



SearchLites

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The Quarterly Newsletter of The SETI League, Inc.

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Why We Shouldn't Hide Our Problems from ET

by Douglas A. Vakoch, Ph.D. (vakoch@seti.org)

For nearly 50 years, the Search for Extraterrestrial Intelligence (SETI) has scanned the heavens with radio telescopes for signs of alien technology. At the same time, scientists have painstakingly crafted messages to send in reply. When NASA launched its Voyager missions in 1977, for example, both spacecraft carried audio recordings depicting the diversity of life and culture on Earth.

But never have those messages truly represented all of humanity. On 15 May [2009] that will change as the SETI Institute launches a project to collect messages from people around the world. Though there are currently no plans to transmit these messages into space, the project aims to foster a global discussion about whether we should send more than symbolic messages to the stars, and if so, what we should say.

The standard wisdom in interstellar diplomacy is to avoid controversy - a sometimes elusive goal. In the early 1970s, NASA attached plaques to two Pioneer spacecraft etched with basic mathematics, science and line drawings of a man and woman. Some complained the space agency was sending "smut into space", with the naked figures revealing more than they deemed proper for a first encounter.

Other messages have escaped such criticism. One from the Arecibo Observatory in Puerto Rico depicts the human form in so few pixels that its sex is not clear. The Voyager recordings excluded war, poverty and disease.

However, a comprehensive message to the stars should not shrink from the details. Might not an advanced extraterrestrial species, savvy in the ways of intelligent being, notice that something was missing from our description of ourselves? An acknowledgment of our flaws and frailties seems a more honest approach than sending a sanitised, one-sided story. Honesty is a good starting point for a conversation that could last for generations.

If we continue to dodge controversy, we risk sending messages that are both brief and boring. We sometimes clash in our beliefs and customs; we disagree over matters of taste and morality. In no small part this diversity of perspectives is what characterises us as a species. And it may just make us intriguing enough to the inhabitants of other worlds to elicit a reply.

Readers may post their interstellar message suggestions to <http://messages.seti.org>.

Editor's Note: this article first appeared in New Scientist magazine online, at <<http://www.newscientist.com/article/dn16981>> on 18 April 2009, and is used here by the kind permission of New Scientist and the author. ❖

Editorial Repsonse:

Not The First Global Message to ETI

by Alexander L. Zaitsev (alzaitsev@gmail.com)

On the front page of this issue of *SearchLites*, Dr. Doug Vakoch writes:

But never have those messages truly represented all of humanity. On 15 May [2009] that will change as the SETI Institute launches a project to collect messages from people around the world.

Dr. Vakoch should be well-informed about the following past projects:

1. Richard Braastad's (USA) activity on collecting messages from people around the world before Cosmic Call 2003 Transmissions

(<http://www.cplire.ru/html/ra&sr/irm/CosmicCall-2003/index.html>):

... personal messages from thousands of people in over 50 countries were included in Cosmic Call 2003. These messages were submitted, primarily through e-mail, to Team Encounter's offices in Houston, Texas where the messages were prepared for transmission. The personal messages included text, still image, audio and video files. Any analog messages submitted by Team Encounter members were transformed by Team Encounter into digital format. All told, the personal messages were organized into 24 electronic folders and, in total, represented 220 megabytes of information. It was clear that for their radiation into space the transmission rate of 400 bauds would not be sufficient - bit-by-bit transmission of such a large amount of information would take more than 50 days of transmission time. Therefore, we transmitted the personal messages at a rate of 100 kbauds. As a result, we spent a total of approximately 11 hours transmitting the Personal Messages in Cosmic Call 2003.

Future researchers should find the Personal Messages quite interesting. We consider these messages as being a unique expression of creativity by Terrestrials from around the world at the boundary of the second and third millennia. We shall mention only some of the 24 Personal Message folders:

- o HellotoETI (This folder contains all files of the Web site - currently hosted at <http://www.ieti.org/> - created by Canadian futurist Allen Tough)
- o Flags of the World (Contains the flags of 282 states and some international organizations)

