

Conference Calendar

For details about the following conferences check the web at
<<http://www.setileague.org/general/confnce.htm>>, or email
<info@setileague.org>.

* - SETI League participation confirmed

* **February 21, 1999:** Radio Society of Great Britain *National VHF Convention*, Sandown, Surrey, England.

March 5 - 7, 1999: *Contact XVI*, Santa Clara CA.

* **March 28, 1999:** *SETI League Annual Meeting*, Little Ferry NJ.

* **April 2 - 4, 1999:** *Balticon 33*, Baltimore MD.

April 9 - 10, 1999: *Southeastern VHF Conference*, Atlanta GA.

* **April 16, 1999:** *Susquehanna Valley Amateur Astronomers*, Bucknell University, Lewisburg PA.

May 14 - 16, 1999: *Dayton Hamvention*, Dayton OH.

* **May 17, 1999:** *SETI League Regional Meeting*, Science World, Vancouver BC Canada.

* **May 18, 1999:** *Opening of UFOs: The Why Files*, Science World, Vancouver BC Canada.

* **July 11 - 14, 1999:** *Society of Amateur Radio Astronomers*, NRAO Green Bank WV.

* **July 22 - 25, 1999:** *Central States VHF Conf.*, Cedar Rapids IA.

* **August 2 - 6, 1999:** *6th Bioastronomy Conf.*, Kohala Coast HI.

September 2 - 6, 1999: *Aussiecon Three / 1999 Worldcon*, Melbourne Australia.

* **October 8 - 10, 1999:** *AMSAT Space Symposium*, San Diego CA.

* **October 12 - 23, 1999 (tentative):** *Microwave Update*, Dallas TX.

* **November 12 - 14, 1999:** *Philcon '99*, Philadelphia PA.

* **March 26, 2000:** *SETI League Annual Meeting*, Little Ferry NJ.

May 12 - 14, 2000: *ARRL National Convention and Dayton Hamvention*, Dayton OH.

July 20 - 23, 2000: *Central States VHF Conference*, Winnipeg Manitoba.

August 7 - 19, 2000: *XXIVth International Astronomical Union General Assembly*, Manchester University, UK.

August 31 - September 4, 2000: *Chicon 2000 World Science Fiction Convention*, Chicago IL.

September 9 - 10, 2000: *European Radio Astronomy Club Second International Convention*, Heppenheim, Germany.

* **February 12 - 14, 2001:** *OSETI III Conference*, San Jose CA.

* **August 30 - September 3, 2001:** *Millennium Philcon World Science Fiction Convention*, Philadelphia PA. ❖



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Now The World's Longest-Running SETI Publication
**the Quarterly Newsletter
of The SETI League, Inc.
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Introducing:

Our Regional Coordinator for France

Elisabeth Piotelat (email: piotelat@in2p3.fr) was born in 1971 in Lons Le Saunier in the East of France. She grew up in a small village dreaming of planes and stars, surrounded by cartoons, space conquest books, and model rockets. At the age of 18 she bought her first telescope and discovered Science Fiction.

In 1992, Elisabeth was admitted to the ENSIMEV (Ecole Nationale Supérieure d'Ingenieurs en Mécanique et Energétique de Valenciennes) to become a "generalist engineer." In 1994, she had a four-month training period in the DLR in Lampoldshausen (Germany), where she studied the frost formation on spacejets in the atmosphere. She received her diploma after another training period in the Nançay radio-observatory, where she worked on the design of a Human-Computer Interface. During the holidays, she remained in Nançay as an operator for the big radio telescope.

Elisabeth worked for the chip manufacturer Melexis in Tessenderlo (Belgium) for one year, but could not stand the disorganization (there was no real hierarchy) and her colleagues' misogyny (she was told that she had been recruited because there were no female engineers in the company). Being an alien is really hard! She learned a great deal about electronics at the beginning, but quickly got the impression that testing LEDs and relays in ovens was a waste of time. She had better dreams, full of radio telescopes.

