astronomical unit = 1 AU = distance between the Sun and Earth). The third member of the system Alpha Centauri C lies 13,000 AU from A and B, or 400 times the distance between the Sun and Neptune. This is so far that it is not known whether Alpha Centauri C is really bound to A and B, or if it will have left the system in some million years. Alpha Centauri C lies measurably closer to us than the other two: It is only 4.22 light-years away, and it is the nearest individual star to the Sun. Because of this proximity, Alpha Centauri C is also called Proxima (Centauri). Alpha Centauri A is a yellow star with a spectral type of G2, exactly the same as the Sun's. Therefore its temperature and color also match those of the Sun. Alpha Centauri B is an orange star with a spectral type of K1. Whereas Alpha Centauri A and B are stars like the Sun, Proxima is a dim red dwarf with a spectral type of M5 - much fainter, cooler, and smaller than the Sun. Proxima is so faint that astronomers did not discover it until 1915.

Alpha Centauri is a special place, because it may offer life conditions similar to our solar system. A star must pass five tests before we can call it a promising place for terrestrial life, as we know it. Most stars in the Galaxy would fail. In the case of Alpha Centauri, however, we see that Alpha Centauri A passes all five tests, Alpha Centauri B passes either all but one, and only Proxima Centauri flunks out. The first criterion is to ensure a star's maturity and stability, which means it has to be on the main sequence. Main-sequence stars fuse hydrogen into helium at their cores, generating light and heat. Because hydrogen is so abundant in stars, most of them stay on the main sequence a long time, giving life a chance to evolve. The Sun and all three components of Alpha Centauri pass this test.

The Sun And Its Nearest Neighbors	Sun	Alpha Centauri A	Alpha Centauri B	Proxima
Color	Yellow	Yellow	Orange	Red
Spectral type	G2	G2	K1	M5
Temperature	5800 K	5800 K	5300 K	2700 K
Mass	1.00	1.09	0.90	0.1
Radius	1.00	1.2	0.8	0.2
Brightness	1.00	1.54	0.44	0.00006
Distance (light-years)	0.00	4.35	4.35	4.22
Age (billion years)	4.6	5 - 6	5 - 6	~1?

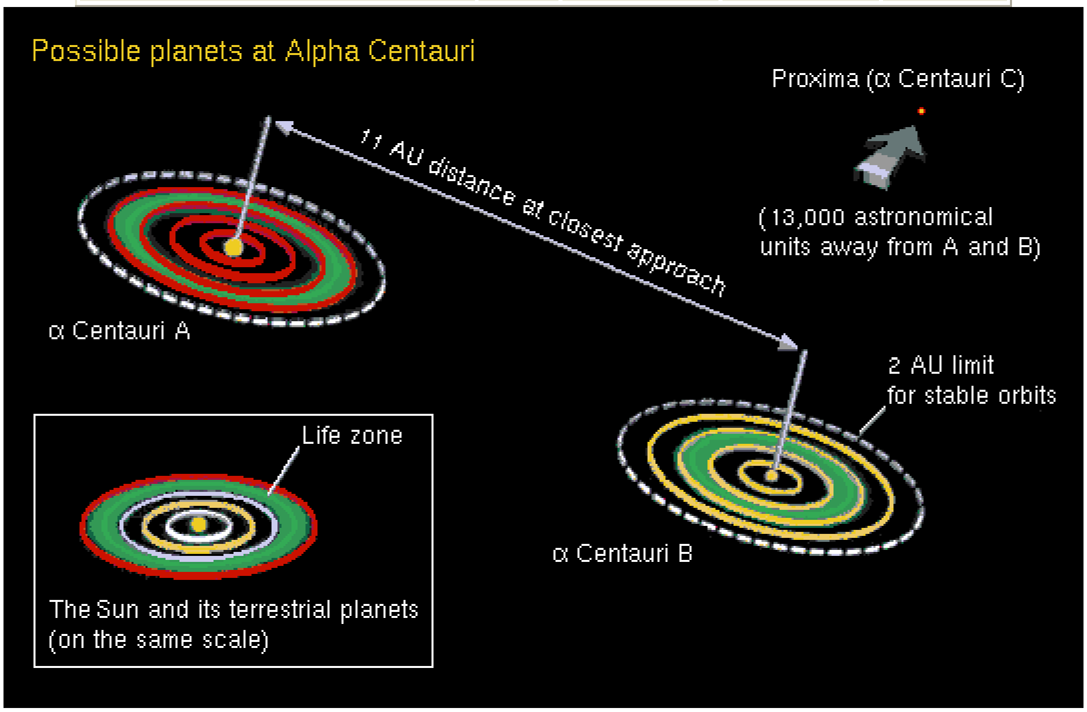
The second test is much tougher, however, we want the star to have the right spectral type, because this determines how much energy a star emits. The hotter stars - those with spectral types O, B, A, and early F - are no good because they burn out fast and die quickly. The cooler stars - those with spectral types M and late K - may not produce enough energy to sustain life, for instance they may not permit the existence of liquid water on their planets. Between the stars that are too hot and those that are too cool, we find the stars that are just right. As our existence proves, yellow G-type stars like the Sun can give rise to life. Late (cool) F stars and early (hot) K stars may be fine too. Luckily, Alpha Centauri A passes this test with bravour, as it is of the same class as our Sun. Alpha Centauri B is a K1 star, so it is hotter and brighter than most K stars, therefore it may pass this test or it may not. And the red dwarf Proxima Centauri seems to be a hopeless case.