- o DavidBowie (Contains the song "Starman" by world renowned rock musician David Bowie)
- o KFT (Contains music and images of KFT, a rock band from Hungary)
- o Crimea (Contains the flags of Crimea and Evpatoria, the Evpatorian insignia, and a photo of the 70-m EPR dish)
- o Ukrainian Pictures (Contains the drawings and pictures of Ukrainian schoolchildren which were delegates to an international education forum [iEARN-2002] in Moscow. Also contains the emblem of the radio message created by an Evpatorian schoolgirl, Katya Karpushkina - the winner of a competition devoted to the 2500 year anniversary of Evpatoria)
- o NewMexicoMemorial (Contains the text of a resolution passed by the New Mexico state legislature in 2003 designating the second Tuesday in February as "Extraterrestrial Culture Day" in New Mexico, and that the resolution, "be transmitted into space with the intent that it be received as a token of peace and friendship")

2. Oli Madgett's (U.K.) activity on collecting messages from people around the world before AMFE-2008 Transmissions

(http://en.wikipedia.org/wiki/A_Message_From_Earth):

The messages were to be selected through a competition hosted by Bebo, in which more than 12 million Bebo users were invited to join. They were to be selected later through a web vote. An advanced third party application was developed for the AMFE project, which was integrated in Bebo's social network environment. Using this application, its users submitted text messages and pictures and drew images, which were translated into a binary format.[3] Originally, an idea of interstellar radio message composition by the public, which are using special web site, was suggested by Alexander L. Zaitsev in 2002 in his abstract Project METI@home: Messages to ETI from home

We therefore welcome the SETI Institute into that small group of organizations that has developed interstellar messages based upon input from people all around our planet.

Disclaimer: The opinions expressed in editorials are those of the individual authors, and do not necessarily reflect the position of The SETI League, Inc., its Trustees, officers, Advisory Board, members, donors, or commercial sponsors.



Minutes of the Fifteenth Annual Membership Meeting

19 April 2009

SETI League Headquarters, Little Ferry, NJ

- **Call to Order**

The meeting was convened at 13:03 hours EDT, in the Library at SETI League Headquarters, Little Ferry NJ, by Executive Director Emeritus Dr. H. Paul Shuch (attending via telepresence). Three SETI League members in good standing present, along with one member of the press. Our Bylaws requiring one percent of the current membership to be in attendance for the conduct of SETI League business, the above represents a quorum.

- **Minutes of 2008 Membership Meeting**

The Minutes of the 2008 Membership Meeting having been previously posted to The SETI League's World Wide Web site, a motion was passed to accept the minutes as published.

- **Treasurer's Report**

Presented jointly by the Executive Director and the Secretary/Treasurer, covering the calendar year 2008 (as e-filed).

1. Revenues: Dues and Contributions \$20,890, Interest Income \$60, Total \$20,950.
2. Expenses: Educational/Scientific Programs \$18,201, Management/General \$8,428, Fundraising \$710, Total \$27,339.
3. Revenues minus Expenses: (\$6,389) [deficit].
4. End of 2008, SETI League account balances equalled \$4,943. 2008 beginning net assets \$11,332.
5. Current balance (cash on hand and owed) is approximately \$3,129.
6. 2009 Budget: Projected Revenues \$20,950, Program Expenses \$18,000, Management/General Expenses \$4,000, Fundraising Expenses \$1,000, Projected deficit (\$2,050), Projected Ending Balance \$2,893.

This report was accepted by those present.

- **Executive Director's Report**

The Executive Director's annual report of Program Service Accomplishments having been previously posted to The SETI League's World Wide Web site, a motion was passed to accept the report as published.

- **Committee Reports**

- **EME Committee**

Report by station trustee Richard Factor. Moonbounce antennas were destroyed by high winds over the past winter. Efforts are underway to develop and implement a more robust antenna design. Beacon remains off the air indefinitely.

- **Awards Committee**

Awards Committee chairman David Ocame being absent, executive director H. Paul Shuch announced the 2009 Giordano Bruno Memorial Award winner as Dr. Jill Cornell Tarter, prominent radio astronomer and holder of the Bernard Oliver Chair for SETI at the SETI Institute. The winner of the 2009 Orville Greene Service Award is Prof. Alex Antonites, SETI League regional coordinator for South Africa.

- **Old Business**

1. **Very Small Array**

Executive Director Emeritus H. Paul Shuch reports that no further work was accomplished on this technical initiative in the past year, due to lack of funding.

2. **Ostrich Farm Facility**

President Richard Factor reports that no further work was accomplished on this proposed new radio astronomy facility in the past year, due to lack of funding.

3. **Mid-Year Renewal Letter**

Secretary/Treasurer Heather Wood last issued a mid-year letter in 2007, with good results. It was recommended that The SETI League resume issuing such mid-year appeals.

