

Event Horizon

Summer 2001

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A Good Talk, and Summer Musings on the Search for Extraterrestrial Intelligence

Doug Black

It was back at the end of May. The crowd filed into the Convention Center's Chedoke Room, casual but with lots of anticipation. Dr Jill Tarter, who directs Project Phoenix for the SETI Institute, was about to give the Helen Sawyer Hogg Lecture. This annual public lecture was set up by the Canadian Astronomical Society (CASCA). Its title was "SETI: Pulling Signals Out of Noise", and maybe just that slightly technical tone kept away the folks with questions about aliens, or even the "face on Mars". For whatever reason, they weren't at the talk. I suspect that a lot of the amateur astronomers present had read the April Sky and Telescope article on "The Future of SETI" and had been thinking about it. I'd never heard a talk by Dr Tarter. She came across

as a very capable and realistic person, and I could also see where Carl Sagan's Ellie Arroway had originated.

As I recall (and I can only hope that at least some of these details are right!) the talk started with a general current picture of SETI.

Life is generally associated with planets. So far, we've found 67 planets plus three around a pulsar, four planetary systems. We could detect planets just like Jupiter and Saturn but do need time for them to orbit a bit. The proposed Kepler Mission would watch 100,000 stars for transits. We're starting to look for short laser pulses, and this is promising because it's not too hard for them to outshine their star at some frequency.

There are three kinds of searches: directed (SETI's

own choice of what to look at when), commensal (piggyback) and data mining. But it's a huge search; with x, y, z, t, frequency, polarization, modulation etc the search space has nine dimensions!

There are also **three directions** in which SETI searches are heading. The first way is to build an inexpensive array of radio dish telescopes from off the shelf components to monitor about 100,000 stars. A second direction is to search for very brief light pulses from about a million stars. And finally, an omnidirectional sky survey array could look for strong transient radio output from "billions and billions" of stars. That last method seems to be gaining favor.

The **Project Phoenix** targeted search listens to frequencies from 1.2 to 3 GHz, although

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Event Horizon - New Options for Delivery

The HAA has always prided itself as being "affordable". Not too surprisingly, one of the major costs in our yearly budget is mailing issues of our newsletter, Event Horizon, to our members. In very rough terms, every Event Horizon which we put in the mail costs \$1.

Many, but not all, of our members have access to the Internet. If a fraction of our members who currently receive paper copies elects to receive their Event Horizon's by e-mail as a PDF (Portable Document Format) file, we can dramatically lower our mailing costs. The usual PDF reader, called Adobe Acrobat, is available free of charge as a standalone program and it also contains free "plugins" for the most popular Web browsers.

There are a number of advantages to receiving the PDF version:

- they will arrive more quickly
- they can include colour
- you can receive them when you are away from home, but still have access to your e-mail
- you can elect to print only

- what you wish to save in hard-copy
- you will help to keep our membership fees low
- there is no hard page limit (due to mailing costs) for an expanded EH which might be warranted before or after special astronomical events
- it might even be environmentally friendly!

If you have a very slow dial-up connection, then you may wish to continue to receive Event Horizon's by Canada Post. During the last two years, PDF versions of Event Horizon have varied between 125 and 480 kilobytes. We will make every effort to keep the size of the PDF files as small as possible, but you should judge your patience with e-mail downloads accordingly!

If you interested in participating in this new trial, please send an e-mail to Ann Tekatch at: tekatch@sympatico.ca You can switch back to the "snail mail" version of the newsletter at any time.

Marg Walton and Doug Welch

HAMILTON AMATEUR ASTRONOMERS

Event Horizon is a publication of the Hamilton Amateur Astronomers (HAA).

The HAA is an amateur astronomy club dedicated to the promotion and enjoyment of astronomy for people of all ages and experience levels

The cost of the subscription is included in the \$25 individual or \$30 family membership fee for the year. Event Horizon is published a minimum of 10 times a year.

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NNNnnnnnnNNNNnnnnnn - Know Your Mosquito

If you have been observing this summer, you may have noticed some of our winged "friends" hanging around, sucking blood, and generally being a nuisance. In the spirit of "knowing your enemy", I have sought to learn more about these beasts. I have no illusions that this will aid me in being bitten less often - mosquitoes have been on this earth much longer than humans and I'm sure when their most delectable species is no longer around, they will make due.

First, you should know that only the females bite. There. I've said it - despite it probably not being politically-correct. What do the males eat? Steak and eggs, of course! No ... actually they eat ... nectar - and they call themselves males! The females actually can get by on nectar, too, unless they want to produce a brood of eggs - they need their "blood meal" for the extra energy required for this activity. The itching is caused by a substance the female injects

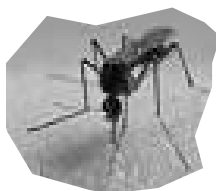


to prevent the "bite" from clotting while she loads up with blood. If there is a vertical surface nearby, you will frequently find that the females head over to it to rest immediately after dining. (If

you get bitten while sleeping, this is useful knowledge to allow you to seek revenge!)

