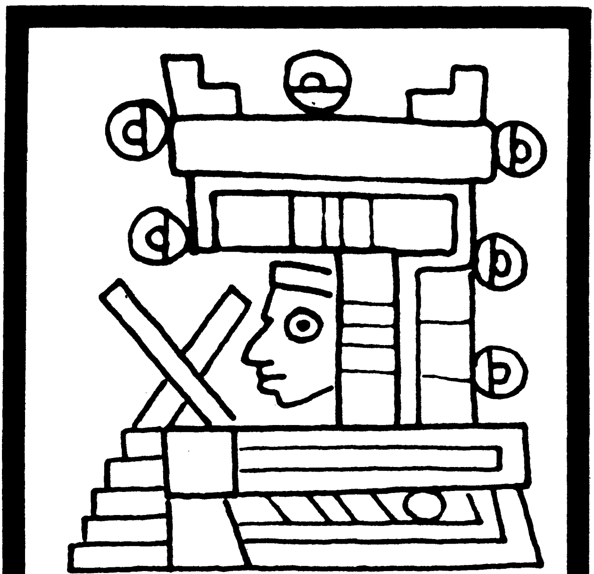
NOVA NOTES



Halifax Centre

Nov-Dec 1984
Volume 15
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NOTICE OF MEETINGS

Date: Friday, November 16th : 8:00 P.M.

Place: Nova Scotia Museum: Meeting to be held in the lower theatre. Access from parking lot & side entrance

Topic: An activity night based on the role of computers in astronomy. Several people will give brief talks on the computers they use and then everyone will get to see the systems up close.

****

NOTE: THIS IS THE FIRST FRIDAY !

Date: Friday, December 7th : 8:00 P.M.

Place: Nova Scotia Museum: Meeting to be held in the lower theatre. Access from parking lot & side entrance

Speaker: As a speaker and topic for this meeting have not been finalized, a separate mailing will be sent to all members before the meeting.

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REFRESHMENTS WILL FOLLOW BOTH MEETINGS !

****

About the cover: The cover this issue is a figure from a codex (picture document) produced by the Mixtec Indians of central Mexico about 1520, just before the Spanish conquest. It depicts a priest looking out of the window of a temple. The figures studding the temple are thought to represent stars while the priest appears to be using crossed sticks as a collimating device to aid him in the observation of something at the horizon.

The **LUNENBURG COUNTY ASTRONOMY CLUB Notes**

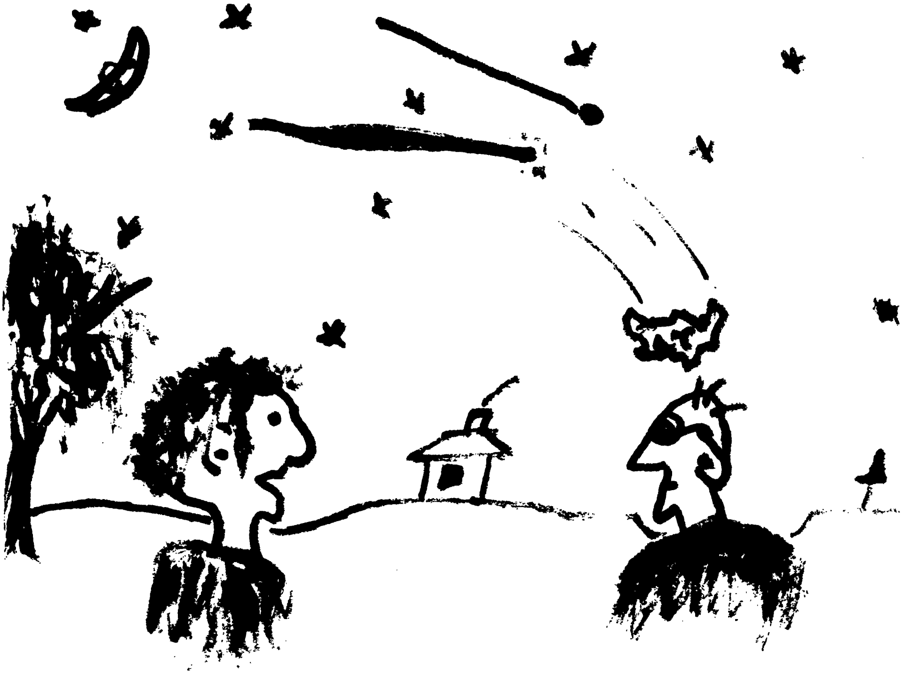
The L.C.A.C. is dropping the "formal club" format of regular meetings for a more casual one. This is due to a very low level of participation and extremly poor attendance of meetings. This can be blamed on the small population base we have. While 4 or 5 active members out of a membership of 15 isn't a bad percentage, it just isn't enough to surport the activites expected of a formal club.