4. **Annual Report**

The SETI League's 2008 Annual Report is available to members via the website, in Portable Document Format (PDF).

5. **Volunteer Appreciation**

Gratis renewal for a period of one year was offered last year to our lapsed Committee Chairs and Regional Coordinators, conditioned upon their continued volunteer service. A motion was adopted to continue this program for the 2009 membership year.

- **New Business**

1. **SARA Proceedings**

For the past three years, in lieu of sponsoring a SETICon technical meeting, The SETI League assisted the Society of Amateur Radio Astronomers (SARA), a SETI League affiliated society, in conducting its annual technical conference at NRAO Green Bank WV. The Executive Director Emeritus served as Editor of the Proceedings of those three conferences. Based upon past success, The SETI League will be assisting with this year's SARA Conference, and editing SARA's 2009 Proceedings as well.

2. **Next Meeting**

The next Annual Meeting will be held at the same venue. The date of Sunday 18 April 2010 has been approved. The meeting will be at 1300 hours EDT, to be followed immediately by the Board of Trustees meeting. The date and time will be announced to the membership via the website and newsletter.

- **Good and Welfare**

A report on the status of ailing member Dr. Allen Tough was given by the Executive Director Emeritus. Concerns were expressed, and regards sent, by all present.

- **Adjournment**

The Annual Membership Meeting was adjourned by the Executive Director Emeritus at 13:22 hours EDT on 20 April 2008. A Regular Board of Trustees meeting followed. ❖

Book Reviews:

**Deep Space Flight and Communications:
Exploring the Sun as a Gravitational Lens**

by Claudio Maccone, reviewed by H. Paul Shuch
Copyright © 2009 Springer-Praxis Books (Berlin)
ISBN 978-3-549-72942-6, 401 pp

Most SETI League members are already familiar with the work of Dr. Claudio Maccone, through his regular presentations at various conferences. An advocate of gravitational lensing to dramatically increase the sensitivity of radio telescopes, and a passionate proponent of the adaptive Karhunen Loeve Transform (KLT) for SETI digital signal processing, Maccone was awarded the Giordano Bruno Memorial Award, the SETI League's highest technical honor, in 2002. Much of the material in his latest book was previously presented as papers at various SETICon, EuroSETI, and European Radio Astronomy Club meetings, as well as at annual International Astronautical Congresses around the globe. This textbook, however, is far from a collection of conference papers. It promises to be the seminal work in a newly emerging field of study.

The concept of gravitational lensing, long practiced by optical astronomers, is only recently being recognized as a signal amplifying technique for radio astronomical applications. Since the considerable mass of a star can focus incoming photons from distant sources, the result is a radio telescope of stellar proportions. Unfortunately, as Maccone shows in this book, in the case of our own Sun, those photons focus at a distance of 550 astronomical units and beyond. Thus, in order to use the Sun as an effective gravitational lens, one must launch radio receivers into solar orbit at greater than interplanetary distances. The mechanics of such a space mission are discussed in the present work, as are the communications challenges of commanding and controlling a spacecraft in the face of three-day one-way propagation times.

In addition to the astronautical challenges of such a mission, Maccone discusses the need for highly optimized, computationally intensive signal processing and analysis techniques. Not surprisingly since he expounded on its use in his doctoral dissertation decades ago, Maccone now advocates the KLT for this esoteric application, shows how it can improve SETI signal-to-noise ratio by three orders of magnitude as compared to the more conventional Fast Fourier Transform (FFT), and introduces improved algorithms to finally make its implementation feasible on available computational platforms. Finally, given the high velocities of relative motion involved for space missions to 550 AU and beyond, relativistic corrections become an important consideration, which Maccone explores in the present work.

Two decades in the making, *Deep Space Flight and Communications* is the result of merging two previously published, smaller books by the author. The first, *The Sun as a Gravitational Lens: Proposed Space Missions*, corresponds to Part I, and the second, *Telecommunications, KLT and Relativity*, corresponds to Part II of this revised and updated book. The extensive revision process has brought Maccone's two 20th Century works firmly into the 21st Century, and beyond.

Confessions of an Alien Hunter
by Seth Shostak, reviewed by Paul Gilster
Copyright © 2009 National Geographic Society
ISBN 978-1-4262-0392-3, 309 pp; \$27

Shostak's new book *Confessions of an Alien Hunter* makes a strong case for continuing SETI as our digital capabilities expand. Indeed, given the daunting challenge of interstellar distances, it could be argued that our sole contact with extraterrestrial civilizations, if they exist, will take place through communications from afar, mediated by radio or light.

