

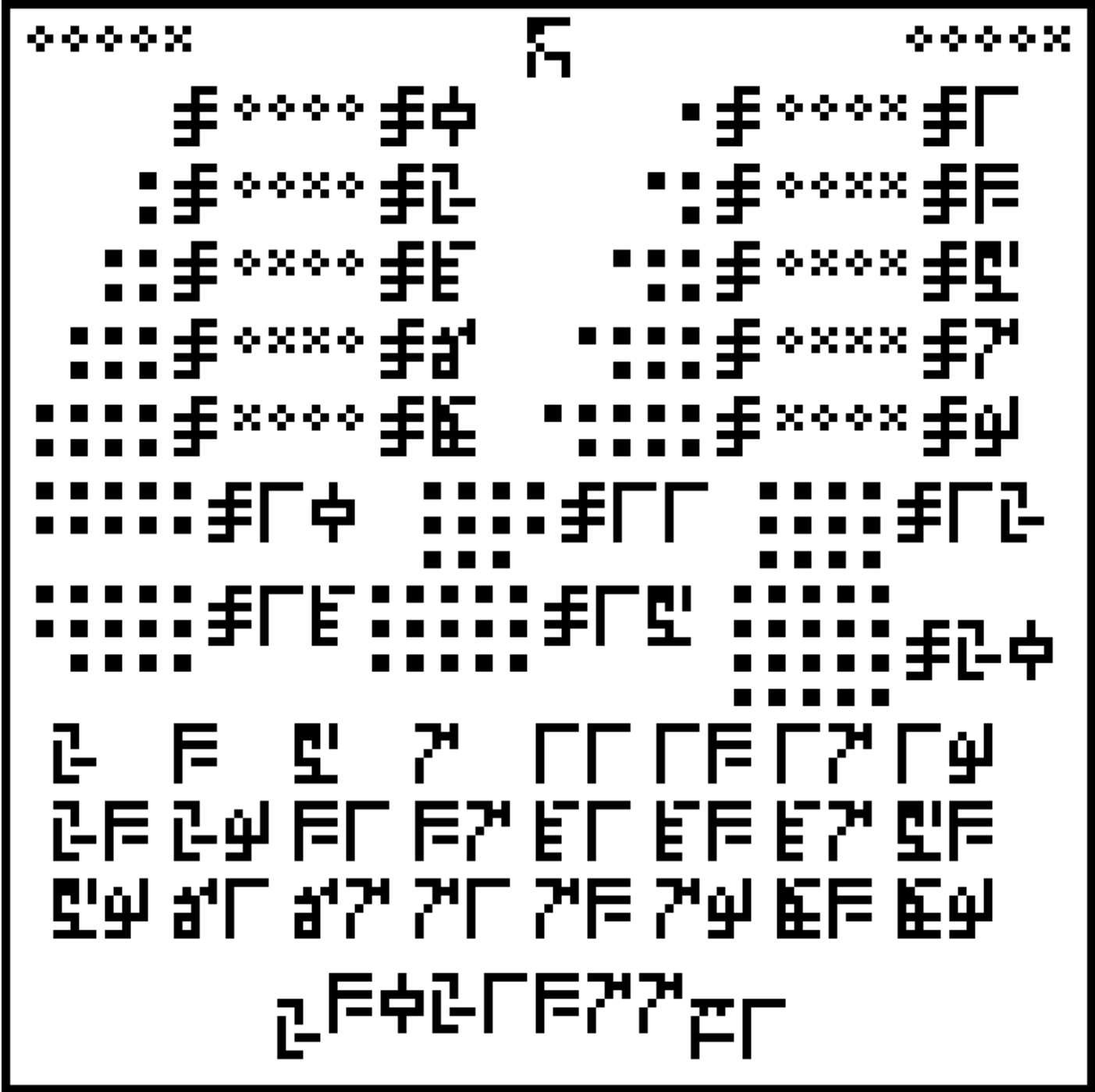
The Universe of Discourse


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A message to the aliens, part 1/23 (numbers)


Earlier articles: [Introduction](#) [Common features](#)

This is page 1 of the [Cosmic Call](#) message. An explanation follows.




This page, headed with the glyph for “mathematics” , explains the numeral symbols that will be used throughout the rest of the document. I should warn you that these first few pages are a little dull, establishing basic mathematical notions. The good stuff comes a little later.

The page is in three sections. The first section explains the individual digit symbols. A typical portion looks like this:


..... = 0111 = 7

Here the number 7 is written in three ways: first, as seven dots, probably unmistakable. Second, as a 4-bit binary





number, using the same bit symbols that are used in the page numbers. The three forms are separated by the glyph , which means "equals". The ten digits, in order from 0 to 9, are represented by the glyphs



The authors did a great job selecting glyphs that resemble the numerals they represent. All have some resemblance except for 4, which has 4 horizontal strokes. Watch out for 4; it's easy to confuse with 3.

The second section serves two purposes. It confirms the meaning of the ten digits, and it also informs the aliens that the rest of the message will write numerals in base *ten*. For example, the number 14:



Again, there are 14 dots, an equal sign, and the numeral 14, this time written with the two glyphs  (1) and  (4). The base-2 version is omitted this time, to save space. The aliens know from this that we are using base 10; had it been, say, base 8, the glyphs would have been  .

People often ask why the numbers are written in base 10, rather than say in base 2. One good answer is: why not? We write numbers in base 10; is there a reason to hide that from the aliens? The whole point of the message is to tell the aliens a little bit about ourselves, so why disguise the fact that we use base-10 numerals? Another reason is that base-10 numbers are easier to proofread for the humans sending the message.

The third section of the page is a list of prime numbers from 2 to 89:



and finally the number $2^{3021377} - 1$



which was the largest prime number known to humans at the time. (The minus sign and exponentiation notation are explained on later pages.) Why? Again, to tell the aliens about ourselves: here's a glimpse of the limits of our mathematical knowledge.

I often wonder what the aliens will think of the $2^{3021377} - 1$. Will they laugh at how cute we are, boasting about the sweet little prime number we found? Or will they be astounded and wonder why we think we know that such a big number is prime?

The [next article](#), to appear 2015-08-12, will discuss page 2, shown at right. (Click to enlarge.) Try to figure it out before then.



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