The L.C.A.C. will still hold summer observation sessions (especially during the winter and spring of Halley's comet) and hold one or two "Astronomy Days" each year.

The only real difference will be simply that the amatures in the area will gather at their own convenience, for observations or what ever, and if an unexpected event occurs or an interesting speaker happens by, they can call a meeting ... in other words, no regular meetings but still organization.

Happy Observing...

Darrin Parker
(observing chairman LCAC)



YOU'VE SEEN METEORS, BUT HAVE YOU EVER SEEN A METEORITE?

HAVE YOU?

Here's your big chance:

MARK THIS DOWN ON YOUR CALENDER:

A long, long time ago, in a museum far, far away, the LCAC booked a meteorite exhibit.
Now it's almost here. MAY 1985 is the date, place: Desbrisay Museum, Bridgewater, N.S.
WATCH NEXT ISSUE FOR DETAILS.

ATTENTION COMPUTER BUFFS

At the recent General Assembly in Hamilton, the National Council approved a motion setting up an Ad Hoc Committee which would examine the possibility of establishing a microcomputer network between the Centres and within the National Office. The potential for its use appears to be great, not only with regards to the exchange of useful programs of interest, and providing an inexpensive communications link between the Centres, but also facilitating the normal business conducted between the Centres and the National Office. Within the National Office itself, are many tasks that can better be handled with the use of a microcomputer.

In order to determine the feasibility of such a plan, we require some common ground with regards to the equipment available. An inventory of Centre microcomputers tahat might be used for such a network would be desirable. To that end, we would like any members who would be willing to cooperate to provide the following information:

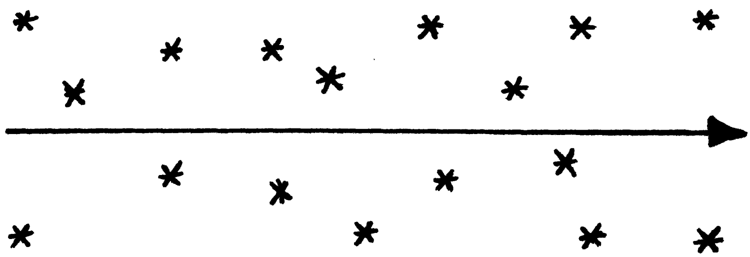
- name
- address
- phone number
- computer (make and model)
- modem (make and baud rate)
- printer (make and model)

As the National Office would like to obtain this information from all Centres by December 31st, please bring it to either the November or December meetings and leave it with someone on the executive or you can mail it to the Halifax Centre (see the inside front cover for the address).

PLANETS OF STARS OTHER THAN THE SUN

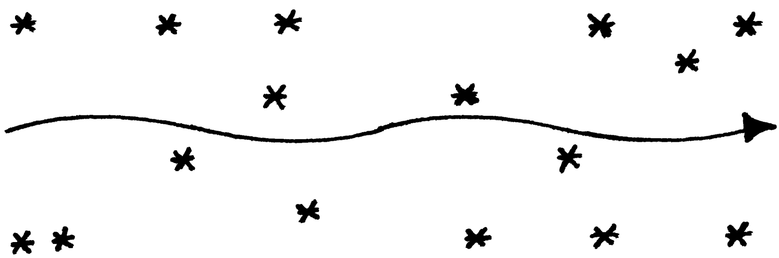
Recent astronomical research by earth-bound astronomers and space-launched equipment has pointed to the possibility that there may well be planets of stars other than the Sun. Stars are visible to us because of the light they give off but planets, if they are close enough to us, are visible only because of reflected star light. Since planets of other stars are great distances from us it is therefore impossible to see their relatively weak reflected light, especially against the background of a bright star. There is an indirect way to determine if a star might have some planets. This is the same method that has been used to discover white dwarfs. By studying the proper motion of a star, its apparent motion accross the sky in relation to other stars, one can see if that star follows a straight line or appears to wobble somewhat. The field of astronomy that is engaged in the study of measurement of objects in the sky is known as astrometry.

