

CANOPUS

The Astronomical Society of Southern Africa

Johannesburg Centre

Monthly Newsletter for September 2000

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**The Sir Herbert Baker Library, 18a Gill Street, Observatory, Johannesburg
P.O.Box 93145, Yeoville, 2143**

Editorial

The August meeting marked the first of the Jo'burg Centre's year under the auspices of your new committee. The main speaker, Professor Ron Buta, gave an excellent talk on Galaxies which was very well received. Currently working with Prof. David Block at Wits University, he is the first of many interesting speaker/subject combinations lined up for the 2000/1 year.

Your new Chairman for 2000/1 is Tom Budge, and his very able second-in-charge is Chris Stewart - welcome back to the committee gentlemen and we look forward to the next year under your guidance. Tom is of course a past chairman of the Jo'burg Centre and serves on the committee of the parent body, while Chris served on the committee until a couple of years ago (1998) when he left these sunny shores (*shores in Jo'burg???*) for several months under the Northern skies of Belgium.

Bill Wheaton has supplied an update on the happenings at NASA and JPL with emphasis on the ISS or International Space Station. When finished, this orbiting edifice will be unmistakable as it cruises overhead in the early evening or morning - no other artificial satellite will produce quite as large a reflection.

Brian has supplied us with the Heavenly Happenings for the next 2 months as well as the Variable of the month - Delta Scorpii - which as many of you will know, appears to have undergone some sort of cataclysmic shake-up and has become much brighter than it was in the past.

What would you like to read about in Canopus? Please drop your editor a line on any subject(s) you'd like to see, or even better ... if you are a budding journalist, and have an article you'd like to submit, send it through. I can almost guarantee you it'll be published as is.

It's that time of the year again where we ask you to pay your annual subscription fees which remain unchanged for the new year. *Our fee structure, and especially the Family Member subscription, are very inexpensive for the perks they provide - access to a site with some excellent telescopes, a library with a great selection of books and magazines, the "Mars Bar" and of course, last but not least, your own Johannesburg Centre magazine - Canopus.*

The Editor

chris@penberthy.co.za

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Notice of Meeting

The **September** meeting of the Johannesburg Centre of the Astronomical Society will be held in the Sir Herbert Baker Library, 18a Gill Street, Observatory, on Wednesday the 13th of September, 2000 at 20:00.

Topic:

History of a Large Telescope

By: **Tony Hilton**

Future Meetings

October 11 th	Meteorite Collecting	Trevor Gould
November 8 th	Impact Craters	Prof Uwe Reimold
December 9 th	Under the Full Moon	Annual Star Party

Are there any subjects that you would like to hear at one of the monthly meetings? Contact your local friendly committee member and ask her/him to discuss it in committee.

Dark Sky Viewing

On the Saturday nearest New Moon at Tom Budge's Farm in the Magaliesberg. Remember that this is by arrangement only as most observers will be following specific viewing programmes and if you don't have your own 'scope, you should contact one of the observers (e.g. at the monthly meeting) to arrange some viewing time with them.

23 rd September	Year End Star Party 2000
28 th October	<i>"Under the Full Moon"</i>
25 th November	9 th December

Annual Subscription Fees

There are no changes to the Johannesburg Centre's subscription fee structure for the 2000/1 year. The joining fee remains R50-00 and the Annual fee R100-00. The Family membership subscription fee also remains unchanged at R125-00. The Family membership is restricted to couples and their co-resident dependants and although all Family members receive full rights as members of the Centre, only one copy of the monthly magazine, Canopus, will be posted to the family address. The annual subscription form is included with this issue of the Canopus and we would like to urge you as members to pay your subs as early as possible to enable your committee to plan the Centre's projects for the year ahead.

Please post your subscription fee, or deposit/transfer it directly into the Society's bank account at **NEDBANK**. The Account information is as follows:-

Bank:	NEDBANK
Branch	Name: Park Plaza
	Code: 19 21 42 44
Account	Type: Current Account
	Number: 1921 013761
	Name: <u>ASSA Johannesburg Centre</u>

Please remember to write your name on the deposit slip or to include your name as a reference on a direct transfer. Then fax the details to the Chairman to let him know that you have paid via direct deposit or transfer so that you will be kept on the Canopus mailing list.

Jo'burg Centre Outings for 2000

Your Committee is making arrangements for several outings during the year. Amongst these are some old favourites as well as a couple of new ones which should prove interesting.

Swinburne was visited, and an article has been promised for the next issue of Canopus.

Boyden has been cancelled due to lack of availability of the 60" but we'll plan a visit again next year.