Let's face it, the numbers are tough. The fact is that we can already do interstellar travel, provided we're content with transit times of many tens of thousands of years, which is what our fastest spacecraft ever, New Horizons, would take to reach Proxima Centauri. A quick look at alternatives leads Shostak to note that ion engines aren't up to the challenge, while anti-matter requires the creation and storage of vast amounts of exotic, hard to contain particles. Wormholes? Fine, but we don't know yet whether they exist or how to use them.

If all this sounds depressing, consider Shostak's alternative, the use of telepresence to extend human vision, hearing and touch to our stellar neighbors. Thus we go, but we go robotically, sending what he calls "proxy explorers" to nearby stars, aided by ever increasing miniaturization that allows us to make payloads tiny. Perhaps the idea is a driver for nuclear-powered rocket technologies whose development has stalled:

A plausible solution would be to re-energize NASA's development of nuclear-powered rockets, with the intention of building a craft able to send clusters of micro-bots into deep space at velocities of, say, one-tenth light speed. Depending on financing and our ability to garner international cooperation, these probes could be sent off before the 21st century starts to wane. By the middle of the following century, on-the-scene data from Epsilon Eridani, the nearest known planetary system, could be in our hands.

Virtual wanderings through a data feed from another star are compelling indeed, fueled by our telepresence proxies and data collectors. Who wouldn't want to plug into the Epsilon Eridani Channel, immersing the senses in a wrap-around virtual experience that not only allows us to explore another planetary system, but also suggests that the wave of such exploration is ever outward?

Here I want to plug in another quote from the book, which is a lively and satisfying account of what it's like to be SETI's major spokesman in today's world. Here Seth is talking about various schemes for interstellar travel and he touches upon new physics:

Numerous and highly intriguing schemes have been proposed to do this. Alas, most of them require marshaling massive amounts of energy or rounding up exotic material that might not even exist. Scientists will not say that such schemes are impossible. We also can't say whether they are possible, because theories in this field are still incomplete. Yet even if one of these schemes eventually looks right on the blackboard, there is no guarantee that it is feasible in practice.

Exactly so. The key statement is "theories in this field are still incomplete." Completing them is not the work of a single lifetime, nor is the resultant coupling of theory with technology that may develop. As we examine realistic technologies like telepresence via robotic probes, what can be done to keep our investigations of other possibilities alive?

For as lively as telepresence would be, many of us would like to go one better. Propulsion research is a parallel stream, one that continues to flow even as we tune up and deploy the latest technologies available to us. Pushing its limits may or may not result in breakthroughs of the sort Shostak mentions. But one thing we can say for sure is that if we stop searching for them because of our current limits, we won't find them.

And if they're not there to be found? Here's the point: By focusing our efforts on the nature of the possible, we should learn more about how the universe works, which is an end in and of itself. I've been asked on more than one occasion what will happen if scientists fail to find a way to achieve the kind of travel we see in Star Trek. The answer is that we'll take different, slower methods to get to the stars, but we will still have learned a great deal about physics along the way, identifying key issues and sketching in many unknowns.

That's a quest worth taking. And while it's reassuring to realize that the kind of telepresence probes Shostak is talking about are feasible in a not terribly distant future, we still find ourselves confronted with a universe whose vast mysteries - dark energy, dark matter, the very nature of gravity - point to possibilities we have yet to explore. Nature yields up her secrets but slowly and often confronts us with surprises, which is why we must keep basic research alive. And if we create an Epsilon Eridani or Tau Ceti Channel along the way, count me an avid subscriber.

Primates and Philosophers: How Morality Evolved

by Frans de Waal
Princeton Science Library, 2009
paperback, \$14.95

"It's the animal in us," we often hear when we've been bad. But why not when we're good? Primates and Philosophers tackles this question by exploring the biological foundations of one of humanity's most valued traits: morality.

In this provocative book, primatologist Frans de Waal argues that modern-day evolutionary biology takes far too dim a view of the natural world, emphasizing our "selfish" genes. Science has thus exacerbated our reciprocal habits of blaming nature when we act badly and labeling the good things we do as "humane." Seeking the origin of human morality not in evolution but in human culture, science insists that we are moral by choice, not by nature.