One of the first stars that came under serious scientific studies to determine if it had planets was Barnard's star. At almost six light years (.0017 seconds of arc) distance from the Sun, only the Alpha Centauri triple system is nearer, it was a good candidate because of its large proper motion and great angular extent this would display. Peter van de Kamp, working at the Sproul Observatory, studied many observations taken of Barnard's star from 1937 onward and consequently reported that he had discovered a wobble in its proper motion. To him this indicated that there might be a Jupiter like planet in an elliptical orbit. He later added a second Jupiter like planet to better explain his data and allow for more circular orbits. More recently, however, other astronomers were not able to discern a wobble in Barnard's star and attributed Peter van de Kamp's earlier findings to faulty telescope equipment. Although some wobble may be present the matter remains unresolved.

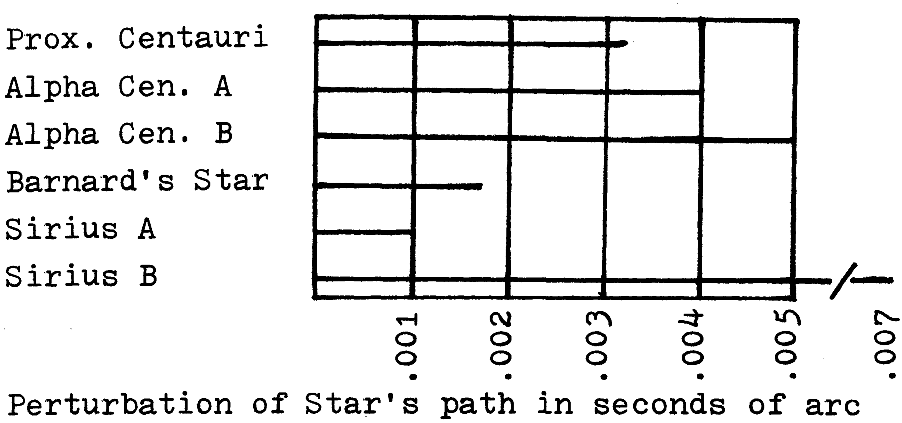


ABOVE: A star without the gravitational force of planets would move across the heavens in a straight line.

BELOW: A star that has planets would have a slight wobble (the closer the star to us, the greater the apparent motion and perturbation).



BELOW: The graph estimates the perturbations a Jupiter size planet would have on its sun.



Since the Earth's atmosphere distorts astrometric measurements other methods must be found to search for extra-solar planets. One of the benefits of recent research is the development of more precise spectroscopic equipment. A star's wanderings from the straigh and narrow can also be measured by detecting changes in its radial velocity, that part of its motion which is directed toward us or away from us. With todays equipment it is not very difficult to determine radial velocity to within about 50 meters per second. Equipment now being developed and tested should be able to measure radial velocities that show a difference of 10 to 13 meters per second which is sufficiently accurate to indicate a Jupiter size planet should one exist. A benefit of using the spectroscopic method is that it can also be used to check astrometric measurement since the two methods actually complement each other. Astrometry measures movements in the perpendicular plain and spectroscopy measures when movement is determined edge-on.