We will also be looking at the possibility of arranging visits to other ASSA Centres (e.g. the Pretoria Centre) during the year - and also try to see if we can organise some joint ventures.

Haartebeeshoek - Wolf Lange is attempting to organise a visit later in the year, as well as a visit to the Suikerbosrand Nature Reserve.

Tswaing Crater - still trying to set up a day visit under the guidance of Prof. Reimold

Telescope Making Classes

Would you like to make your own telescope?...or finish off a partially finished one? Well your opportunity has arrived (once again). Join the Telescope Making Class being held under the guidance of Brian, Evan and Chris. Contact Brian on 803-8291 if you are interested.

Eclipse June 21st 2001

We are looking at the possibility of chartering a plane to fly to Lusaka on the morning of the eclipse and fly back again after the event. Flying time is about 1hour 50 mins each way. The cost will be approximately R2000 per person and that includes all airport taxes and refreshments on the plane.

If you are interested then PLEASE CONTACT ME AS SOON AS POSSIBLE. If we do not get enough people to charter a plane then this deal will have to be cancelled.

Brian Fraser

Email: brian.fraser@macsteel.co.za

Tel: Work 871-0370 Home 803-8291

Eclipse accommodation in Zambia

All hotels are fully booked for the period around the eclipse. We have however made arrangements to get camping accommodation near the centre of the shadow track, for those who may be interested in travelling to Zambia. You will need to provide all equipment. Cost will be USD 20 pp per night, minimum 2 nights. Again this needs to be booked AS SOON AS POSSIBLE, so if you are interested then PLEASE contact me. Lusaka is about 1650 km from Johannesburg.

Don't leave it. There are THOUSANDS of tourists travelling to Africa to see this eclipse, so make up your mind NOW. If you snooze you lose.

Astronomy in the Eastern Transvaal

One of our members, Bill Lockhart, has retired to the little town of Belfast in the Eastern Transvaal, about 220 km from Johannesburg. He has built himself a little observatory to house his 10-inch Meade LX200 and has a CCD camera and attachments to fit a 35mm camera on the telescope.

But over and above this, he has been befriended by a group who have a 12-inch Meade LX200 in a forest reserve just outside Belfast, and has assisted them in getting to know the night sky. In exchange they have allowed him the use of the 12-inch. The forestry company SAFCOL have a little resort, called Lakensvlei, on a small dam in one of their forests about 15km outside Belfast. The area is well known for its trout fishing, and that is the main activity at these chalets. However they have built a small observatory, in the middle of this vlei, with a

rotating dome and a 12-inch Meade telescope. And it is there for the use of guests.

Other activities include trout fishing, birding at a hide on the vlei, horse riding, hiking, boating and general lazing around. There is a small restaurant and bar facilities where you can warm up before venturing out to the dome. The skies are magnificent. There are 6 chalets sleeping 8 people each and 6 chalets sleeping up to 4 people each. Cost works out at about R160 per person per night over the week-ends - a little less during the week.

Bill would be glad to have visitors around.

His phone Number is 083-244-9138.

Brian Fraser

JPL and NASA News

Bill Wheaton
2000 September

International Space Station ISS

With the successful launch of the Russian service module Zvezda and its remote-controlled docking with the initial two modules of the ISS in late July, a logjam has broken, and an exciting schedule of further launches and assembly is in store for the next year. Of course, in the short term, the most important effect of the ISS on astronomy may be the interference of yet another very bright artificial object in the night sky, affecting observing sites practically worldwide. But from a broader point of view, the relationship of the ISS to astronomy, and indeed to science, is a bit tenuous, and indeed quite controversial in the USA, where it is widely seen as a boondoggle, taking money from "real science" to serve the engineers and the institutional needs of NASA. While the financial drain is beyond arguing, it is a sad fact that pure science, as an abstract intellectual enterprise, does not have much of a constituency in the US, nor probably worldwide. Of course everyone wants science to cure cancer, raise their standard of living with neat gadgets, or increase prosperity with new jobs and productivity, but that's all applied. While I have always made my living in basic research, I have mostly not seen the space program as primarily driven by the values of academic science. The most spectacular example is the old Apollo Moon Program. We would never have spent \$24 billion in 1960s dollars, for example, in order to understand the origin of the Moon -- the very idea is ludicrous. Yet the Apollo Program was in fact a bonanza for science, and did lead to a much deeper understanding of the history of the Moon and of planetology generally.