Citing remarkable evidence based on his extensive research of primate behavior, de Waal attacks "Veneer Theory," which posits morality as a thin overlay on an otherwise nasty nature. He explains how we evolved from a long line of animals that care for the weak and build cooperation with reciprocal transactions. Drawing on both Darwin and recent scien-

tific advances, de Waal demonstrates a strong continuity between human and animal behavior. In the process, he also probes issues such as anthropomorphism and human responsibilities toward animals.

Based on the Tanner Lectures de Waal delivered at Princeton University's Center for Human Values in 2004, *Primates and Philosophers* includes responses by the philosophers Peter Singer, Christine M. Korsgaard, and Philip Kitcher and the science writer Robert Wright. They press de Waal to clarify the differences between humans and other animals, yielding a lively debate that will fascinate all those who wonder about the origins and reach of human goodness.

Frans de Waal is C. H. Candler Professor of Primate Behavior in the Department of Psychology, and Director of the Living Links Center at the Yerkes National Primate Center, both at Emory University. In 2007, *Time* magazine selected him as one of the 100 People Who Shape Our World. His books include *Our Inner Ape* (Riverhead) and *The Ape and the Sushi Master* (Basic Books), both New York Times Notable Books of the Year. ♦

Press Release:

SETI League Announces Annual Awards

Little Ferry NJ., 19 April 2009 -- At its Annual Meeting this afternoon at its New Jersey headquarters, the nonprofit SETI League, leaders in a global search for extra-terrestrial intelligence, recognized two individuals for major contributions to the art and science of SETI. Honored this year for their efforts and accomplishments were Dr. Jill Tarter of the United States, and Prof. Alex Antonites of South Africa.

The SETI League recognized Dr. Jill Tarter, who holds the Bernard M. Oliver Chair for SETI at the SETI Institute, California, with its annual Giordano Bruno Memorial Award, for technical excellence in the service of SETI. Certainly one of the world's best known radio astronomers, Dr. Tarter served as Project Scientist for NASA's SETI program, the High Resolution Microwave Survey, and has conducted numerous observational programs at radio observatories worldwide. Since the termination of funding for NASA's SETI program in 1993, she has served in a leadership role to secure private funding to continue the exploratory science. Currently, she serves on the management board for the Allen Telescope Array, a joint project between the SETI Institute and the UC Berkeley Radio Astronomy Laboratory. When this innovative array of 350 6-m antennas begins operations at the UC's Hat Creek Radio Observatory, it will simultaneously survey the radio universe for known and unexpected sources of astrophysical emissions, and speed up the search for radio emissions from other distant technologies by orders of magnitude.

Alex Antonites, Professor Emeritus of Philosophy at the University of Pretoria, was selected to receive The SETI League's annual Orville Greene Service Award, for

exemplary volunteer service to the nonprofit organization. A longtime member of The SETI League, Prof. Antonites continues to serve as The SETI League's first volunteer Regional Coordinator for the Republic of South Africa. He has written technical articles and guest editorials for The SETI League website and *SearchLites*, its quarterly journal, given countless media interviews about SETI science, technology, and philosophy, and made SETI presentations over the years on college campuses, at museums and science centers, and to amateur radio clubs. His efforts have done much to gain recognition for SETI in South Africa and beyond, as a respectable scientific pursuit.

As neither award recipient was able to be present at today's meeting, formal award presentations will occur in the near future. SETI League executive director emeritus Prof. H. Paul Shuch plans to present Tarter with her plaque at the National Radio Astronomy Observatory, Green Bank WV, in late June, where she will be Keynote Speaker for the annual SARA Conference. He will similarly honor Antonites in person at a planned 2011 International Astronautical Congress in South Africa, should no prior opportunity present itself.

In other actions at today's meeting, the Board of Trustees accepted the Executive Director's and Secretary/Treasurer's annual reports; adopted a 2009 budget; re-elected its officers (Richard Factor, WA2IKL, President; A. Heather Wood, Secretary/Treasurer; H. Paul Shuch, N6TX, Executive Director Emeritus) to serve on a volunteer basis for an additional one-year term; approved an extension of new SETI League memberships dues for members in good standing of affiliate society SARA, the Society of Amateur Radio Astronomers; and agreed to continue cost sharing of the Executive Director Emeritus' health insurance premiums.