With the introduction of fiber-optics to measure the red shift instead of the usual prism astronomers will be able to obtain much sharper spectral images. Another improvement in their efforts to gain more precise data astronomers are now recording the spectral image on photoelectric detectors. The earth-bound efforts to detect planetary systems continues but a new star in the heavens has opened far horizons. NASA's IRAS has been exceedingly successful in the discovery of dust rings around some distant stars, including Vega. By seeking data in the infrared spectrum. IRAS has a certain advantage. Since the radiati output of a star and planet only differ in a small amount, the star does not mask the planet as it would in visible light. In a galaxy with billions of stars the possibility of other solar systems seems very likely and so the search will continue.

Peter Steffin

THE ORION NEBULA - A RECENT ACQUISITION ?

One of the sky's most famous objects is the Great Nebula in Orion. Known to most amateurs as M42, the nebula is seen on dark winter nights as a hazy patch in the sword of Orion. Through even modest amateur scopes the billowing green clouds offer one of the most spectacular deep sky views around. Given that the nebula is easily visible to the naked eye today, it is rather surprising that the nebula was only discovered in 1610. A strong historical case can be made for the nebula not existing before this time.

In 1609 Galileo mapped the region of the sword and belt of Orion. Although not very accurate, his maps were complete to about 6th magnitude. On Galileo's map of the sword area no nebula is shown. There is no doubt that his telescope would have shown the nebula had it been there. Galileo was certainly aware of the historical references to nebulae and not being one to mince his words, he would have described it had he seen it.

In November 1610, Nicolas Peiresc, observing from his observatory in France, was 'surprised' to find the middle star in the sword surrounded by a small illuminated cloud. No further observations of the nebula were made until 1659 when the Dutch astronomer Christian Huygens rediscovered the nebula. In his sketches of the nebula it is noteworthy that only three stars in the Trapezium were marked. Huygens believed from further observations of the nebula that rapid changes were taking place in it.

The noted Persian astronomer Al-Sufi, in his catalog of c. A.D. 986, mentions the Andromeda nebula (M31), but not M42 despite the fact that they are about equally conspicuous and does not include any nebula in his map of Orion although he correctly positions M31. On a celestial globe made in London about 1590 by Thomas Hoade there is again no mention of a nebulous object in Orion, though to be fair, he did not mark M31 either. In Oriental records, especially the Soo-Chow catalog from c. 1154 there is no mention of a nebulous star in Orion. To testify to the catalog's accuracy, they marked seven stars in the Pleiades and noted that Lambda Orionis was a group of three stars and not a nebula. The three stars in Orion's sword are noted and the maps appear to be complete to magnitude 6.

In more modern times, William Herschel first observed M42/43 in 1774. In 1783 he reported that NGC 1982 appeared to be joined to M42 but by 1784 he decided that it was no longer connected. Herschel was convinced, through a series of careful observations of the nebula up to 1811, that changes were taking place within the nebula. It is significant that in all the maps he made of the nebula he missed several stars of about 11th magnitude that can easily be seen with a 15 cm scope nowadays. It is possible, since we know that the Orion nebula is an active star forming, that these are stars of the FU Orionis type. These stars of late spectral type can suddenly brighten by 5-6 magnitudes and then hold that level. They become suddenly turned on. The prototype, FU Orionis, increased in brightness by 6 magnitudes from 16 to 10 in only a few months. Possibly one of the Trapezium stars, though they are of a much earlier spectral type, underwent the same kind of brightening. Only one star, depending on its proximity to the cloud, would be needed to cause the nebula to fluoresce at its present luminosity. The nebula's brightening would not coincide with the star's because its rate of brightening would be limited by the speed of light and the optical depth of the cloud.

Taking the nebula's distance to be about 400 parsecs and its diameter as 1.5 parsecs, then the Trapezium stars would be less than 0.3 parsecs from the front edge of the cloud. It would thus take about 5 years for the nebula to reach equilibrium luminosity, which is not inconsistent with the historical record. If true, this would make the Orion nebula, at 400 years old, one of the youngest known celestial objects.

reprinted from "the Starseeker" (Calgary Centre)