In the beginning of 1998, Elisabeth found a place in the Computing Center of the IN2P3 (Institut National de Physique Nucléaire et de Physique des Particules). She is responsible for all that has to do with technical documents (FrameMaker, web...). She discovered the SETI League last March and wonders why she did not see it sooner. Her first contacts with Amanda and Paul were excellent. Within a few months she learned more things (thanks to the mailing list and the Project Argus report) than during her whole year in Belgium. Her "Nancay nostalgia" disappeared and she knows that there is a lot to do with the League: making it better known in France and, maybe, one day building her own station. ❖

Guest Editorial:

Speaking for Earth

by Jon Lomberg (lomberg@aloha.net)

There has been much discussion within the SETI community as to how Earth might reply to a verified signal from another civilization in space. Most agree that, sooner or later, a reply message would be sent. What properties should a reply from Earth have? Here are some I would think are acceptable to all: It should be truthful. It should be ecumenical or at least nondenominational. It should be well crafted, elegant in both the artistic and scientific sense of that word (Dirac would say there is no difference).

Truthful sounds easy, but is very hard. Everyone has a bias. On the Voyager record we decided to put our best foot forward and avoided depicting war, poverty or disease. For various reasons I stand by this position and would probably make the same decision today. But many people criticized us for telling a half-truth, if not an outright falsification about what Earth is like. Outright deception is easy to forbid. But the decision about which information to include also excludes. That is the hardest choice, best made in good faith by one group and judged in good faith by another.

Nondenominational is a little easier, but only a little. The message can't come from Mecca, the Vatican, or the US Congress. It must avoid endorsing any particular religion, philosophy or ideology. Again, this sounds easier than it is. Isn't belief in the scientific method a kind of ideology? Is a message that implicitly extols our scientific accomplishments but excludes our spiritual beliefs nondenominational?

Elegant. You know it when you see it, and when you don't. Here's something I find inelegant: There has been a recent trend of including CD ROMs with recorded signatures or personal messages (on Cassini, Huygens, and Stardust, for starters). While this may have some value as feel-good publicity for the missions, these artifacts are not messages, but they will inevitably be confused in the public mind with messages. We put a record on Voyager and a CD on Cassini. Must be the same thing, right? But I can't think of a worse design for a message than an unorganized collection of written messages.

Let's ignore the fact that a CD ROM is a terrible message carrier because no alien technology, no matter how advanced, could decode it. Unlike an analog record or engraved plaque, text and picture files can never be read without the correct software, which is impossible to reconstruct from first principles, even for a very smart ET. But even if it could be read, what would ET make of a species so dumb they created an artifact without any attempt to make it a comprehensible, self-extracting, anti-coded, triply redundant, graduated content message? That our message was page after page of meaningless scribble? Possibly that we were interested only in speaking to ourselves.

I mention this because designing an interstellar message is a challenge that is both awesome and fun, appealing to every mind that likes puzzles. As we begin to think of how to reply, we should have some model in mind. These free-for-all signature CD ROMs muddy the waters about what a message must be like, in exactly the same way that almond-eyed humanoid UFO aliens muddy the image of what real ETs

might be like. Several other organizations are now trying to create right now even worse messages. The Sci-Fi Channel wants to send your greeting from a radio telescope, if they can find one willing to sell out to them. Another entrepreneur wants to sell space on metal plates to be launched in extra-solar orbit -- buy a plate and put anything you want on it -- philosophical rumination, poem, "favorite legal brief" (honestly, he has proposed that). It doesn't bother me that these messages are private and uncensored. It bothers me that they are so badly designed. I find written notes in English an annoyingly stupid way to present our civilization.

That is the error of the grass-roots message. Very naive messages get made by people who have not thought very hard about how utterly distinct species could say something understandable to each other.

[Prof. Doug] Vakoch's praise of the Voyager record was gratifying, of course, to this designer. He identified the fact that our small group had been successful because it was interdisciplinary (scientists, artists, writers, and musicians). Carl Sagan and Frank Drake deserve the credit for that. They could have kept it entirely the province of astronomers but chose not to. And Vakoch acknowledges that our team made an honest attempt to rise above its own cultural biases and create a message that represented all of Earth. How well we did that has been argued, but no one has disputed that we at least tried. A single incident serves to illustrate the difficulty of this when involving an organization like the United Nations to do it: For the sequence of greetings in spoken languages -- intended to suggest the variety of spoken tongues on Earth -- we asked the UN to supply us with a very short "hello" from each delegate to the General Assembly. What we got back from the UN was a few long, utterly inappropriate speeches by the members of the Committee on Outer Space. We had to create the greetings sequence ourselves, recorded by speakers from the ethnically diverse Cornell University community.