Largely using radio telescopes and optical telescopes, SETI scientists seek to determine whether humankind is alone in the universe. Since Congress terminated NASA's SETI funding in 1993, The SETI League and other scientific groups have privatized the research. Amateur and professional scientists interested in participating in the search for intelligent alien life, and citizens wishing to help support it, should email join@setileague.org, check the SETI League Web site at <http://www.setileague.org/>, send a fax to +1 (201) 641-1771, or contact The SETI League, Inc. membership hotline at +1 (800) TAU-SETI. Be sure to provide us with a postal address to which we will mail further information. The SETI League, Inc. is a membership-supported, non-profit [501(c)(3)], educational and scientific corporation dedicated to the scientific Search for Extra-Terrestrial Intelligence. ❖

Event Horizon

SearchLites' readers are apprised of the following conferences and meetings at which SETI-related information will be presented. League members are invited to check our World Wide Web site (www.setileague.org) under *Event Horizon*, or email to us at info@setileague.org, to obtain further details. Members are also encouraged to send in information about upcoming events of which we may be unaware.

June 19 - 21, 2009: *Concertino '09*, Arlington, MA.

June 28 - July 1, 2009: *Society of Amateur Radio Astronomers* Conference, NRAO Green Bank WV.

July 1 - 5, 2009: *Dr. SETI* ® to perform at *Mensa Annual Gathering*, Pittsburgh, PA.

July 23 - 25, 2009: *Central States VHF Conference*, St. Charles IL.

August 6 - 10, 2009: *Anticipation*, 67th World Science Fiction Convention, Montreal, Quebec Canada.

September 4 - 6, 2009: *Fifth International Radio Astronomy Congress*, Heidelberg, Germany.

October 10 - 11, 2009: *AMSAT Space Symposium*, Baltimore, MD.

October 12 - 16, 2009: *60th International Astronautical Congress*, Daejeon, Korea.

October 23 - 24, 2009: *Microwave Update 2009*, Dallas, TX.

November 20 - 22, 2009: *Philcon 2009*, Cherry Hill, NJ.

April 17, 2010, 0000 UTC - 2359 UTC: Eleventh annual SETI League *Ham Radio QSO Party*: 3.551, 7.0309, 7.2039, 14.084, 14.204, 21.306, and 28.408 MHz.

April 18, 2010: Sixteenth SETI League Annual Membership Meeting, Little Ferry NJ.

June 4 - 6, 2010: *Rochester Hamfest*, Rochester NY.

June 2010 (dates TBA): *Society of Amateur Radio Astronomers* Conference, NRAO Green Bank WV.

September 2 - 6, 2010: *Aussiecon 4*, 68th World Science Fiction Convention, Melbourne Australia.

October 2010 (dates TBA): *61st International Astronautical Congress*, Prague, Czech Republic.

November 19 - 21, 2010: *Philcon 2010*, Cherry Hill, NJ.

October 2011 (proposed; dates and details TBA): *62nd International Astronautical Congress*, South Africa. ❖

Ask Dr. SETI

Cosmic Background Peak Frequency Change

Dear Dr. SETI:

In 1964, Arno Penzias and Robert Wilson measured cosmic background radiation and determined it to be caused by the big bang. They measured the energy at a certain frequency. My question is:

Would we expect that the frequency (of the peak amplitude) of this cosmic background radiation to change over time as the universe ages? If so, has this ever been measured?

Sincerely, Bernard from Bell Labs

The Doctor Responds:

This is an excellent question, Bernard, because you specifically asked about the *peak* radiation frequency. All thermal blackbody radiation (and the Cosmic Microwave Background is no exception) covers a wide *range* of frequencies. You recall correctly that, at Bell Laboratories, Holmdel, NJ, Penzias and Wilson first detected the cosmic microwave background radiation (research which won them the Nobel Prize). They were receiving at a frequency around 4 GHz -- well below the amplitude peak, but still detectable with their huge horn antenna and cryogenically cooled maser amplifier.

Over the nearly half a century since, their measurements have been confirmed over a wide range of frequencies. From these multiple measurements, points on a curve were established, and the peak frequency was determined (it is variously reported as being 279.5 GHz or 160.4 GHz, depending upon how you define 'peak'.) From these observations, the corresponding blackbody temperature has been determined to be on the order of 2.7 Kelvin. From space, the Wilkinson Microwave Anisotropy Probe has further refined this figure to 2.715 Kelvin.