For the third test, a system must demonstrate stable conditions. The star's brightness must not vary so much that the star would alternately freeze and fry any life that does manage to develop around it. But because Alpha Centauri A and B form a binary pair there's a further issue. How much does the light received by the planets of one star vary as the other star revolves around it ? During their 80-year orbit, the separation between A and B changes from 11 AU to 35 AU. As viewed from the planets of one star, the brightness of the other increases as the stars approach and decreases as the stars recede. Fortunately, the variation is too small to matter, and Alpha Centauri A and B pass this test. However, Proxima fails this test, too. Like many red dwarfs it is a flare star, prone to outbursts that cause its light to double or triple in just a few minutes. The fourth condition concerns the stars' ages. The Sun is about 4.6 billion years old; so on Earth life had enough time to develop. A star must be old enough to give life a chance to evolve. Remarkably, Alpha Centauri A and B are even older than the Sun, they have an age of 5 to 6 billion years, therefore they pass this test with glamour, too. Proxima, however, may be only a billion years or so old, then it fails this test, too. And the fifth and final test: Do the stars have enough heavy elements - such as carbon, nitrogen, oxygen and iron - that biological life needs? Like most stars, the Sun is primarily hydrogen and helium, but 2 percent of the Sun's weight is metals. (Astronomers call all elements heavier than helium "metals".) Although 2 percent may not sound a lot, it is enough to build rocky planets and to give rise to us. And again, fortunately, Alpha Centauri A and B pass this test. They are metal-rich stars.

Now to the final question. Do we find at Alpha Centauri warm, rocky planets like Earth, full of liquid water? Unfortunately, we don't know yet whether Alpha Centauri even has planets or not.

What we know is that in a binary system the planets must not be too far away from a particular star, or else their orbits become unstable. If the distance exceeds about one fifth of the closest approach of the two stars then the second member of the binary star fatally disturbs the orbit of the planet. For the binary Alpha Centauri A and B, their closest approach is 11 AU, so the limit for planetary orbits is at about 2 astronomical units. Comparing with our system, we see that both Alpha Centauri A and B might hold four inner planets like we have Mercury (0.4 AU), Venus (0.7 AU), Earth (1 AU) and Mars (1.5 AU). Therefore, both Alpha Centauri A and B might have one or two planets in the life zone where liquid water is possible.