That would be the problem with messages made by bureaucracies like the UN. They just don't get it. People accustomed to issuing noncommittal press releases reduce all messages to bland pap. Large governmental and scientific bureaucracies would certainly have to approve the message after it was made, but no such organization could create a good one itself -- unless it farmed it out to its own small group.

In 1991, when Sandia Labs had to design a 10,000-year nuclear waste warning marker for the U.S. Department of Energy, they organized things in a way analogous to the Voyager record. They convened a small panel of interdisciplinary experts in fields including geology, materials science, archaeology, linguistics, cognitive psychology, architecture, and graphic design (and including four SETI veterans -- me, Frank Drake, Woody Sullivan, and Ben Finney) and had us analyze the problem and create a design for a warning marker, meant to be comprehensible to all humans for the next 10,000 years, whatever their language, culture, or technological level.

The fact that a small group was ultimately responsible for both the record and the waste marker allowed there to be a vitality and coherence in the design that would have been much harder to achieve in any larger working group with multiple layers of review and approval.

It would be better to entrust the task of a Reply From Earth to various small groups, let them do it, and then have a panel of "experts" decide which was the best (tough to figure who is on that panel, but for starters eminent people in the creative arts, physical and social sciences, cryptography and language theory, religion -- better to have them review a message than to make one -- and, I suppose, international security and defense) rather than trying to have hundreds of people in many separate organizations try to design it together. It should be a design competition. Then you could open it up widely to submissions from individual artists, ad hoc organizations created to craft a message, universities, etc.

Who would eventually make the best message? My guess would be an interdisciplinary mix of creative people with backgrounds in a wide variety of fields, from semiotics to software design, from visual arts and music to game theory and particle physics. We don't know what the universal touchstones will be (maybe the incoming message will give some good clues). But the outgoing message should pool our particular cognitive and creative styles into a harmonious whole. How is this to be done? I think you'll recognize it when you see it. I would like the message from my planet to be both rich in content and clever in form. Lewis Thomas was right on the money when he suggested Bach as an exemplar of the characteristics our message should have. ❖

Toilets of the Gods

or "The Colon-isation of Space"

by Sir Arthur C. Clarke, SETI League Technical Advisor

Space scientists recently completed an examination of orbital debris recovered after circling the Earth for several years. They discovered that much of it was coated with a thin film of what was delicately described as "fecal matter" attributed to astronauts' sloppy sanitation.

This may solve one of the mysteries of life's origin on Earth: it seems to have arisen almost as soon as conditions were favourable, and not after the billions of years of molecular trial and error required by what Isaac Asimov called the 'unblind working of chance.'

Obviously, organised life-forms need have occurred only once in this Galaxy, if the very first space-faring civilisation was as careless about the environment as we are. Years ago, Hoyle and Wickramasinghe suggested that life had a cosmic, and not terrestrial, origin. They may be right, though not precisely in the way they imagined. It's a humbling thought that we may have arisen from dumped sewage; the first chapter of Genesis would certainly require drastic revision.

On the other hand, if -- as some philosophers have suggested -- this Earth does indeed harbour the only life in the Universe, that deplorable state of affairs is now being rectified. We may draw some consolation -- I hesitate to say inspiration -- from the fact that our descendants are already on their way to the stars. But we certainly would not recognise them, and it might be tactless to ask exactly how they got there. ❖

Do LDEs Emanate From Alien Probes?

by Chris Boyce (cb@ndirect.co.uk)

Radio amateurs in The SETI League have recently been discussing Long Delayed Echoes (LDEs), radio signals detected by the sender seconds or minutes after being transmitted. This phenomenon has been observed for over 70 years and is widely documented. One working hypothesis is that LDEs are evidence of interstellar probes trying to get our attention. Though there is little in the record to support this hypothesis, further study is warranted.

A natural explanation for LDEs was put forward by Anthony Lawton almost a quarter century ago ["Long Delayed Echoes: the Search for a Solution" by A.T Lawton and S.J. Newton, *Spaceflight*, vol. 6 no. 5, pp 181-187, May 1974]. This was written in response to Duncan Lunan's hypothesis that the 1920s LDEs could be pattern interpreted and that they indicated a station-keeping probe from Epsilon Bootes lay in either the L4 or L5 Lagrange points in the Moon's orbit around the Earth (published in his book *Man and the Stars*, 1973 -- published as *Interstellar Contact* in the USA). Such a probe had been suggested by Bracewell who also suggested a message may lie in the echoes themselves.