The female lays her eggs in still water. So if you want lots of mosquitoes, it is an excellent idea to build your observatory near a marsh.

How do the male and female find each other? Personal ads, usually. Well, not exactly. It turns out that the wingbeat frequency of the female is well-matched to a very peculiar set of antennae of the male mosquito's head. The male will "go for the gusto" if it hears the appropriate, species-specific buzz. (The male mosquito also has a wingbeat frequency, but fortunately for all concerned, it is typically a few hundred cycles per second higher in pitch.)



There are a number of "attractants" for female mosquitoes. Exhaled carbon dioxide, lactic acid, and sweat have all been reported as having some attractant value. None is overwhelmingly more important than the other. Having warm, exposed skin is certainly a plus, as far as female mosquitoes are concerned. While a number of chemicals have some repellent value, none come close

to "DEET" in effectiveness.

Mosquitoes seem to take flight in great numbers about 20 minutes after sunset, so illumination level is clearly a trigger in terms of how active they are. Temperature and relative humidity also are important.



You might be amused to know that ultrasonic devices have been repeatedly shown to have no repellent value whatsoever. Not too surprising for a bug which mainly is tuned to a frequency slightly above middle C!

It would be very interesting to find out which species we have here in the Hamilton area. If it gets cloudy some night you are observing, think about collecting up some little beasties for identification. If we get organized, maybe we can make some recording of female wingbeats and see if we can tell the species apart from each other!

Doug Welch

Extraterrestrial Intelligence

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they'd really like to examine 1-10 GHz. They look for narrowband signals, using two widely spaced telescopes in the US and Great Britain to rule out local signals. To be chosen the star must be at least three billion years old. By the way, the signal from Pioneer 10 has been used as a standard, to give Phoenix something to calibrate to. It's being replaced, as it disappears, by signals bounced off the moon. Phoenix has now run long enough to rule out "strong terrestrial radars" from 500 stars, out to 155 light years.

The **Allen Telescope Array** at Hat Creek California extends Project Phoenix. When complete in a few years it will be 365 six-metre dishes, made from inexpensive components, looking at frequencies from 0.5 to 10 GHz. The array is compact, but irregular, shaped a bit like Darth Vader! It can be "steered" a bit, so that sensitive directions can be pointed at targets, and the "nulls" can be pointed at satellites. And it will search the Galactic Plane, covering 100,000 stars in about seven years. But why stop at a hectare? Future plans include a Square Kilometer Array, at maybe under \$600 per square meter.

Optical SETI was next. To make an optical signal stand out as a beacon, an efficient way would be to send it as very brief pulses. The Harvard Targeted Optical SETI project and other related projects look for just such brief pulses. The Harvard project is piggy-backed, on a telescope used to search for orbiting companions of stars.

Dr Tarter continued, on the topic of arrays of simple, stationary radio antennas which can image the whole sky. Ohio State University's **Argus Project** is one of these (see www.bigear.org). The limiting factor here is definitely computing power. As I understood it, to run a 4000 by 4000 element array would need today's computers plus 15 years' application of Moore's Law. (This "law" is an observation that computer chip density and/or computing speed doubles every 18-24 months.)

The lecture ended. An excellent summary of SETI as far as I could tell. During the question period, Doug Welch offered the suggestion that at frequencies reserved for astronomy by a civilization, we may actually see a lack of signals. (The alien astronomers may be much better at preserving those frequencies for their own searches!) This becomes more important as other civi-

lizations may switch, as we are doing, to digital transmissions which resemble noise as opposed to our early analogue transmissions.

What if we do somehow detect someone "out there"? What about contacting them? Jill Tarter seems to feel that we're not yet an old enough civilization to be deliberately transmitting.

I personally agree completely with that, but one thing still bothers me about the whole idea of contact. Whether "they" were a bit behind us, or more likely well ahead, wouldn't we have a big difficulty communicating, or even understanding them? Except in the sense that astronomy includes all the other disciplines, this isn't specifically an astronomy problem. More like a mathematics-and-biology problem. It's about our inability to understand even beings which are very near us in intelligence and genetics. When we someday have a **generalized** way to understand other mammals, maybe we'll be able to extrapolate, to understand folks who may be ahead of us, and maybe even to understand ourselves better. Something to look into!

Perseids - The Legendary Shower...

The Perseids are probably the best known meteor shower for observers and the public alike!