Similarly with the station, although NASA's nominal justification for it is mostly in terms of science, applied or basic. Instead, I see it as part of NASA's larger goal of supporting human exploration and expansion into space, and as such it creates its own enthusiasm and financial resources, different and larger than anything scholarly research could ever command. Being myself very enthusiastic about those larger goals, I am just happy that the pursuit of them also opens up opportunities, ecological niches, for astronomy and the other sciences. Parasitic science, if you will. In any event, I hope that the experience gained on the station will allow us to gain an increasing facility in operations in this strange new environment, so that eventually we will be able to undertake projects and programs that cannot be realistically considered

today, and that the benefits will be felt in radical and unforeseen ways across the entire spectrum of human activities, from the economic and environmental, to the philosophical and cultural, to the purely scientific.

At this writing, space shuttle Atlantis is on KSC Pad 39B, being prepared for launch to the ISS on September 8, for an 11-day, seven-person logistics mission with supplies and equipment needed prior to the arrival of the first crew, scheduled for November. A Russian Progress supply vehicle docked with the ISS on August 8, and boosted it to a slightly higher orbit. It is the first of many such Progress supply missions, which together make up a large part of the Russian contribution to the ISS project. The next assembly mission, scheduled for October 5 by shuttle Discovery, is to deliver the so-called Z1 truss and PMA-3 Pressurized Mating Adapter, plus Ku band communications equipment and Control Moment Gyros (CMGs). Unfortunately at the moment there is a problem in the CMG unit, which may delay the flight; or may well have been resolved by the time you read this. "CMG" is NASA-speak for a system of massive flywheels, with their axes oriented in different directions. By spinning the wheels faster or slower, the attached spacecraft can be reoriented in space without the need for the expenditure of any precious reaction control propellant. Then, if the CMG problem is resolved, and after the launch of the first crew aboard a Russian Soyuz on October 30, the space Shuttle Endeavor will arrive around the end of November for the next assembly flight, with the first big cargo of solar arrays, photovoltaic converters, and radiators. The solar arrays are the first of four huge modules which will dominate the visual appearance of the completed station. Since the long truss where they will finally be mounted is not yet installed, they will temporarily go on the Z1 truss brought up in October.

All this is quite confusing without a long series of assembly diagrams to show what goes where. Also, since the potential for problems and delays, leading to adjustments in the schedule, are inevitably large in a project of this magnitude and complexity, it does not seem very useful to report in detail on the launch manifest many months in advance. Fortunately, NASA has recently reorganized its ISS web pages, and now provides several terrific facilities for keeping up with the show. At the ISS Assembly page,

<http://spaceflight.nasa.gov/station/assembly/index.html> is a link to a current table of the ISS flights in store, with further links to a page for each flight that features nice pictures of the assembly at corresponding stage. There is also link to a good video clip of the entire assembly, which can be stepped through slowly and examined at each stage. Finally, the Russian Space Agency and the US

company Eastman Kodak have also announced that they will provide free live coverage in still and video form of the ISS assembly in real time over the Internet, worldwide, using Kodak digital cameras mounted inside and outside the new Zvezda service module. The cameras will be delivered on a future space shuttle flight.

Mars Program

After a difficult review of months duration, necessitated by the many questions raised after the wrenching disasters that befell the 1998-1999 Mars missions, NASA has decided to proceed with two identical rovers for the 2003 launch opportunity. You may recall that the old plan, described here in May 1999, featured both an orbiter and a lander for each of the next few opportunities. Recall also that launch opportunities occur a few months before oppositions (thus every 2 years and 7 weeks, on the average), with the next ones after 1999 being in 2001 and 2003. The old program was modified in May 2000 after the December 1999 loss of Mars Polar Lander, by canceling the 2001 lander, but leaving the corresponding 2001 orbiter mission in place. That decision left open what to do about 2003, the next opportunity, also nominally scheduled for both a lander and an orbiter.

The surviving Mars Surveyor 2001 orbiter mission is scheduled for launch on 4 April 2001, and will arrive on 20 October. After a 76-day period of aerobraking to achieve a low-altitude 2-hour orbit, the scientific part of the mission will begin. Three instruments will be aboard. THEMIS, a THERmal EMission Imaging System, will provide both a high-resolution camera and an infrared spectrometer to map surface mineralogy. A Gamma-Ray Spectrometer (GRS) will map the surface elemental composition and detect water or ice to a depth of many centimeters. And MARIE, the Mars Radiation Environment Experiment, will help determine the surface radiation risks for future human explorers. The spacecraft will also be equipped to serve as an Earth-relay for communications with future Mars craft, either landing, orbiting, or on the surface. Lack of such communications was a significant factor obscuring the fate of the Mars Polar Lander, which simply disappeared behind the planet and was never heard from again.