Lawton's natural origins hypothesis was regarded as sufficiently impressive by the British Interplanetary Society for them to award the author Fellowship of the Society. Since that time it has been cited a number of times usually in the context of dismissing further investigation of the phenomenon.

That notwithstanding, the L4 and L5 points actually were subsequently investigated but with negative results ["A search for natural or artificial objects located at the Earth-Moon libration point", *Icarus*, vol. 42, pp 442-7, 1980].

Twenty years ago, in my book *Extraterrestrial Encounter*, I presented a case for ET probe searching. This was based on the hypothesis of the replicator probe strategy outlined by Michael Arbib ["The Likelihood of the Evolution of Communicating Intelligences on Other Planets", in *Interstellar Communication: Scientific Perspectives* (C. Ponnampertuma and A. Cameron, Eds.), Boston: Houghton Mifflin Co., (1974) pp. 59-78]. This appeared so logical a strategy that I assumed, then and now, that any alien society with sufficient technical proficiency would probably adopt it if they intended exploring the cosmos.

There is good reason to make further searches. The technological level of the probes need not be particularly advanced beyond our own, whereas the average ET society may well be hundreds of millions of years beyond ourselves with technologies possibly "akin to magic," to paraphrase A.C. Clarke. Replicator probes need only be a few steps beyond us in technological development even if they were released a billion years ago. They will also be autonomous, self-sufficient and self-aware systems closer to biological entities than any robot device we might imagine. They will also be highly intelligent.

And they will be local. They'll have been in the Solar System for tens of millions of years at least. So where they are concerned, we are the new kids on the block! ❖

Science Corner:

Testing the Null Hypothesis

by John Marcus, MD (MarcusJohn@aol.com)

SETI is perhaps the most highly interdisciplinary of sciences, encompassing not only astronomy, biology, engineering and physics, but also psychology, metaphysics, probability, and belief. But it is, first and foremost, a science, one to which we hope to apply the scientific method.

A colleague on the SETI email discussion list wrote, "Scientists (and really, everybody, either consciously or unconsciously) use the scientific method for problem solving. It's just that most people don't realize that they are doing it!" Would that this were so. As a scientist, a mathematician, a physician, and a generally philosophical person, I like to think I know a little bit about problem solving and logic. And I think that the scientific method (proving the null hypothesis false) is rarely used in general problem solving. Let's take, for instance, the need to buy a car.

Scientific method: The null hypothesis is "I cannot afford the car." Now, let me set about proving this null hypothesis void. I will first examine my bank account and my income....

Usual method: I probably can afford the car. Now let me see what this probability really is by examining my bank account and income....

The difference is subtle, but important. You can see that the scientific method involves a Boolean logic variable of false, that once proven incorrect, leaves a Boolean logic variable of true. Once something has been proven true, you have added new information to the sum of human knowledge. But in real life we usually deal with lack of certainty. So we have probabilities, instead of Boolean logic. This is a different kind of math. This math was described by a person named Bayes. And there is a Bayes theorem for this kind of logic. Bayes theorem goes like this:

There is an *a-priori* probability (a number between 0 and 1).

There is an *a-posteriori* probability (a number between 0 and 1).

There is a test, which examines reality, and changes the probability: $\text{post-p} = \text{test}(\text{prior-p})$

You can see that the above involves a mathematical function. This function may be found on the web.

Let's work a sample problem. I believe there is a 30 percent chance that I can afford a turbo 911 Carrera. I want to examine this probability. (This is the problem solving goal.) Now, I will perform the test: Look at my bank account and income. There is not enough there. Oh well, now there is an *a-posteriori* probability, a 10 percent chance of me affording that Carrera. Now, I have another test: I will discuss it with my wife. After careful deliberation, she says no. Well, that lowers the probability to about one percent. The probability is not zero, because I could do some things that would force the issue, and raise the probability. But as things stand right now, it remains unlikely that I will buy a Carrera.

A web search on Bayes Theorem will turn up a ton of references. I leave them as an exercise for the student.