More Messier Objects

In November and December, we are midway between the two seasons during which the Milky Way dominates the southern sky. The South Galactic Pole (SGP), which is about 10 degrees south of Beta Ceti, transits the meridian at 9 PM on November 20 (7 PM on December 20), reaching its maximum altitude of 18 degrees at the latitude of Halifax/Dartmouth. When the SGP is on the meridian, the Milky Way stretches in an arc across the sky from due east to due west, passing just 18 degrees from the zenith through Cassiopeia. This arrangement provides a southern sky relatively barren of stars, since we are viewing in a direction out of the plane of our galaxy. On the other hand, we have a better chance of seeing other galaxies, since the view is not blocked. To find galactic deep sky objects, we have a better chance if we look into the galactic plane. For Milky Way afficionados, a serious condition occurs six months from now, during spring, when the North Galactic Pole culminates and the Milky Way plane is just 18 degrees above the northern horizon.

The following list contains some of the Messier Objects observable in binoculars during November and December. Most of them are galaxies or globular clusters. Remember to wear your wooly hat and thick socks - you won't be moving around much and, in my experience, your observing faculties are sharper if you are comfortable.

M15 Globular cluster in Pegasus. This bright cluster can be found on a line from Theta through Epsilon, which form the horse's head (in my view). Extend the line almost as far again to find the cluster. A short distance southwest is one of those peculiar little constellations, Equuleus, the Little Horse.

M2 Globular cluster in Aquarius. Once you have found M15, move due south (i.e. away from Polaris) towards Beta Aquarii. The cluster lies about two-thirds of the way.

M33 Spiral galaxy in Triangulum. This galaxy is another member of our Local Group. It is one of the few objects which give the binocular observer an advantage over the telescope observer, unless the latter has a rich field telescope. It has an integrated magnitude of a 5th magnitude star, but the light is spread over a solid angle about the size of the full moon, giving it a low surface brightness. Look for this object in dark skies between Alpha Trianguli and Beta Andromedae.

M77 & M74 Spiral galaxies in Cetus and Pisces. These are this issue's challenge objects: don't look for them if you can't find M33. M74 is 1.5 degrees ENE of Eta Piscium. M77 is near Delta Ceti. If you find this one, pat yourself on the back - you will have seen the most distant Messier Object. You can impress your friends by telling them that you can see a distance of 16 megaparsecs (52 million light years) with your binoculars.

NGC 869 & 884 "Double Cluster in Perseus" These two clusters were not listed by Messier, who apparently didn't care for open clusters, but they are extremely easy to find. They are situated in the "Sword-Handle" between Alpha Persei and Delta Cassiopeia. These qualify as "ancient" clusters, having been listed by Ptolemy.

If you are a frequent observer with binoculars, I recommend James Muirden's book "Astronomy with Binoculars". The star charts and descriptive notes in this book concentrate on objects viewable in binoculars, so you won't waste time looking for nebulae and galaxies beyond your reach. An old, rather dog-eared, paperback edition of this book resides in the RASC Halifax Centre Library, open during monthly meetings. Apparently, the newest edition of this book contains a special supplement on Halley's Comet.

Dave Chapman

THE FIRST CELESTIAL NAVIGATORS

Thousands of years ago man used the stars to help navigate the vast oceans. Even with today's sophisticated navigation satellite networks there are those who still prefer the old ways. But our fine feathered friends, the birds, may have had a big jump on us. They find different points on this planet using the stars as markers.

In recent times, some of the astounding methods used by the class avies to get around have come to light. The shorter length of autumn daylight hours may be enough to trigger the migratory instinct. The distances birds travel in migration may vary from a few hundred feet, for populations that live high in mountains and move to the valleys for the winter, to 17,000 km for certain seabirds.

A German ornithologist, Gustav Kramers, experimented with a species of warbler (a small bird). Putting the birds in a rotatable circular cage and then exposing it to the night sky, he found that the birds constantly fluttered in the direction of normal migration. When denied a visual sighting on the stars, the birds fluttered in random directions. They were then exposed to planetarium skies rotated 45, 90 and 180 degrees from true north. The birds responded by altering their directions to conform with the navigational information given by the stars.