Now, when I went to school, I was taught that the cosmic background temperature was 3 Kelvin. Does this mean that the universe has cooled almost three tenths of a degree in less than half a century? Hardly! We are just getting more precise in our measurements.

On the other hand, the universe *is* cooling! That's because it is expanding. From the time of the Big Bang some 13.7 Billion years ago, up until now, that background temperature has dropped from millions of degrees to pretty near absolute zero. So, over time, the background radiation's frequency peak should indeed be dropping. Only, that change is occurring over galactic timescales, and would not be measurable over human lifetimes. In fact, instrumentation error will impart variability greater than the changes we are trying to detect. So, no, during the eyeblink of history during which we've had radio astronomy, we have not been able to measure this change.

Still, that was a great question!

The Day the Earth Stood Out

Dear Dr. SETI:

The producers of the remake of "The Day The Earth Stood Still", as a publicity stunt, transmitted the film towards the nearby star Alpha Centauri. If there's anyone there, do they have any chance at all of actually watching the film?

Larry, Boston

The Doctor Responds:

If we start with the assumption that the Alpha Centaurans are infinitely advanced, and possess technology limited only by the laws of physics, then the easy answer is, "of course they could." I prefer not to place limits on ETI's technological prowess, budget, or resources. But, from a practical standpoint, I think there's little chance of advanced extraterrestrials watching this particular transmission. Here's why:

It's axiomatic in telecommunications circles that there is no substitute for capture area. Given an antenna large enough, there's no limit to the sensitivity of a receiving system, or to the distance over which a weak signal can be recovered. To paraphrase Clarke's Law, "any sufficiently advanced antenna is indistinguishable from being there."

But, make no mistake, the signal in question is incredibly weak, beamed from a tiny antenna driven by a very low-power transmitter. For the system used in this transmission is no planetary radar, but rather an off-the-shelf commercial satellite uplink terminal, not very different from the equipment many of our members use in their ham radio pursuits. Thus, the antenna required to intercept it over interstellar distances is incredibly daunting. I'll save you the math here (the entire link analysis will appear in a paper presented to the [International Academy of Astronautics](#)) and cut to the chase. My calculations show that the Centauran receive antenna would have to be more than 3,000 km in diameter.

Consider that Arecibo, the largest radio telescope currently extant on Earth, is a mere 305 meters across, and that the most grandiose array even contemplated by humans, the planned Square Kilometer Array or SKA, will have about ten million times less capture area than the antenna I have tasked the Centaurans to build. Even if they succeeded in constructing a suitable array, can you imagine the challenges of aiming it within a millionth of a degree, from a moving planet, toward a moving target? By my rough calculations, it would have to be re-aimed about 500,000 times per second in order to keep our transmission within its beamwidth. And even that assumes that they know, *a priori*, that a transmission is being beamed toward them, and at what time, and on what frequency, and from what direction, and what its modulation characteristics are, and...

No, I think it safe to say that even the most technologically advanced of extraterrestrials will be spared from watching this particular Hollywood blockbuster. ❖

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SearchLites Volume 15 No. 3, Summer 2009

Annual Renewal: Is This Your Last SearchLites?

SETI League memberships are issued for the *Calendar Year*. Please check the expiration date indicated on your mailing label. If it reads December 2008 or earlier, you have already expired, and *must* renew your SETI League membership **now!** Please fill out and return this page along with your payment.

Please renew my membership in this category:

Full Member	\$50 / yr
Supporting Member (elderly, retired, or disabled)	\$35 / yr
Scholarship Member (full-time students only)	\$25 / yr
Household Member (same address as a Full Member)	\$15 / yr
Household Life Member (same address as a Life Member)	\$300
Life Member (until we make contact)	\$1,000
Sustaining Life Member – a generous <i>annual</i> pledge of:	\$1,000 / yr
Patron (priority use of The SETI League's radio telescope)	\$10,000
Director (Patron membership plus seat on advisory board)	\$100,000
Benefactor (a major radio telescope named for you)	\$1,000,000

Annual memberships are issued for the calendar year. Those processed in January through April expire on 31 December of that year. Those processed in September through December expire on 31 December of the *following* year. Those members joining in May through August should remit half the annual dues indicated, and will expire on 31 December of the same year.

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The SETI League invites you to pay your membership dues and additional contributions via credit card, using the PayPal online payment system. Simply log on to www.paypal.com and specify that your payment be directed to paypal@setileague.org.

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	(u/c)*	(o)*
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