Let's see how the above applies to SETI. Do I have belief in ETs? No, but I have a probability in mind. You may wish to phrase the question differently: Do I have a belief in the probability of ETs? Yes, I do. I wish to apply a test (the Argus search). There are other tests. These may raise the probability, if the search succeeds.

The Scientific Method for the Argus search is this:

There are no ETs (null hypothesis).

You can never prove the negative. So, we now design an experiment (Project Argus, for example) to try to prove that statement wrong, recognizing that it takes only one clear, unambiguous counterexample to reject the null hypothesis.

I find the scientific method to be artificial and limiting, because in real life we never deal with any certainty about anything. On the other hand, if it is certainty which we seek, then the scientific method is probably the best way to achieve it. ❖

Apparent Hoax Dismays SETI Scientists

LITTLE FERRY, NJ., November, 1998 -- Claims in the press beginning on 28 October 1998 about an intelligently generated signal from the vicinity of the nearby binary star system EQ Pegasi are the result of either an elaborate hoax or severely flawed science, according to SETI League executive director Dr. H. Paul Shuch. This SETI "hit" was allegedly received by an amateur in England. The nonprofit, membership-supported SETI League has been analyzing this claim since October 23rd. None of its 63 active observing stations around the world has been able to confirm it. The signal was reported anonymously in a message hacked into a *closed* (private) signal verification email list. Subsequently, the hacker went to the BBC, which broke the story. The perpetrator asserts that he/she is *not* a SETI League member, which is scant consolation to that scientific body.

The "signal" has been thoroughly discredited by a host of radio astronomers, amateur and professional, who have analyzed the images posted to the Internet. The person who reported the alleged signals has violated every principle of responsible science. He or she has not followed the carefully crafted SETI League signal detection protocols to which all SETI League participating stations are signatory. The person has not adhered to international policies regarding signal verification. This amateur radio astronomer has not identified himself or herself, and not answered private emails from either The SETI League's executive director or its volunteer regional coordinator in England, making any meaningful follow-up impossible. And he or she has not waited for backup analysis before announcing this "find" to the press. If this is not a blatant hoax, it is the worst kind of irresponsible science (the kind which gives all credible scientific endeavors a bad name).

"Anonymity and scientific integrity are mutually exclusive," says Shuch. "A responsible scientist, amateur or professional, takes ownership of his or her mistakes, as well as accomplishments. One of the responsibilities of scientific organizations like The SETI League is to help the media make that distinction."

Editor's Note: Subsequent to this press release, the hoax degenerated into media claims of a Government cover-up, of a rapidly approaching alien spaceship, and of an international conspiracy involving The SETI League. Members are urged to apply the test of reason to all such claims. ❖

Interstellar Nano-Probes

by Leon T. Darcy (etrc@mpx.com.au)
Extra Terrestrial Research Centre

In January of 1998, Dr. Allen Tough of the University of Toronto attended the *SETI in the 21st Century* international conference, held at the University of Western Sydney, McArthur campus. There, he presented a paper on micro interstellar probes. I listened attentively and thought that he may be onto something as this would be the ideal means for extraterrestrial intelligences to explore the universe. It also dawned on me that we Earthlings are already using the same technology to explore our own solar system.

As I am writing this, Pioneer 10 and 11 have long since left our solar system and entered interstellar space, carrying an etched message and gold disc for any extraterrestrial intelligence to decipher and listen to, thus alerting them to our existence and where in this Galaxy our planet resides. The technology used in these probes is by today's standards very primitive, as miniaturization of electronic components has progressed since then. The time will eventually come when a probe equivalent in sophistication to the Pioneers would be the size of a golf ball, the only restriction on total size being the propulsion system and the fuel storage for that system.

If and when we decide in the future to send probes to explore our extra-solar neighbors, a propulsion system would not be required to launch these probes, as they could be released by a shuttle mission, and sent on their way with an initial boost from a cannon or other like device. Once the shuttle achieved orbit, a small pressurized container built into these probes could be used to make small course corrections, through small nozzles and controlled by the probes' onboard computer. These small nano-probes would eventually enter other solar systems and, on detecting radio emissions from any inhabited planet, could go into orbit around that planet to observe and record any transmissions.