A Cornell University ornithologist hand-raised a number of indigo buntings for a similar type of experiment. He found that young birds failed to orient well if denied visual experience of the sky until fall. It appeared that the young buntings not only learned the night sky, but in particular that part of the sky which shows the least rotation; the circumpolar sky. He also had the birds treating Betelgeuse as if it were Polaris simply by rotating the planetarium sky around that particular star.

The sun can also play an important part in bird migration. Results of additional experimentation with caged starlings which were in the migratory state appeared to prove this. The birds oriented themselves with the angle of the sun when leaving specially designed cages. The normal migratory direction was taken until mirrors were placed in close proximity to the cages, deflecting the sun's rays into the cages at different angles. The birds left in a correspondingly wrong direction at approximately the same misplaced angle of deflection. It took the birds some time to shake off their confusion and re-orient themselves.

The homing pigeon is among the best of avian navigators. Taken from it's home in any direction and any distance, it can almost certainly find it's way back to the roost. One theory that may explain the uncanny navigational ability of this particular group of birds is the "sun-arc" theory. When the bird finds itself at an unknown location, it will observe the sun. After release it will fly randomly or in a circle using up a period of time. It will then measure that short part of the sun's movement along it's arc. (Note: measure in this case means the bird's ability to distinguish two points along an arc). It will then extrapolate from that segment to determine the sun's highest position. Using it's internal clock the pigeon determines the sun's progression along the arc. The bird will compare the two values (noon altitude and progress) with the values it remembers from home. The outcome is then quite simple, at least for the bird. If the sun's altitude is too high, the bird knows that it is south of home. If the sun is too far along it's arc, it is east of home. The bird will then fly northwest until the sun's values are correct or one could simply say "the bird would fly in such a direction that would put the sun in the proper position at the proper time for it's home location". THe altitude of Polaris above the horizon and the degree of westward rotation of the star field could be used in much the same manner.

Another amazing fact is that birds recognize constellations. Another experiment with captive indigo buntings in migratory restlessness during the fall, was used to determine whether birds rely on particular stars as cues for orientation. The birds were exposed to a planetarium sky identical to the outdoor sky at the time of the experiment. The birds oriented themselves well in the planetarium sky. The sky projected was then reversed. The birds then fluttered in the reverse direction, validating the planetarium sky as holding some cue for orientation. What was it? To answer this question, different stars and constellations were successively blocked from view. THe buntings continued to flutter in the right direction until the Big Dipper and the North Star were blocked from view. At this time they were noticeably disoriented. Thus the evidence seems to favor the Big Dipper in relation to the North Star as the cue to direction finding in the night sky.

Adelie penguins, when moved from their breeding colonies at Cape Crozier on the coast of Antarctica to the far interior, oriented themselves by the sun and departed in one direction, ultimately returning to their nesting sites. The birds headed straight for the coast on essentially parallel courses without any convergence on Cape Crozier. Apparently the birds, when released, had no information on the nest sites. They took their direction from the sun and maintained that direction by the sun's azimuth.

Ah! but "alas" you say. What happens on a bad day, or an overcast night when the birds cannot obtain a visual sighting on the sky? It is quite simple. The penguins mentioned above became totally disoriented. As for the species of nocturnal migrants, if the ceiling is not too high, they will try to fly above the overcast in an attempt to view the stars. Those that cannot will either land or continue to fly under the clouds. In this case confusion usually sets in and the birds fly into TV towers or tall buildings with the predictable outcome.

Man has studied, watched and worshiped the sky for thousands of years. With Columbus and the Norsemen navigating the oceans with their primitive compasses and the stars. Back to the ancient Egyptians using the rising of Sirius as a signal to plant crops. It is almost paradoxical to think that an epoch before this, thousands upon thousands of little eyes were trained on the sky for much the same reasons. So if you are ever called a bird brain, consider yourself as having been complimented.

