PHYS 1040: The Drake Puzzle

by Shane L. Larson

"Our sun is one of 100 billion stars in our galaxy. Our galaxy is one of billions of galaxies populating the universe. It would be the height of presumption to think that we are the only living things in that enormous immensity."
~ Wernher von Braun

PART A: Introduction

The Search for Extraterrestrial Intelligence (SETI) has long been of interest to humankind. The problem is how would we communicate with extraterrestrial biological entities (EBEs) if we met them?

It is said that in 1820, the famous German mathematician Karl Friedrich Gauss recommended that a giant right triangle of trees be planted in the Russian wilderness, an exercise that would demonstrate to EBEs that the inhabitants of Earth were civilized enough to understand geometry. It is also said that 20 years later, the Viennese astronomer Joseph von Littrow proposed digging a twenty-mile-long ditch in the Sahara, filling it with kerosene, and lighting it at night, again to communicate that there was intelligent life down here.

The American radio astronomer Frank Drake is generally credited with beginning the first serious efforts in modern times. In 1960, at the Green Bank radio astronomy facility in West Virginia, he began the first modern search for radio signals of extraterrestrial origin, called *Project Ozma*.

In the years that followed, there was a great deal of debate as to whether or not we could actually decode a message if we received it, and even more to the point, whether or not an EBE could decode a message from us if it received one. So Frank picked up the challenge, and mailed to several scientists around the world a piece of paper that had only a string of 1's and 0's on it, in an unmarked envelope. No explanation, no requests, no instructions: just the number string. Every single person who received the number string extracted a message that Frank had encoded into it!

Drake's experiment proved the idea that communication without preamble was a viable idea, and was the basis for the signal which the planet Earth sent out into the galaxy (towards a globular cluster in Hercules, some 24,000 light years away) from the Arecibo Radio Telescope, in Puerto Rico, in 1974.

So you already have more of an introduction than Drake's friends, or the possible receivers of the 1974 message. In the same vein, I am sending you a signal below. There is some information in the following stream of numbers.

PART B: The Signal

"Who needs TV?" you exclaim one day, and commandeer your satellite dish to search for extraterrestrial intelligence. Within several hours of starting your search, you run across the following interesting signal:

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10000000000000000000000000000000000011010001011101100111011000000 1
11011101101000101000101010001010000010000100111010101011001100110 01
10000001110010011010101010001010100010100000001001001101111101110 1
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10011101010000011100100110000000000000000000000000000000000110100
01011101000110001101110111011101101000100100100010101000101001 0
00110101010010010001010100011100100111011010100100100010101000 10
10010000101101111101110111011000110101001001110110000000000000000 0
0000000000000000001
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Decode this signal, and answer the following questions:

- ▷ Write a short description of the decoding process.
- ▷ What is the content of this message?
- ▷ Was the encoded message given in a useful way to communicate with extraterrestrials? Why or why not?

PART C: Communicating

Now it is your turn to communicate with the Cosmos.

- ▷ Write your own pictorial message in the same spirit as the Drake Puzzle. Remember to make the message size the product of two prime numbers.
- ▷ Write out your message both in picture form (on graph paper), and as a string of 1 and 0 that I can send out into the Cosmos through my radio telescope.
- ▷ Write a short paragraph about the message: the correct size of the message, and the content.
- ▷ You're going to have to pick someplace to send your signal. If you got to send one signal, and got to choose where to send it, what would *you* consider when choosing where to point your radio telescope when you hit send, and why?