Terrestrial Life Conditions: Questions for Any Star	**Sun**	**Alpha Centauri A**	**Alpha Centauri B**	**Proxima**
On the main sequence?	Yes	Yes	Yes	Yes
Of the right spectral type?	Yes	Yes	Maybe	No
Constant in brightness?	Yes	Yes	Yes	No
Old enough?	Yes	Yes	Yes	No?
Rich in metals?	Yes	Yes	Yes	?
Has a stable planetary orbit?	Yes	Yes	Yes	Yes
Could planets form?	Yes	?	?	Yes
Do planets actually exist?	Yes	?	?	?
Small rocky planets possible?	Yes	Yes	Yes	Yes?
Planets in the life zone?	Yes	Maybe	Maybe	No



Deep Sky /Challenge Object-September 2003

Chris Randall

★ **SSO**: Summary for the 15 September 03

Object	Constellation	Mag	% Ill	Rise Time	Transient	Set Time	Note
Sun	Leo	-26.7	100	07:05	13:15	19:25	
Moon	Tarus	Bright	74	22:24	04:36	11:27	
Mercury	Leo	2.9	6	06:28	12:40	18:52	
Venus	Virgo	-3.9	99	07:43	13:47	19:55	
Mars	Aquarius	-2.5	98	18:39	00:06	05:29	Gorgeous!!!!
Jupiter	Leo	-1.7	100	05:43	12:09	18:35	
Saturn	Gemini	.7	100	01:40	08:35	15:30	
Uranus	Aquarius	5.7	100	18:17	23:55	05:28	
Neptune	Capricornus	7.9	100	17:14	22:38	03:59	
Pluto	Ophiuchus	13.9	99	13:21	18:51	00:24	
Pallas	Cetus	8.6	98	22:13	03:54	09:34	Asteroid

★ **BSO**:

Epsilon Pegasi – Double star in Pegasus, magnitudes 2.4 and 8.4, separation 142”. Coordinates are 21h 44.2m +09° 52’.

31 Cygni (Omicron1) – Triple star in Cygnus, magnitudes 3.8, 6.7, and 4.8, separation 107” and 337”. Coordinates are 20h 03.6m +46° 44’.

NGC 7078 (M15) – Globular Cluster in Pegasus, magnitude 6.4, size 12’. If you have a large scope in a dark spot try and find **Pease 1**, a planetary nebula, in foreground (1” in size).

NGC 7089 (M2) – Globular Cluster in Aquarius, magnitude 6.5, size 13’.

★ **DSO**:

NGC 7009 (C 55) – Planetary Nebula in Aquarius, magnitude 8.3, size 44” x 23”. This is the “Saturn Nebula”.

NGC 7006 (C 42) – Globular Cluster in Delphinus, magnitude 10.6, size 10.6. Very distant globular.

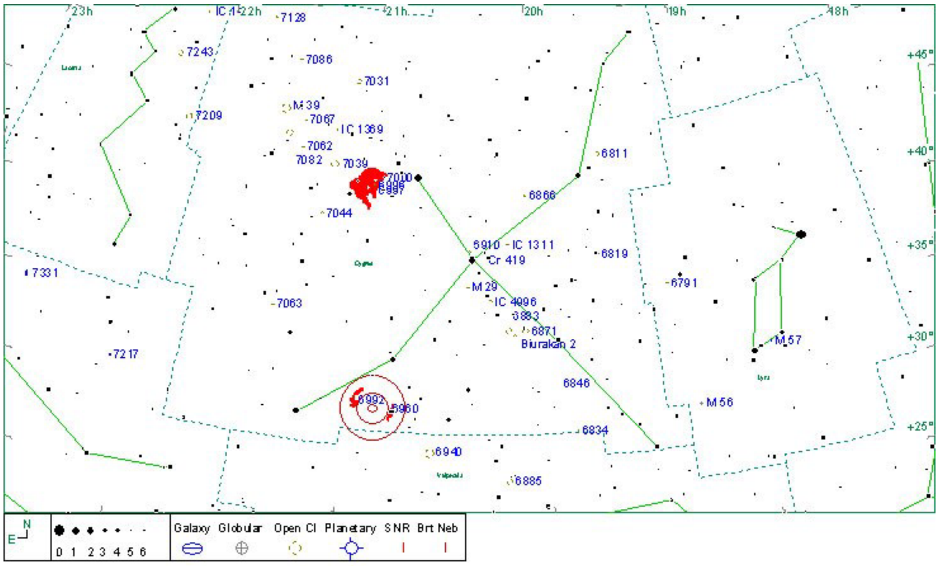
NGC 7000 – Bright Nebula in Cygnus, size 120’. This is the North American Nebula.