As space is a hostile environment, many probes would be lost due to collisions with meteorites and component failure. But with hundreds sent on any mission, some would survive intact, to complete the intended mission. A probe, on detecting any extraterrestrial intelligent life, could be programmed to locate and "attach" itself to any communication satellites orbiting that world, thus parasitically recharging itself from that satellite's power source and recording telemetry and communications streams. The problem of man retrieving the data from the probes "on station" could be done by the other surviving probes acting as relay stations transmitting the data back to Earth for analysis.

This future look at the world of nano-probes may, to some, seem far-fetched. But I believe that within the next 20 years such probes will be launched, initially to investigate our outer solar system, then the Galaxy. To believe we are alone in this Galaxy would be as much of a mistake as believing our Earth was the centre of the Universe, so to assume that we are the only technologically advanced civilization would be an equal mistake.

As my small research group (Extra Terrestrial Research Centre) investigates ways and means to detect ETIs, Dr.

Tough's idea of nano-probes warrants as much thought and study as conventional SETI detection methods. Are nano probes released by extra-solar intelligences already here in our solar system, and, if so, how do we detect them? To answer this question we must remember what our future probes might do: attach themselves to communication satellites. I propose a system of satellites be put in orbit as "bait" and designed to trap any probe that attaches itself to that satellite. It would then send a signal to the ground station where retrieval of the satellite and its parasite could be effected. Since man began exploring space early astronauts reported "bogeys" which are still unexplained. Could these "bogeys" be probes? High frequency radar detects unknown fast moving targets on a regular basis. Could these targets be swarms of probes moving through our solar system?

Until we have an actual detection of an extraterrestrial intelligence, be it by microwave detection or a pulsed laser, we must take into account the possibility of nano-probes, sent by some extraterrestrial intelligence, being present in our solar system eavesdropping on us. ❖

Remembering Michael Papagiannis

by Dr. Peter Schenkel (schenkel@ecnet.ec)

Dr. Michael Papagiannis, one of the great pioneering minds of SETI, is no longer with us. He passed away last year after a prolonged illness.

Michael was a brilliant astronomer, but I remember him mainly as an enthusiastic researcher and supporter of SETI, to which he made many outstanding contributions. He believed that the existence of advanced ETI was very probable and that some day we would achieve contact for the benefit of mankind. In his many publications on the subject he speculated on their nature and how eventual contact would change our anthropocentric views. He coined the term "bioastronomy" and was the meritorious first editor of *Bioastronomy News*.

What I most admired in Michael is that in spite of his high standing in the scientific community he was modest and unpretentious and so humane. He would go out of his way to understand and help others. I will never forget his kind support in promoting my book *ETI: A Challenge for Change*. And I know from his wife Elisabeth that he would have loved to write the foreword for *The Message from Yon*, but had to pass because of his advanced illness.

With his prestigious work, Michael Papagiannis surely left an indelible mark on the search for extraterrestrial intelligence. He had a generous open mind and he speculated about the mysteries which the universe still has in store for us and about our ultimate destiny with a passion, vision and magnanimity rare in the field. Though the deplorable Cold-War period dampened his outlook, he was optimistic about the ultimate triumph of reason to vanquish our destructive tendencies and our capability to spread consciousness beyond our solar system.

I am sure that all those who were lucky to have known Michael Papagiannis closer will feel sad that he is gone. We will all miss him. But he left a lot behind him, something to keep working on. He will not be forgotten. ❖

If You're Out There, ET, Log On

by Prof. Paul Davies, Adelaide, Australia

Until recently, attempts to communicate with alien civilisations have been pursued using radio telescopes. This program, known as SETI (for Search for Extraterrestrial Intelligence), has mostly been passive. Scientists have scanned the skies in the hope of stumbling across a radio signal from a distant planet. From time to time, however, human astronomers have beamed powerful messages into the galaxy, saying, in effect, "hello." Unfortunately, the galaxy being so vast, such messages are really only symbolic gestures. They are extremely unlikely to reach any alien civilisations for tens of thousands of years -- even supposing there is anyone at all out there listening.

Now a Canadian SETI League member, Allen Tough, has come up with a novel idea. Rather than mess about with large bits of expensive equipment, why not simply invite ET to log on to the Internet? Wacky though this proposal may seem at first blush, there is a certain rationale behind it. While it is highly improbable that aliens could come here in the flesh, it is not inconceivable that they would send a small, smart space probe to eavesdrop on our activities. Such an object would go unnoticed by us. It might be no more than the size of a pea, and could be anywhere in earth orbit. From this vantage point, the probe could monitor and analyse all our communications, including the Internet.