The new 2003 missions will feature identical landers based on the highly successful 1997 Pathfinder airbag system, with greatly enlarged rovers, each about the size of a golf cart, and

roughly 110 kg in mass. They will be particularly intended to follow up on the Mars Global Surveyor discovery that substantial quantities of liquid water seem to have been released onto the surface in geologically recent times. If so, then water is probably still present underground today. This would greatly increase the likelihood of finding Martian microorganisms, either fossil or even, just possibly, still living. The realization that a vast population of microorganisms lives deep underground on Earth in rocks, plus the new understanding that a large quantity of material must have been exchanged between Mars and Earth due to ejecta from asteroidal impacts early in the history of the Solar System, yet after terrestrial life seems already to have existed, are important elements in the recent increase in interest about the prospects for Martian life.

The two new rovers will be far more capable than the Pathfinder rover, which was forced to communicate with Earth through its immobile ground station, and was therefore not able to venture far from it. The new missions will dispense with the old Pathfinder ground station, and the rovers will have the capability for direct communication with Earth at high bit-rate, or via the 2001 orbiter as a relay. They will also be able to move about 100 m per day (roughly the total distance the old Pathfinder rover moved during its entire life), and should last for at least 90 days.

The missions will be launched on Delta 2 rockets for a total cost of about \$600 million, of which two-thirds will be for the first. While the second mission comes at a bargain price, the total is still a large sum by recent faster-better-cheaper standards. NASA's willingness to undertake such an ambitious project is a clear sign of the growing scientific excitement about the prospects for life on Mars, and a good omen for the future of Mars exploration. Rumors that a financial crunch would necessitate canceling other planned missions, in particular the Pluto/Kuiper Express, have not been confirmed so far.

Notes

Deep Space 1, crippled by failure of its startracker, has been restored to operation by reprogramming of its on-board computer to use its science camera for navigation instead. The fix was carried out while it was about 300 million km from Earth. After more than 200 days operation of its ion drive to date, setting a record for the duration of operation of any propulsion system in space, DS1 is now on its way to a rendezvous with Comet Borrelly in September 2001. The durability of ion drives has been an issue in the past, and DS1's success opens the way to consideration of the technology for future missions. Although the thrust of DS1's drive is only comparable to the weight of a piece of paper, its high exhaust velocity results in such a low fuel consumption that high velocities can be obtained by

long-duration operation. Meanwhile, the launch of HESSI, the High Energy Solar Spectrographic Imager, has been re-scheduled for 28 March 2001. The spacecraft was seriously damaged when a shake table failed last spring, subjecting it to ten times the specified loads. Fortunately both the imager and gamma-ray spectrometer survived relatively intact, with the main casualties being the solar arrays and the cryogenic cooler for the germanium gamma-ray detectors. HESSI's main objective is to investigate gamma-ray emission from solar flares, and so it should be launched as near the time of the maximum of the 11-year sunspot cycle as possible, which is approximately now.

Bill Wheaton

Outing to the Vredefort Dome

The Royal Society of South Africa, in conjunction with the South African Archaeological Society extended an invitation to join them on the 6th August for an outing to the world's oldest and largest known land meteorite impact site - **THE VREDEFORT DOME**.

The outing was ably led by Dr Uwe Reimold who hails from the Geology Department, Wits University, and Guide Peter Power.

True to form, the heavens opened on the afternoon of the 5th after almost two months of dry skies ! As the outing was to be in the form of a hike through some rather rough terrain, when Sunday dawned to be the most glorious day, newly washed and amazingly warm considering the time of year, a collective sigh of relief was to be heard wafting across the blue sky.

We met at a pre-designated point at 9h30, and continued in convoy towards our destination. The organisers were rather amazed, as the turn-out far exceeded their expectations - nearly three times the expected turn-out arrived at the meeting point. After about five kilometres or so, the convoy was halted and some rather strange hill-like formations were pointed out to us. Peter explained that the oldest granite bed rock had been brought to the surface by the cataclysm, almost a folding had taken place with the oldest, bottom rock layers being exposed whilst the alluvial, younger rocks were now folded beneath. Almost like a wave that the top had curled beneath the bottom. It was fascinating. The formation of fracture lines, and the unusual folding features were also pointed out. These weird formations formed concentric circles of hills and valleys as far as the eye could see, just a smattering of what must have

occurred all those millions of years ago when the "body" slammed into the earth, causing the land and bed rock to react as if a pebble had been thrown into a still pond - awesome !!