NGC 6946 (Arp 29) – Galaxy in Cepheus (on boarder with Cygnus), magnitude 9.7, size 11’ x 9’.

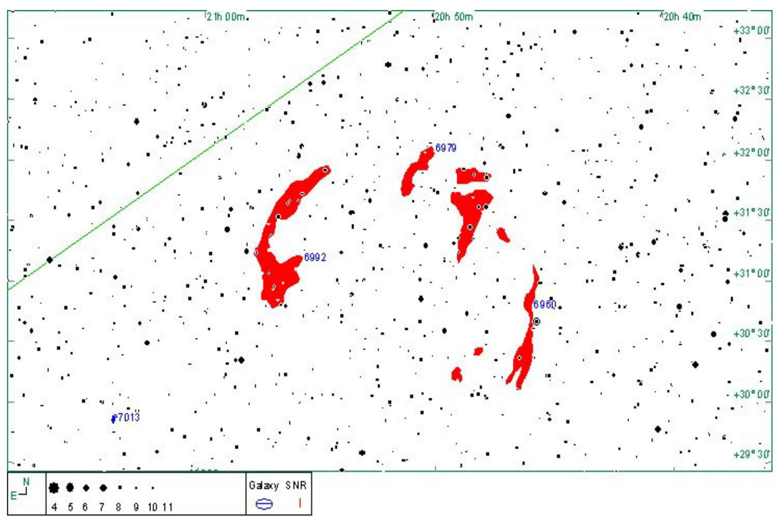
★ **CDMP**:

Veil Nebula – Super Nova Remanant located in Cygnus, varying magnitudes. It consists of several NGC objects; 6992, 6960, 6979.

The Veil Nebula is located approximately 2,600 light years away in the constellation of Cygnus. William Herschel discovered it visually in 1784 using his 18-inch reflecting telescope. It is know by many names ranging from simply The Veil, the Bridal Veil, Filamentary Nebula, the Cygnus Loop, Witches broom, and others I haven’t found. It also has a large number of designators from many catalogs. Here is a small portion of the designators that make up this nebulae complex; NGC 6960, NGC 6979, NGC 6992, NGC 6995, NGC 6960 (LBN 191) /6974/6979/6992 (Cederblad 182B)/6995/IC 1340 (G74.0-8.5). The large number of designators is primarily due to the large area covered, and low surface brightness of the object which made many early observers believe they were not the same object.



It is a large complex of nebulae that spans over 3 degrees of the Sky. It is the expelled remnants of a supernova that occurred about 5 - 10,000 years ago, and can be obviously seen strewn all about the region on long exposure photos. Variations between data sources place the distances in a range from 1,400 light years to 10 Million light years, and age ranges up to 15,000 years ago. It's the two brightest parts that are typically seen visually. The brighter, eastern portion, NGC 6992/95, can be seen in binoculars from a dark site as a long curving hazy streak of light. Experienced observers under truly dark skies may be able to detect the western portion, NGC 6960, as well. The western portion (NGC 6960) is more difficult, but it can still be a good place to start because it is easy to find the correct star field, due to the presence of the 4th magnitude star 52 Cygnus on the right half arc, but the star is known to be a foreground object and has no connection with the nebula.