If you find that prospect hard to believe, reflect on the fact that the American and British security services already do much the same thing. Every day, the world's radio and telecommunications traffic is tapped by secret agencies and sifted by supercomputers to seek key word associations to do with terrorism, drug trafficking and the like. And that is using human technology. With a multimillion-year technology at its disposal, ET could easily wiretap our most mundane exchanges, and thereby build up a comprehensive picture of human life. Part of that picture would be the Internet, which has now evolved into the World Wide Web. As Net surfers know well, you can access just about every aspect of human affairs with an efficient search engine. If ET is eavesdropping, the Web would be a fast way to learn about us and our society -- warts and all.

What better way, then, to persuade ET that we are finally ready for that great cosmic encounter than to create a customised website for our galactic cousins to access? Tough has financed a suitably welcoming website, featuring patrons drawn from the international scientific community (myself and The SETI League's executive director included) in the hope that someone or something out there might come to the party.

Now this has to be regarded as a long shot, but, then, so is conventional SETI with its needle-in-a-haystack search of the heavens. The great advantage of going on-line with a nearby alien probe is that there isn't an annoying thousand-year time delay in the conversation due to the transit time of the radio waves. In the event that ET visits the website and decides to log on, I promise that readers of this column will be the first to know. ❖

Ask Dr. SETI™

Send your questions to Ask Dr. SETI, PO Box 555, Little Ferry NJ 07643, or email to askdrseti@setileague.org. Remember, he's not a *real* doctor (but rather, a Ph.D., the kind who actually has to work for a living!). For health questions, consult a competent medical professional.

Dear Dr. SETI:

I was looking at the Excel spreadsheet for Doppler corrections on The SETI League website. There is mention of Doppler correction for the rotation of the Earth, but what about the rotation of the Earth around the Sun, which would be a much greater component? Is this already included in the above template or is another template/program required for that?

Randy, Oz

The Doctor Responds:

You're right, Randy, that the absolute Doppler for the Earth's orbit around the Sun (and the Sun's around the Galactic Center, for that matter) is large compared to Geo-rotational Doppler. And the spreadsheet doesn't address these. But we're less interested in absolute Doppler than we are in the rate of change of Doppler shift. The former, if known, would give us the actual transmit frequency (which is relatively unimportant). With the latter, we can find out very quickly whether a source is moving with sidereal time (in other words, whether it's truly extra-solar).

The contribution to total Doppler rate of our path around the sun varies with latitude and season, but for the test calculations I ran is on the order of one-fifth the Doppler rate-of-change contributed by the Earth's rotation. Over the short observing times available to us (especially in drift-scan mode), we may never see the slow rate of change in the "large" Doppler values, but we can easily determine the rapid rate of change in the "small" one. And it is rate of change of frequency, rather than the frequency change itself, which we use to separate the cosmic wheat from the terrestrial chaff.

When designing our search strategy, we also need to anticipate Doppler rate so as to determine maximum integration time and minimum bin width for our digital signal processing. In this context, all three Doppler contributions may prove significant, and thus we encourage our members to address the problem of analyzing the algorithms and developing a more complete Doppler spreadsheet.

SETI League Software Committee co-chairman Dan Fox adds:

"While it is true that we are more interested in the change in Doppler than the actual Doppler for SETI work, since many of us are also set up to do radio astronomy for other reasons, it might prove useful to have those formulas available. For instance, several people have noticed how much the hydrogen line gets shifted by the motion of the earth relative to various parts of the galaxy. If we want to search near the hydrogen band in various frames of reference using long integration times, we should be able to figure out where the hydrogen line is Doppler shifted to." ❖

Hardware Corner:

Computer Radios Not Ideal for SETI

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SETI League Eastern Australia Regional Coordinator

There has been much recent discussion on the SETI email lists about a new class of microwave receiver, which resides on a plug-in card and disappears into your computer. Such receivers (of which the WinRadio manufactured in Australia is a prime example) are nearly ideal for a host of applications. Unfortunately, SETI is not one of them. The problem has to do with the high levels of interference generated within modern, high-speed computers. Although shielding on computer-card receivers may be adequate to reject most such interference, SETI is about detecting impossibly weak signals -- the sort that computers generate in abundance.