Ron Walsh

> The known is finite, the unknown infinite; intellectually we stand on an islet in the midst of an illimitable ocean of inexplicability. Our business in every generation is to reclaim a little more land.
>
> —T.H. Huxley, 1887

The Enigma of Sirius

It is probably a safe bet to say that most people, whether inclined to astronomy or not, have noticed Sirius shining brightly in the winter sky. Its prominence as the brightest star would suggest that it has been well observed by people throughout history, and indeed this has been the case. The Babylonians, Chinese and of course the Greeks and Romans made many observations of this star. The Egyptians worshipped Sirius as a god because each year it's first heliacal rising (i.e. it's first rising just before the sun on the eastern horizon) occurred immediately prior to the annual flooding of the Nile. Some Egyptian temples even include alignments with Sirius. In the Americas, this star also figures prominently in that its position is part of the design of the medicine wheels of the prairies and is also used in the street layout of the ancient Aztec city of Teotihuacan (now Mexico City).

In much the same way that historical accounts of the Crab supernova have helped astronomers who study the Crab Nebula, any historical references to Sirius may prove useful to stellar astronomers. Before proceeding any further, let us take a quick look at the Sirius system the way we currently understand it. Sirius is a binary star system composed of Sirius A, which is a normal A-type main sequence star; and Sirius B, a white dwarf which is 10,000 times fainter than Sirius A and can only be seen in a large telescope. As a main sequence star, Sirius A is not thought to have undergone any major changes in the last several hundred million years. On the other hand, Sirius B, at some point in history ran out of hydrogen fuel at its core. It would have started to burn helium and would consequently have gone through a red giant stage. According to current theories, this stage would last for several tens of millions of years followed by a shorter period of time (about one million years) during which Sirius B would have lost most of its outer atmosphere andevolved from a red giant to a white dwarf. Once Sirius B reached this stage, its surface temperature would have been about 100,000 K. From this initial value, its temperature would decrease at an increasingly slower rate. Sirius B now has a surface temperature of 30,000 K, implying that it has been a white dwarf for a considerable time.

If you have followed everything so far, you may be wondering how an enigma could possibly arise. Both Sirius A and Sirius B should have been in their present state for a very long time compared to human standards. You may have deduced that there must be something in the historical observations of Sirius which would throw a monkey wrench into our current theories of stellar evolution. This does seem to be the case. During the period from 1000 B.C. up until about 200 A.D., every person who wrote on the subject of Sirius describe it as being a RED star !

Let us examine these observations. Although the Egyptians observed Sirius for a very long time, they left no surviving records as to it's astronomical properties. This is probably due to their purely "astrological" use of Sirius's heliacal rising. Babylonian texts from c. 700 B.C. refer to Sirius (which they called KAK.SI.DI) as "shining like copper". This phrase may be ambiguous, as it may refer to Sirius's color or perhaps to the fact that Sirius was brilliant, like polished copper. The Greeks wrote of Sirius as being "colored", and the early Romans often refer to Sirius as "the red dog". Additionally, the astute Roman observer Seneca wrote "the redness of the Dog Star is deeper, that of Mars milder, that of Jupiter nothing at all". This statement would seem to be unambiguous.

Many other notable Greeks and Romans have referred to Sirius as being red in one way or another in their writings. This list includes Homer, Virgil, Ovid, Pliny and Cicero. However, probably the most convincing evidence comes from Ptolemy. His famous work "The Almagest" contains a listing of over 1000 stars, in which the color of the star is given if observable. Six stars are listed as being red: Aldebaran, Betelgeuse, Antares, Arcturus, Pollux and Sirius. There have been several explanations as to why Ptolemy would have listed Sirius as a red star. Perhaps some prestigious ancient writer had made a dreadful mistake at some time in the past and everyone since had copied the error. This type of incident has happened in the past. An example would be the case of Aristotle recording the wrong number of teeth in a horse's mouth and the mistake not being noticed for several centuries. However, this seems most unlikely to have happened with so many different cultures and Sirius such a prominent object. Another explanation is that ancient observers only looked at Sirius when it was very near the horizon, and thus much reddened. If this were the case, then why would not Ptolemy have listed Alpha Centauri as being red when from Alexandria where he compiled the Almagest that star never rises more than a few degrees above the horizon. One other possibility stems from the fact that we do not have an original copy of the Almagest. We do have one version which was translated from Greek to Arabic about 900 A.D. and then back into Greek. In the summary at the end of the book, one is told that there are a total of five red stars, whereas if one counts them in the star tables there are six. Could the reference to Sirius being red have been a translational or transcription error, or could the reference to five stars be an error. We do have a second copy which dates from c. 1300 which was never translated, but simply transcribed over and over. It's summary refers to a total of five "nebulous" stars.