Again in our vehicles, the convoy continued and we eventually reached our destination - Smilin' Thru Resort. We all piled into a darkened hall (rather packed like sardines as so many bodies were NOT expected) where Peter Power gave a lecture on the genesis of the impact dome, and what can still be clearly seen of the impact site after 2,020 million years. Satellite pictures of the impact area were startling to say the least, and the vastness of the destructive force of the impact "body" was really brought home - you could hear a pin drop as the scenario unfolded. Once Peter had impressed us all with his vast knowledge of this immense happening, Dr Reimold fascinated us all with his extensive knowledge of the Geology of the area, and proved to us beyond a shadow of doubt, that this was definitely an impact site of tremendous proportions, and not merely an old volcanic crater, as was previously believed.

In a near future meeting, Members of the Jo'burg Centre will be entertained by Dr Reimold lecturing on impact sites - not to be missed, believe me!

Next came the "fun" part. We all assembled in the car park, and the trek through the Bobbejaan Ridge began, this ridge, a tiny part of the dome which still remains in the centre of the impact crater.

Dr Reimold had a wealth of information about the "hole" area, the different rock ages, formations, geological abnormalities, and was fielding the eager questions that come thick and fast. It was fascinating

to hear that if the impact had not occurred, there would not be a "Witwatersrand". It was explained the basin left by the impact (stretching well beyond the gold-bearing reef), the upheaval, as well as the gradual filling in of gold bearing sediment gave birth to our famous gold fields. Imagine the whole area encompassing Gauteng, Freestate, and parts of the N.W.Province being without mines - quite a sobering thought.

We were informed that this impact crater is far larger, and older than the one in Chixulub, that in theory was responsible for the demise of the dinosaurs.

The hike continued, and continued - the length of time seemed to have a bearing on one's level of fitness. We eventually reached our destination, the highest point in the vicinity and surveyed our breathtaking surroundings - standing on upturned bed rock that was almost as old as our mother earth, all of us quiet, and in awe - feeling the warm breeze - listening to the insect life droning about us, and seeing in our minds eye the cataclysmic event that tore into our earth, exposing her belly, and sending shock-waves that must have been felt throughout our green planet - 2,020 million years ago.

Louise Penberthy

Southern African Meteorite Recovery Program - Spring Expedition

Dates:	22 September – 26 September 2000 inclusive
Area:	Within the bounds of the existing permit South of Upington, Northern Cape. Previous sites minimised the dangers of being mugged, or attacked by insect or other nasties. We cannot guarantee your safety, though...
Program:	Depart 02:00 Friday 22 Arrive Upington 13:00 Find site and set up camp [and telescopes] Saturday – Monday: search for South Africa's 50 th meteorite! Tue: Return home
Workshop:	Interested people, including those wishing to volunteer for this expedition are invited to a workshop to be held at the Sir Herbert Baker Library Building, Union Observatory, 18a Gill Street, Observatory, Johannesburg at 20:00 on Friday 15 September 2000. The workshop shall cover meteorite recognition, a slide show of the last expedition, finalising of the sites, logistics and general discussion. I would hope to introduce you to Dr Paul Buchanan, a professional meteoriticist.
Costs:	There is no cost associated with joining the expedition. However, it does cost money to get there, and you need to bring adequate provisions. A detailed list of "things to remember" will be handed out at the workshop, but bear in mind up front that you should have a tent, sleeping bag, food and water for the duration. If the selected site is within striking distance of civilisation, details of accommodation possibilities will be issued. For those wishing to fly in [and out] I can put you in contact with a good pilot, who, with luck, will be joining the expedition anyway.
Questions:	Should there be any questions prior to the workshop, please contact me. 083-212-8945 <i>trevorgo@tnet.co.za</i>

Trevor Gould

HUBBLE DISCOVERS MISSING PIECES OF COMET LINEAR

From: NASAnews@hq.nasa.gov
RELEASE: 00-122

To the surprise and delight of astronomers, NASA's Hubble Space Telescope has discovered a small armada of "mini-comets" left behind by what some astronomers had assumed was a total disintegration of the explosive comet LINEAR.

Hubble's powerful vision has settled the fate of the mysteriously-vanished solid nucleus of the comet, which seemed to disappear after it moved around the Sun.

On July 27, ground-based observers lost sight of the bright core of the comet and suggested that the nucleus disintegrated into a pile of dust. Astronomers at the Space Telescope Science Institute (STScI) in Baltimore, MD, quickly reprogrammed Hubble to search for the missing nucleus. Johns Hopkins University astronomer Hal Weaver said he was stunned when the Hubble image popped up on his computer screen. "My first thought was Hubble Space Telescope does it again! We caught the fish! This is amazing, very exciting, very neat."

Though comets have been known to break apart before, this is the first time astronomers have a close-up view of the dismantling of a comet's nucleus due to the Sun's heat. Since the 1950s, researchers assumed comet nuclei were loose clusters of ice and dust, called cometesimals, held together by gravity. Solar heat causes the ices to sublimate and violently release gas as explosions and garden hose-style jets. The pressure of the solar radiation blows away particles like debris caught in a gale.