As an example of the sort of spurious signals which plague SETI researchers (amateur and professional alike), see the images on The SETI League "What We've Heard So Far" page. Three of these displays show a very exciting "hit" which turned out to be some spurious signals from a computer I had on the workbench. In particular, the signals were coming from a SCSI hard disk controller card that was exposed from the case shielding. My main reason in expounding all the above, is to indicate that SETI is based on the detection of very weak signals that have been integrated out of the noise. Using FFT methods we can pull these almost "non-existent" signals out from the background noise.

I believe that a receiver like the Win Radio system would be a great device for the amateur radio / computer enthusiast who wants to "scan" around a bit, but forget it for SETI use. The fact that the radio is surrounded by the computer (a really RFI noisy piece of equipment) means that it will get all sorts of low-level signals from the computer hardware. These signals, even though at a very low level, will accumulate into "hits" if you integrate the received signal enough times. In other words, a low noise environment is very important. With all the gain we are using at the front end looking for those elusive signals, we can pick up all sorts of strange apparitions from all sorts of places, including our own equipment.

The traces on my FFTDSP came from a very weak signal emanating from an oscillator on the SCSI controller. It was a harmonic from the low frequency crystal Oscillator that clocked the data registers from the hard disk drive, very weak but present. I have seen these "wiggles" before, shown to me by Dr. Jill Tarter from the SETI Institute. They were probably the same sort of signal that has plagued researchers with super-sensitive receiving equipment.

The scientists at the Parkes Radio Observatory constantly complain about the RFI they get from their on-site computers. If they get it, so can we.

My advice to ARGUS station builders is: use equipment that is well shielded from the outside world. Use the minimum possible number of system components. As other SETI League members have discovered, it's better to down convert using one stage of conversion, not two.

Use lots of shielding to reduce those false hits; they only cause stress when they occur. I should know, we have had a

few signals that have almost defied our efforts to find out where they came from. Only by carefully searching the local environment did we eventually track them down. None of them ETIs (unfortunately). But you never know!

Editor's Note: Several of the companies which produce receivers-on-a-card also manufacture well-shielded external receivers, which merely plug in to the host computer via a serial, parallel, or SCSI interface. Rosetta Labs, for example, now offers its top-of-the-line WinRadio under two model numbers: WR-3100i (for Internal) and WR-3100e (for external). Such external receivers should be less prone to the type of computer RFI which Mr. Welstead describes than their internal brethren. ❖

Mini-Reviews

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Infinite in all Directions by Freeman Dyson

An interesting walk through the philosophy of Freeman Dyson, covering life as a scientific phenomenon followed by ethics and politics. Some interesting observations, but very little (okay, no) data to speak of. (I want to have lunch with this guy. There's more to Freeman Dyson than meets the eye.)

Astronomy and Cosmology by Fred Hoyle

An obviously dated piece of material (copyright 1975), but a very well-organized work. Summary-level coverage of many aspects of astronomy and cosmology. A little light in the mathematics for me, but not a bad place to start. A guess would be that this book was intended as an entry-level astronomy and/or cosmology text book.

The Story of Jodrell Bank by Sir Bernard Lovell

Most certainly a must read. For anyone considering the construction of even a small radio telescope I urge you to read this and read it carefully. The book chronicles the design and building of the dish at Jodrell Bank. It includes the effects it had on its designer, its builder, the press, and the surrounding communities. I've never been much for books written from diaries, but this one was worth it.

Home Is Where the Wind Blows by Fred Hoyle

I should have known from the title that this was, for me, a mistake. The book follows the title and pretty much goes where the wind blows. It is largely an account of Fred's travels and experiences. It contains no real data to speak of. Only in Marion, Indiana, would this book be placed in the reference section of Astronomy.

Pale Blue Dot by Carl Sagan

I know I'm probably asking for it by even commenting on this book, but here goes. I don't think I've ever read a book that talked so much and said so little. I enjoy Sagan's style (a little sappy at times) and it's obvious from the book's content that he was (and still is) one of the greatest minds in science. But I'm of the impression that this book was written not for science, but as a public relations push for science, exploration, and political change. I'm not sorry I read it, just sorry I didn't manage my expectation of it. ❖

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