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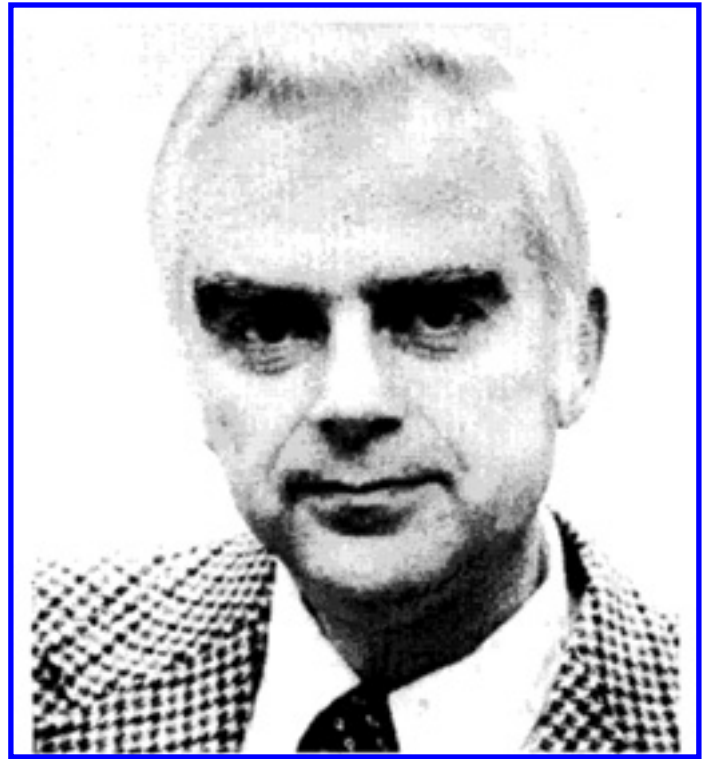


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SETI

By: F. (Frank) D. Drake

Detecting a SETI signal is in some ways the simplest of tasks, while in other ways it is the most difficult. A real signal has "intelligence" written all over it. But that signature can appear in countless guises; after all, we are surely dealing in SETI with a multitude of cultures far different than ours. Then what will be their electromagnetic hieroglyphs? Will we recognize them, especially if they flash only briefly through our electronic systems? Perhaps they will be ephemeral will-of-the-wisps — was it an intelligent signal



which blinked past, a spasm of normal galactic radiation, or a signal from earth finding its way fleetingly into our receiving system? There is a profound problem here.

Perhaps I can explain better by describing an experience which happened a few weeks ago at Arecibo. Two graduate students, Chip Cohen and John Simonetti, and I were in the midst of a lengthy search for radio emission from a previously undetected molecule of particular interest, glycine. The most basic of amino acids, the stuff of life perhaps everywhere in the galaxy. To find it would encourage our beliefs that life is common in space. We were observing on a wavelength near 30-cm, a band not used in radio astronomy, and not protected from radio interference by the international agreements which protect most radio astronomy frequencies. Our observations were taking place in the middle of the night, and we were tired after many nights of this routine. We were seeing spectral lines, all right, perhaps from glycine but more probably from hydrogen. And we were impressed at the fact that we had received no radio interference at all in the many weeks of observing we had piled up in this frequency band. Actually, this is not too surprising because Puerto Rico is relatively isolated in the middle of an ocean, and most transmitters, even all the TV stations, turn off at night.

Every five minutes, the spectrum of the radio waves captured over the preceding five minutes would flash across the screen in the control room. Then, after

hundreds of noisy repeats of the same spectrum, there suddenly appeared a spectrum with a new set of peaks in it: The complex yet obvious signature of an intelligent radio signal carrying information in the form of pulses. At 3:23 in the morning! And how eery: The signal was exactly on the radio frequency of the glycine molecule, that special place in the spectrum which we had been staring at vainly for weeks. What could be radiating such a signal, on such a frequency, at such a time?

Our telescope operator had noticed the sudden onset of a variation in the output of our receiver. It resembled the typical effect of a malfunction in the system which commands the beam of the telescope to track the slowly turning sky. But we quickly saw that in fact the signal was the cause, and that it was turning on and off at three second intervals. How odd, how striking, how exactly like our fondest speculation about the nature of the beacon signal of an advanced civilization! And then it was gone, too soon to conduct the classic test of moving the telescope beam to another part of the sky to see if the signal went away. If it disappeared it was cosmic, if not, it was of earth. In our concentration on the search for the makings of primitive life, we had not been ready for a sign of advanced life.

The next night we were ready. And sure enough, 3:26 a.m. the same three second blurring of pulses suddenly commenced. Again on the glycine frequency. Quickly the telescope beam was swept across the sky. The signal remained, just long enough to prove it was from earth and not from the stars. We have never seen it or any other signal in this frequency band again.

There are many lessons here. The difficulty caused by terrestrial transmissions is one. Another has to do with one of the most common SETI questions: "How would you know it is an intelligent signal?" That answer is "It is easy." Here the signal created some ten individual spectral lines, uniformly spaced in frequency, and having strengths relative to one another which matched in detail the special and complex mathematics of trains of pulses. The signal turned on and off, totally, with very precise timing. There are many other ways the signal could have marked itself clearly as coming from "people."

The episode reminds us of important obstacles to success in SETI. What if the signal had been only about five times fainter? Although there is mathematics which could have clearly established its presence, we don't regularly apply such tests to

our data. We might not have noticed the signal until days afterward, if at all. It would have been too late to test it for extraterrestrial origin.

More tantalizing, what if space is full of detectable ETI signals of brief duration, these signals falling on our planet like raindrops, one after another. Each one makes a brief, barely detectable splash, and then it is gone. Our present ways of observing, and even the sophisticated ones being implemented for use in the near future cannot cope with the situation. In none of our systems are we building in an automatic, quick reaction protocol to test possible transient SETI signals. I hope this is not a fundamental mistake.

The above episode is certainly not unique. It differed from the regular experience of radio observers only in the peculiarities and strength of a signal. My own observing experience, when being especially attentive for any receiver output which might be of intelligent origin, is that there seem to be weak signals just popping up out of the noise all the time. Responses at this or that frequency which seem to be more than the noise behavior of the receivers should cause. I often have the same feeling as when I am deep in a forest, and now and then sense faint, brief, vague reminders of the civilized world around me; the distant sound of a jet plane, an auto horn far away, the faint shout of a human. These whispers keep reminding me of the civilization which surrounds the forest. Could it be that in our radio observations we are hearing, all the time, the faint murmurs of countless other civilizations, blowing past the earth as on the wind? Or is it just one more example of the ability of the human mind to perceive patterns in randomness where no real pattern exists?





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