A UHC or OIII filter can really bring out the detail in the nebula. One could spend hours following the arcs. A UHC filter produced similar results but the contrast with the background sky will not as enhanced. When hunting down this object the use your lowest power eyepiece at the telescope is a must. In Larger telescopes gorgeous structure can be seen. Next time you're at a star party do some light leaching. With a 20-inch or larger scope the detail is breathtaking. Even without a large scope, it is well worth the time and effort to view.

Telescope Basics

Bob Taylor

I'm not sure how I ever survived before the Internet. You have a question, logon and surf, and there's a host of answers out there and one of them just might suit you! At our last Challenger

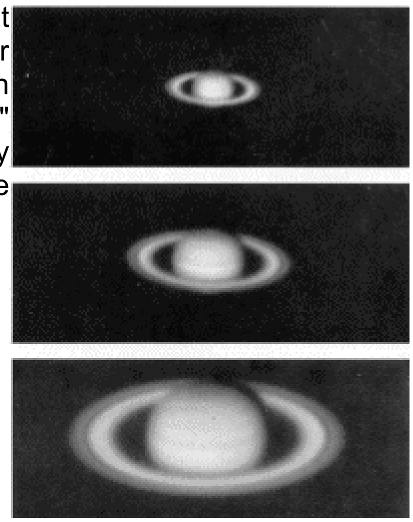
Park Star Party, I was able to “make the rounds” briefly and was amazed (again) at the diversity of equipment our members willingly drug out into the night for complete strangers to play with. Hoping that we would entice some of them to our cause, I have compiled some basic telescope facts from here and there that seem to answer some common questions, well, for me at least.

APERTURE (DIAMETER OF THE LENS OR MIRROR)

This is the single most important factor in choosing a telescope. The prime function of all telescopes is to collect light. At any given magnification, the larger the aperture, the better the image will be.

The clear aperture of a telescope is the diameter of the objective lens or primary mirror specified in either inches or millimeters (mm). The larger the aperture, the more light it collects and the brighter (and better) the image will be. Greater detail and image clarity will be apparent as aperture increases. For example, a globular star cluster such as M13 is nearly unresolved through a 4" aperture telescope at 150 power but with an 8" aperture telescope at the same power, the star cluster is 16 times more brilliant, stars are separated into distinct points and the cluster itself is resolved to the core.

Considering your budget and portability requirements, select a telescope with as large an aperture as possible. The photos to the right demonstrate what increasing aperture will give you -- higher contrast, better resolution and a brighter image. Top to bottom with Celestron telescopes -- C5 (5" aperture), C8 (8" aperture), C14 (14" aperture). (All were taken using eyepiece projection photography at a focal ratio of f/90 for comparison. The effects are even more pronounced during visual observation).



FOCAL LENGTH

This is the distance (in mm.), in an optical system, from the lens (or primary mirror) to the point where the telescope is in focus (focal point). The longer the focal length of the telescope, generally the more power it has, the larger the image and the smaller the field of view. For example, a telescope with a focal length of 2000mm has twice the power and half the field of view of a 1000mm telescope. Most manufacturers specify the focal length of their various instruments; but, if it is unknown and you know the focal ratio you can use the following formula to calculate it: focal length is the aperture (in mm) times the focal ratio. For example, the focal length of an 8" (203.2mm) aperture with a focal ratio of f/10 would be 203.2 x 10 = 2032mm.

RESOLVING POWER

For telescopes this is referred to as "Dawes limit." It is the ability to separate two closely spaced binary (double) stars into two distinct images measured in seconds of arc. Theoretically, to determine the resolving power of a telescope divide the aperture of the telescope (in inches) into 4.56. For example, the resolving power of an 8" aperture telescope is 0.6 seconds of arc (4.56 divided by 8 = 0.6). Resolving power is a direct function of aperture such that the larger the aperture, the better the resolving power. However, resolving power is often compromised by atmospheric conditions and the visual acuity of the observer.