Some astronomers think that the fragments now being seen in LINEAR may be the primordial building blocks of the original nucleus, the so-called cometesimals, which theory predicts should be several tens of feet across. The breakup of a comet tells scientists how it was put together in the first place. The cometesimals were built up from micron-sized grains of dust as it collected in the early solar system, roughly 4.6 billion years ago.

On Weaver's screen were at least a half dozen "mini-comets" with tails, resembling the shower of glowing fireballs from fireworks. They were clustered in the lance-head tip of an elongated stream of dust and an isolated brighter piece in front of the cluster may be the parent nucleus for the smaller fragments. Hubble's exceptional resolution and sensitivity allowed it to reveal the nuclei as

separated bodies at a level of detail never before seen in a disintegrating comet.

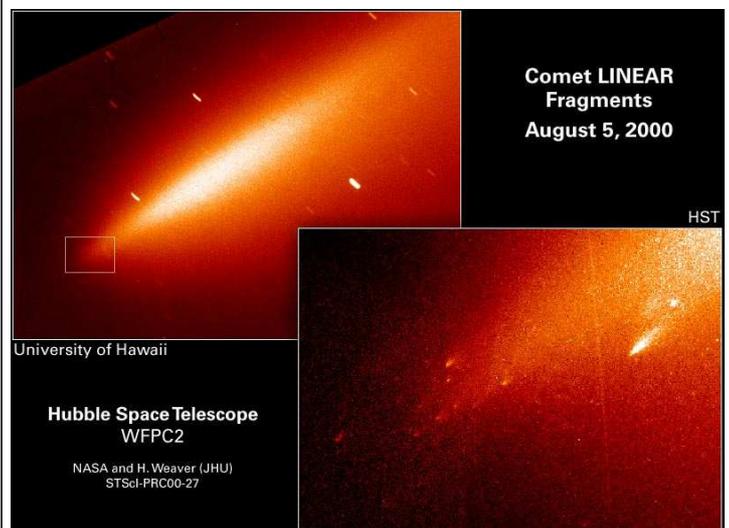
Some astronomers find it hard to imagine how an object the size of a mountain could totally disintegrate in only two weeks. "Actually, I would have been more amazed if Hubble saw no pieces," adds co-investigator Carey Lisse, of STScI. "The comet's breakup was too violent and fast for it to completely vaporize. How do you pulverize something the size of a mountain?"

Weaver says it will be important for the largest ground-based telescopes to try and see the mini-comets as they spread apart. This may yield further clues on the structure of the original nucleus and the sizes of the remaining fragments.

Some astronomers believe this was Comet LINEAR's first visit to the inner solar system, after traveling for nearly the distance of one light-year (six trillion miles) from the vast comet storehouse called the Oort cloud. Other astronomers suggest that LINEAR may have been a fragile piece that broke off of a larger comet that visited our solar system more than 10 million years ago.

It's estimated that 20-30 percent of comets are so fragile they completely disintegrate when they pass the Sun.

The Space Telescope Science Institute is operated by the Association of Universities for Research in Astronomy, Inc., for NASA, under contract with NASA's Goddard Space Flight Center, Greenbelt, MD. The Hubble Space Telescope is a project of international cooperation between NASA and the European Space Agency (ESA).



VARIABLE OF THE MONTH:

R Cen Changing?

Danie's choice of the Mira type variable R Cen as the variable of the month last month has coincided with some discussion on the variable star network about this star. It has been classed as a pulsating Mira star with a period around 420 days, with double humps in the light curve ie two peaks and troughs that are not the same. Astronomers taking a careful look at the light curve for the past 100 years have noticed that both its amplitude of variation and its period have been decreasing. Mira stars with periods in excess of 400 days seem to be unstable and are possibly settling down to a shorter, more regular pulsation pattern. This is one of the reasons why these stars should be observed by amateurs. Another 200 or 300 years of observations and astronomers may yet get to understand what is happening.

Delta Scopii brightens

The centre star in the line of three in the head of Scorpius underwent a remarkable brightening in July. An amateur astronomer in Argentina, Sebastian Otero, one day reported to the variable star network that this star had brightened by about a tenth of a magnitude. Now, if you have ever tried to do some variable star observing you will know that it is very difficult to get to one tenth of a magnitude accuracy - in fact it is hard enough guessing to about 0.3 magnitudes!! So everybody politely ignored him. Anyrate, a couple of days later Sebastian reported that it had brightened some more and then someone else had a good look and found that the star seemed to be different. Then an astronomer did some spectroscopy on delta and found that it *WAS* strange in that there were emission lines in the spectra (stars normally do not show emission lines). It turns out that the star brightened from 2.3 to about 1.8 and it is still very bright as I write this article. It has been identified as a gamma Cas type variable - a very hot young B type star that has experienced some unhappiness in its life cycle. (*Don't we all!*).