There have been several proposals put forward to try to reconcile the conflict between these historical observations and current astronomical theory, however none is without it's problems.

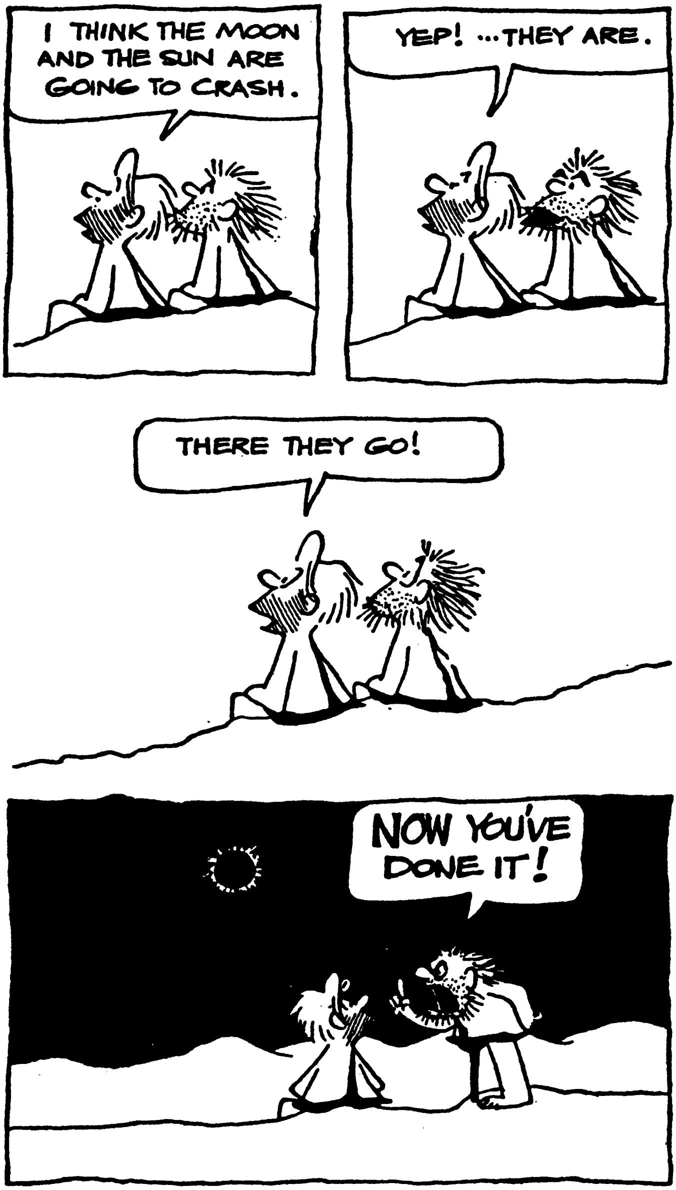
1. Sirius was always blue-white and all of the historical observations are erroneous. There would seem to be too many historical observations and from such a diverse group of observers that it is very unlikely that they are all wrong.

2. A dust cloud passed between the sun and Sirius. This would definitely redden it, but to dim it for such a long period would require either a very small slow moving cloud, or a fast moving but very large cloud. In either case, such a cloud should still be observable, but none has been found.

3. Sirius B was a red giant 2000 years ago. The catch here is that it conflicts with current astronomical theories, which seem to be valid, and which state that it is impossible to go from a red giant to a 30,000 K white dwarf in such a short period of time.

4. Mass transfer from Sirius A to Sirius B could have made a slow nova out of Sirius B. Unfortunately, no mass transfer is now observed between these two stars, and the dynamics of the system would also seem to preclude such an event in the past.

As can be seen, the enigma of Sirius will probably be around with us for a considerable time to come.



reprinted from "Back to B.C."

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