This year, the Perseid (PER) maximum falls on August 12th - a weekend! This is a real plus for getting friends and family out to see this wonderful show. These are fast meteors, at about 59 km per second, and often leave trains behind them. There are many bright Perseids, so even from a less than perfect sky location, an observer will see a respectable number of meteors. For the best effect though, try to get out into the country, away from the light pollution of streetlights. You will see many more meteors for every extra little bit of dark sky.

Perseid meteor rates are expected to have several peaks - at 14 hours UT and at 17 hours UT on August 12th. UT refers to Universal Time, over in Greenwich, England, so calculate your local time accordingly. For example, 14 hours UT on August 12th, converted to Eastern Daylight Time (EDT) for someone on the east coast of North America, would translate to 14 minus 12 hours equals 2 p.m. at Greenwich, which would be 10 a.m. in North America, with the 4 hour time difference.

At maximum on August 12th, the Perseid radiant will be located at 046 degrees, ie RA 3h 4.2m, Dec +58, which is about 4 degrees north of the star gamma Perseus, the middle star of the outstretched right arm of Perseus. The Zenithal Hourly Rate (ZHR) is about 110 meteors per hour, visible with the unaided eye, if an

observer is out under a dark country sky, and if the radiant, the area in the sky where the meteors seem to come from, is directly overhead.

These famous meteors radiate from the legendary constellation of Perseus. In ancient Greek mythology, Perseus was a hero. His mother was Danae - a human. His father was the god Zeus, the son of Saturn and Rhea of the race of Titans, who were the children of Earth and Heaven, which sprang from Chaos.

There was a prophecy that Perseus would slay his own grandfather, so mother and son were locked in a wooden chest and thrown into the ocean. The chest surfaced, and floated to the island of Seriphus, where Perseus grew up. The king of the island, Polydectes, started to fall in love with Danae, and decided to try to get Perseus out of the way. He asked him to go slay the famous female monster Medusa, a Gorgon whose gaze turned men to stone.

It wasn't Medusa's fault that she was a fearsome Gorgon. She had once been a beautiful mortal. Poseidon, Zeus' brother, had seduced her inside a temple of Athena. Athena, the goddess of both war and wisdom, was so enraged that she changed

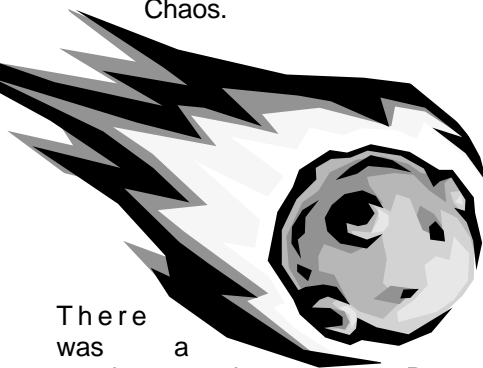
Medusa into a monster, with her beautiful hair becoming a squirming mass of snakes.

Perseus took off to slay her, outfitted with winged sandals from Hermes, the messenger god; a sword of diamond from Hephaestus, the god of fire and the forge; and a magical helmet to make him invisible, from Hades, god of the underworld. He accomplished the feat of slaying Medusa without directly looking at her by using her reflection in his shield. The blood from the unfortunate Medusa's severed head, upon hitting the earth, created the great winged horse Pegasus, who was caught and tamed by Minerva and presented as a gift to the Muses, the daughters of Zeus and Mnemosyne. The Muses presided over literature, art and science.

On Perseus' way home, he came upon the princess Andromeda, daughter of King Cepheus, chained to a rock as a sacrifice to the sea monster Cetus because of the vainful boasting of her mother, Queen Cassiopeia. Perseus rescued the fair maiden and married her, then turned her intended husband, her uncle Phineus, to stone using the head of Medusa. After further exploits, he gave the severed Gorgon head to Athena, who placed it in the center of her shield.

At a later time, Perseus, while attending a funeral in Thessaly, accidentally killed his own grandfather as the prophecy had predicted. Perseus and Andromeda had a daughter whom they named Gorgophone, and a number of sons, including Perses, who is considered to be the fa-

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Perseids....

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ther of all Persians. His granddaughter Alcena would bear a son named Hercules. In the end, Perseus, Andromeda, King Cepheus, Queen Cassiopeia, the great winged horse Pegasus, and the sea monster Cetus were all given places in the stars - and you can see these constellations in your star maps for summer! The star beta Perseus, known as Algol, the Demon Star, is named after Medusa - it fades and brightens every 2.87 days, and was the first eclipsing variable star ever discovered.