This one is dead easy to see. Why don't you monitor it over the next couple of months? Just keep comparing it to the other two stars in the head of Scorpius and see what happens. Perhaps it will return to normal and perhaps it will get a lot brighter.

What are Gamma Cas stars?

GCAS stars are massive blue stars (spectral type O8 to A1) that are evolving off the main sequence (Luminosity classes V to III). First of all they are Be stars, stars with emission lines in their spectra. This hydrogen Balmer emission lines are caused by the presence of a thin envelope of matter previously ejected by the star. In a normal star the light from the photosphere (continuum spectrum) passes through the star's atmosphere (lower density) resulting in an absorption spectrum. But in Be stars, we can see free emission from the light coming directly from the circumstellar matter which produces an emission spectrum. (See graphic)

They may be non-variable Be stars (in the visual), they may be BE variable stars, Be stars with very small variations, or GCAS stars when they undergo important optical activity.

Delta Scorpii was a normal B star ten years ago. It was discovered as a Be star in 1993 and now it has emerged as a new gamma Cassiopeiae variable. Why did these events take place?

The common fact for all Be stars is that they are all very rapid rotators (100 - 500 km/ sec). In some cases, the rotation speed overcomes gravity force and parts of the atmosphere are ejected by the star's equator forming a circumstellar envelope. The orientation and thickness of this ring are the main causes for GCAS variability. Rapid rotation may be an intrinsic property for Be stars and sometimes may be a consequence of mass transfer in a binary system. Tidal forces between a star and its companion may play a crucial role in cases such as delta Scorpii, since the proximity of the companion can increase the strength of the activity in the star's upper atmosphere.

Delta Scorpii is a binary system (the companion is another B star but considerably less luminous) with a period of nearly 20 years, and the point of the orbit when both stars are closest together was reached in

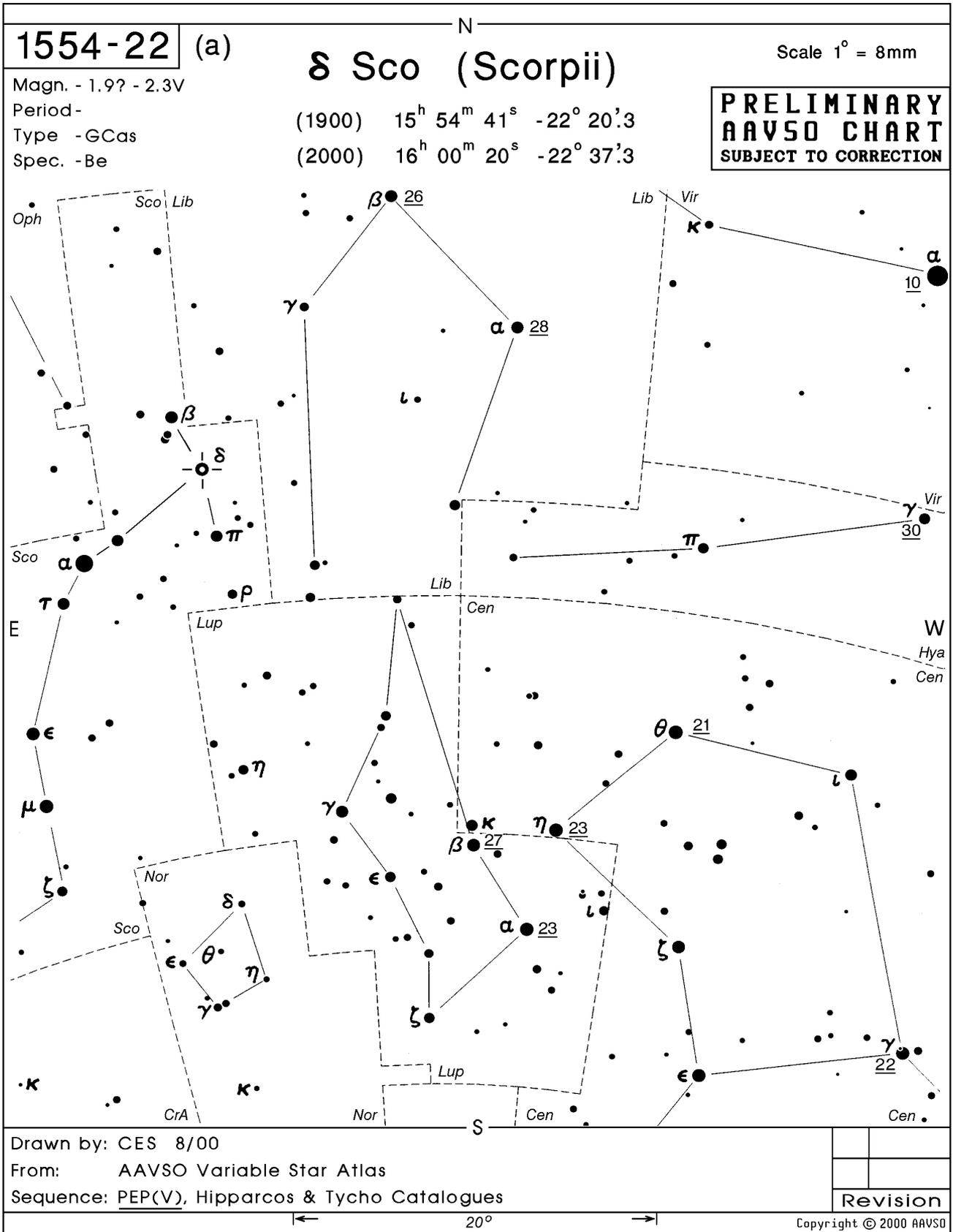
..... JULY 2000 !!!!!. So it's a kind of proof for the theory.