POWER (MAGNIFICATION)

One of the least important factors in purchasing a telescope is the power. Power, or magnification, of a telescope is actually a relationship between two independent optical systems – (1) the telescope itself, and (2) the eyepiece (ocular) you are using.

To determine power, divide the focal length of the telescope (in mm) by the focal length of the eyepiece (in mm). By exchanging an eyepiece of one focal length for another, you can increase or decrease the power of the telescope. For example, a 30mm eyepiece used on the C8 (2032mm) telescope would yield a power of 68x (2032/30 = 68) and a 10mm eyepiece used on the same instrument would yield a power of 203x (2032/10 = 203). Since eyepieces are interchangeable, a telescope can be used at a variety of powers for different applications.

JSCAS Library Notes

By Lisa Lester

The JSCAS library has received a number of donations over the past several months!! Many thanks to all who have donated books, teaching materials, and lectures on CDs! Some of the new items include: two books; Eclipse by David H. Levy, and Patrick Moore on Mars donated by Ed & Eleta Malewitz; a binder full of astronomical activities and lessons for kids from first grade to high school put together by the Astronomical Society of the Pacific, My Favorite Universe on CD, Mega Star 3.0, and The Complete CD Series Understanding the Universe: An Introduction to Astronomy all donated by Bob Hammond. Also, Ken Steele donated a folder full of activities, websites, handouts, etc. Some of the items have already been checked out! I will try to start bringing a library selection to each meeting but remember that the list is online and you can email me and ask me to bring what you are interested in to the meeting or we'll work out a way to deliver items between meetings.

Star Party Report

By Lisa Lester

We had a fabulous turnout last night at Challenger 7 Park for our Mars Star Party. I would like to thank everyone who came with telescopes or binoculars to help out with the event. I'd list names but I never got to see everyone and I certainly don't want to leave anyone out! Thanks also to those club members who came without scopes and talked to the public and pointed them in the right direction since many of our scopes were on the field instead of around the circular driveway. I have no idea how many people came but I do know that they were very patient, excited, and extremely appreciative of us coming out with our equipment to share Mars with them! Kudos to everyone!

The fall fun has just begun! This week club members will be helping the Mars Society out on Wednesday night. I really appreciate those club members willing to bring their scopes out and share Mars with the public at this event since it is on a work/school night! Don't forget our next star party is Saturday, September 27th at Moody Gardens.

This month I'm finalizing the plans for a star party at Hyde Elementary on Tuesday, November 11th. They are having a Science/Astronomy night and have asked for our participation. The event will be from 7:00 – 9:30 pm. In addition to bringing scopes and setting up behind there school they are asking us if we would be able to have some people inside speaking about astronomy, types of telescopes, personal experiences, etc. Let me know if you'd be interested in participating in either part of this event. An Astronaut will be there and they will have some other astronomy related activities going on inside so the crowds will rotate through the building & out to us.

Johnson Space Center Astronomical Society

Agenda for September 12, 2003

Center for Advanced Space Studies
Lunar and Planetary Institute

7:30 Meeting Start and Welcome

7:40 Presentation: Dr. Essam Heggy - Planetary Remote Sensing

8:30 Break

8:45 Calendar Review, Announcements, Awards and SIG Reports

- **Deep Sky, Challenge Object – Chris Randall**
- **Star Party News - Lisa Lester**
- **Tales from CTSP- Ed and Eleta Malewitz**
- **Hernan’s Astronomical Oddities-Hernan Contreras**
- **Solicitations for Officer Nominations**

9:30 Charlie’s Challenge - Charles Hudson

10:00 Door Prizes and Adjourn

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