The famous Perseid meteor shower has been observed for about 2000 years, with the first known information on these meteors coming from the far east. In early Europe, the Perseids came to be known as the "tears of St. Lawrence." Mark Littmann has a wonderful article on the history of the Perseids on the Sky and Telescope website (at <http://www.skypub.com>), and writes:

"Saint Lawrence was tortured and killed in Rome on August 10, 258 during the reign of the anti-Christian emperor Valerian... Citing Quetelet, 'a superstition has 'for ages' existed among the Catholics of some parts of England and Germany that the burning tears of St. Lawrence are seen in the sky on the night of the 10th of August; this day being the anniversary of his martyrdom.'"

Because the orbit of the Perseid meteoroid particles is tilted so much in relation to the plane of our own solar system, the Perseids have stayed fairly similar in characteristics since ancient times, and have not been

changed much by the influence of our large planets such as Jupiter. It was Schiaparelli, the astronomer most noted for observing so-called "canali" on Mars, who discovered that the Perseid meteors were related to Comet 1862 III, also known as 109/P Swift-Tuttle. This was the first proven association between a comet and a meteor shower.

The parent comet itself, 109/P Swift-Tuttle, was discovered in July of 1862 by both Lewis Swift of Marathon, New York and Horace Tuttle of Harvard Observatory, Massachusetts. It was about magnitude 7.5 at discovery and brightened to about magnitude 2 by early September, which is about the same brightness as the stars in the Big Dipper. It sported a tail of between 25 and 30 degrees long, and was quite impressive! By length comparison, the pointer stars of the Big Dipper are about 5 degrees apart. The comet comes around to our part of the solar system about every 120 years and was seen most recently in the mid 1990's. In November of 1992, it brightened to about magnitude 5.0.

The magnitude or brightness of the meteors themselves is interesting as well. Studies by Hruska and Cepelcha in the 1950's indicated that the Perseids generally seem to be brighter before the date of maximum activity than afterwards, but that some periods of brighter or fainter meteors do occur. This tends to indicate some filamentary structure in the Perseid meteoroid stream. In other words, we encounter clumps of brighter or fainter meteors as the earth passes through different layers of long-ago debris shed by Comet Swift-Tuttle.

This is a wonderful meteor shower to observe visually and also a wonderful shower to try taking photos of. Traditionally, it has been difficult to photograph meteors as they can occur in any part of the sky, and being fast, are hard to register on your film. With the Perseid shower, there are a lot of bright meteors and there are hundreds of them over the course of the night in a dark sky. This increases the chances of capturing some on film. You will need a camera that you can take time exposures with, usually about 10-20 minutes in length, a cable release to keep the shutter open, and a tripod or something to steady your camera if you are resting it on a solid surface. Set the camera to wide open, ie. the smallest f-stop that you have, or close to it, and set the focus to infinity. You should use fast film of some sort, ASA 400 or higher, regardless of whether you wish to use black and white, or color film.

In legend or in reality, Perseids are fascinating. We study the meteoroid stream - and we dream about the ancient myths that spawned the constellation the meteors come from in the sky!

Clear skies!

North American Meteor Network
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~meteorobs

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Cosmology Discussion

Presents: *The Analysis of Eclipsing Binaries Containing Cepheid Variables*. Graduate student Dave Lepischak will do our presentation.

It has been called the "Rosetta Stone" of variable star research: a cepheid variable star which is a member of an eclipsing binary system. Such a system would allow the first direct measurements of a Cepheid's stellar properties, such as mass and change in radius, improving both our understanding of stars' internal structure and our ability to measure distance in the universe.

Dave will discuss the difficulties encountered and the results obtained from the first analysis of several systems explaining this rare coincidence of disparate types of stellar variability,

The meeting will be held: Saturday, September 29th, 2001, 8pm in McMaster's Burke Science Building, Room B148

Refreshments will be provided. We welcome our members to bring a small entree. Everyone welcome, open discussion.



For further information, call Larry at (905) 529-1037.

CALENDAR OF EVENTS

- August 17, 18, 24, 25 ~ 8pm
September 7, 8, 15
- August 16-19
- August 21-25

- Friday, September 14, 7:30pm

- Saturday, September 29th, 8pm

BINBROOK OBSERVING NIGHTS - For confirmation or directions call Ann Tekatch 575-5433, Marg Walton 627-7361, Rob Roy 692-3245

STARFEST - River Place Campground, Mount Forest. Details on page 6.

GREAT MANITOU STAR PARTY - held on Manitoulin Island at Gordon's Park. Go to this party for dark skies and a great beach! Details on page 4.

HAA GENERAL MEETING - The meeting will be at the Spectator Building auditorium. Dr. Alison Sills, a new faculty member in the Department of Physics and Astronomy at McMaster, will speak on "When Stars Collide!"

COSMOLOGY DISCUSSION GROUP - The meeting will be held at McMaster University, Burke Science Building, Room B148. Dave Lepischak will speak about: *The Analysis of Eclipsing Binaries Containing Cepheid Variables*. Call Larry at (905) 529-1037 to confirm.