This is the main cause for GCAS variations: rapid rotation.

Brian Fraser

Star Chart for Variable of the Month

Delta Scorpii



The Sky this Month

September 2000

dd hh	dd hh
5 17 FIRST QUARTER	19 19 Jupiter 2.6 N of Moon
7 20 Jupiter 4.7 N of Aldebaran	21 02 LAST QUARTER
8 14 Moon at apogee	22 17 Equinox
9 23 Neptune 1.1 N of Moon Occn.	23 16 Mercury 0.7 N of Spica
11 02 Uranus 1.3 N of Moon	24 10 Moon at perigee
12 19 Saturn stationary	25 17 Mars 2.4 S of Moon
13 20 FULL MOON	27 20 NEW MOON
16 07 Mars 0.8 N of Regulus	29 13 Mercury 7.6 S of Moon
18 19 Venus 2.7 N of Spica	29 14 Jupiter stationary
19 02 Saturn 1.9 N of Moon	30 01 Venus 5.2 S of Moon

October 2000

dd hh	dd hh
5 11 FIRST QUARTER	19 22 Moon at perigee
6 04 Mercury greatest elong. E(25)	20 08 LAST QUARTER
6 08 Moon at apogee	21 05 Jupiter 4.6 N of Aldebaran
7 06 Neptune 1.3 N of Moon	24 06 Mars 3.5 S of Moon
8 08 Uranus 1.4 N of Moon	26 16 Uranus stationary
13 09 FULL MOON	26 22 Venus 3.3 N of Antares
14 19 Mercury greatest brilliancy	27 09 NEW MOON
15 06 Neptune stationary	27 15 Mercury 6.5 S of Moon
16 06 Saturn 1.7 N of Moon	29 22 Venus 12.2 S of Pluto
17 01 Jupiter 2.3 N of Moon	30 05 Mercury in inferior conjn.
18 15 Mercury stationary	30 09 Venus 4.5 S of Moon

LOCAL TIMES of RISE and SET for the MAJOR PLANETS, 2000

Site Location:- Long. **+28.0 deg.** Lat. **-26.0 deg.**

Local Time:- UT **+2.0 hrs.**

Date	Sun		Mercury		Venus		Mars		Jupiter		Saturn	
	Rise	Set	Rise	Set	Rise	Set	Rise	Set	Rise	Set	Rise	Set
Sep 07	06.15	17.57	06.57	18.58	07.27	19.42	05.15	16.21	00.19	10.57	23.34	10.25
Sep 17	06.04	18.01	07.00	19.29	07.23	19.57	04.55	16.11	23.42	10.20	22.54	09.46
Sep 27	05.53	18.05	06.57	19.52	07.19	20.14	04.35	16.00	23.04	09.42	22.14	09.06
Oct 07	05.42	18.09	06.50	20.06	07.18	20.31	04.15	15.49	22.24	09.02	21.33	08.25
Oct 17	05.32	18.14	06.31	19.56	07.19	20.48	03.54	15.37	21.42	08.21	20.51	07.44
Oct 27	05.24	18.20	05.40	18.53	07.24	21.06	03.33	15.25	21.00	07.39	20.09	07.03