process being left alone on some planets for the purpose of "biological refreshing" only, Tsiolkovsky said. In another booklet, *The Unknown Intelligent Forces,* also in Russian, he wrote that those "others" probably have not yet tried to communicate with earth or with other bodies in our solar system because we are still not prepared for this. Such a communication would create confusion and panic in our society, and it is probable that the "others" have decided to wait for our signals.

I must add that these speculations of K. E. Tsiolkovsky have not been praised highly by the Soviet Government, for they are considered groundless and antimaterialistic. The authorities in Moscow could not touch Tsiolkovsky himself, because of his fame and popularity, but his secretary lost his job. The book *Monism of the Universe* ends with 14 corollary "R.M.S. theses" ("R.M.S." stands for *razvye mozhno somnyevatsya,* meaning, "can one doubt that . . ."), which repeat briefly the main conclusions and are very optimistic in tone.

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Scientific Nomenclature

I have long been disturbed by the unscientific character of scientific nomenclature. In all the sciences nomenclature has grown up by a succession of historic accidents. Ideally the name of anything should convey as much information about the object as possible. In most sciences the names of things convey hardly anything in themselves, and any connotation which they have has to be painfully learned. Even where the name of a scientific object has some relation to it, the connotation frequently reflects some accidental property or obsolete theory. It is true, in a way, that hydrogen generates water, as men generate babies, though this may not be its most important property. The connection of tellurium with the earth or of selenium with the moon is obscure.

Fortunately most scientists are unacquainted with the dead languages from which their nomenclature is largely drawn, and so scientific names generally convey merely zero, rather than negative, information. Fortunately, also, physics and chemistry have few enough objects of study so that the learning of a set of arbitrary names is not a hopelessly burdensome task. In biology the problem is very serious but probably hopeless. Biological nomenclature is such a hopeless and vast hodgepodge of historical, geographical, and personal accidents that one despairs of ever reducing it to the slightest semblance of rationality, especially as the objects themselves seem to be the result of a hodgepodge of historical accidents also.

There is one field, however, where the objects of study have a nice rationality of *position* which makes possible a scientific nomenclature in which the name given to an object could be rich with information about it. This is astronomy. Like that of other sciences, astronomical nomenclature is a random historical mishmash of Greek, Arabic, and modern components. The name *Sirius* tells us even less about Sirius than the name *hydrogen* does about hydrogen. Star catalogs are a hopeless potpourri of letters and numbers obeying little or no rational principle. It is possible, however, to devise a system of star nomenclature whereby the name of any star would give in itself most of the essential information about it, so that, given the name, one could immediately deduce the position and properties of the star, or given its position and properties, immediately attach a name to it. It would probably be most rational to reform also the ancient method of counting degrees in sixties, and to go straight to a binary system of numbers. But this is perhaps too radical. Let us accept, therefore, the traditical definition of position in terms of degrees of right ascension and declination, or heavenly latitude and longtitude. There are 360 degrees around the celestial equator. There are 19 usable consonants in the Roman alphabet, if we exclude *q* and *x*, which cannot be used to begin syllables. By a providential accident, 19 × 19 is 361. Two consonants, therefore, will define a degree of right ascension, in the scale of 19. Suppose we number the consonants as follows:

b	c	d	f	g	h	j	k	l	m
0	1	2	3	4	5	6	7	8	9

n	p	r	s	t	v	w	y	z
10	11	12	13	14	15	16	17	18

I grant that the roman alphabet and the languages spelled in it are also in sad need of reform, but here again one reform at a time is probably enough. We can now express any number up to 360 as an ordered pair of consonants. Thus, 0 would be *b,b*; 100 (5 × 19 + 5) would be *h,h*; 200 (10 × 19 + 10) would be *n,n*; 291 (15 × 19 + 6) would be *v,j*. We only need 180° for the declinations, so we might use the first 180 pairs, or start with *b,b* at the South Pole, reaching *g,t* at the equator and *m,m* at the North Pole. We may note that translation from the scale of 19 consonants to the scale of 10 digits is very easy because every double consonant is a multiple of 20. Four consonants in order

now give us the location of any star to within a square degree. We can now use the vowels to indicate other properties. The five vowels (*a, e, i, o, u*) with the 25 diphthongs (*aa, ea, ia,*—down to *ou, uu*) give us plenty of scope and can be numbered in order, giving us 30 possible vowels for each place. Thus, the first vowel could indicate the integer of magnitude; the second vowel, the first decimal of magnitude; the third vowel, color; the fourth vowel, spectral type, or whatever some distinguished international committee of astronomers decided was most important.

With a single name of four consonants we can name one star in each square degree. This gives us 64,800 names—adequate to name unequivocally all stars visible to the naked eye and even well beyond. There may be a few cases, in star clusters like the Pleiades, where a square degree has more than one star visible to the naked eye, but these must be rare. Then, by adding another similar name to the "surname" we can identify 360 × 360 or 129,600 stars per square degree, or over 9 billion in all. This names every square 10 seconds of the sky, which is probably enough for most astronomers. If necessary, a third name would cover all conceivable cases. The names are apt to sound a little Japanese or Italian, but this is surely a small sacrifice on the altar of a world science. Sirius perhaps sounds a little uncouth as Zacafawe, Capella as Gadakugo, and Polaris as Bevamoli, but no doubt the ancient names could be retained for those who wanted to use them, and, as most stars have no names anyway, there would be no fine old traditions to stand in the way of their semantic baptism.

While I am on the subject of reform, having been a binarist from the word *bit*, let me suggest a simple method for saying the binary numbers. I say "saying" rather than "naming" because I do not really approve of naming numbers anyway, any more than I approve of gilding lilies. Even in the decimal system it seems to me foolish to *name* the perfectly good number one-nine-six-oh, or even, in a fit of centesimalism, nineteen-sixty, under the laborious title "one thousand nine hundred and sixty." Attempts to *name* the binary numbers end up in hopeless clumsiness and cacophony. On the othe hand it is perfectly easy to *say* the binary numbers if we adopt one conventional symbol for "1" and another for "0." I have toyed with "Bim" for 1 and "Bam" for 0, in which case we would count: Bim, Bimbam, Bimbim, Bimbambam, Bimbambim, Bimbimbam, Bimbimbim, Bimbambambam, and so on. If this sounds too sonorous I am prepared to compromise on "Bit" (for 1) and "te" (for 0), in which case we count Bit, Bitte, Bitbit, Bittete, Bittebit, Bitbitte, Bitbitbit, Bittetete, and so on. I may point out that (to look a few years ahead) Bitbitbittebittebitbitbitbit has no more syllables in it than "one thousand nine hundred and sixty-seven." I have little doubt, however, that the fact that even scientists have ten fingers will tie the human race to a wholly arbitrary decimalism for many centuries to come.

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Tax Exemption and Research

In the 1 January issue of *Science* [**131**, 7 (1960)] appears the editorial entitled "Tax exempt." I am sure you would be among the first to concede that the tax treatment of scientific research is a subject far too complex to be covered adequately in the single page of an editorial. Nevertheless, the subject is also too important to be dismissed lightly; and to a society having as its purpose the *advancement* of science, proposals to tax research have far-reaching implications that deserve more extensive attention than is given by your short article.

Some statements in your editorial are contrary to fact. The newly proposed