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GRANNY WON'T KNIT
By Theodore Sturgeon

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For Your Information

By WILLY LEY

TOP OF THE WORLD

LAST year, when Mt. Everest was climbed with perfect timing for the coronation of Queen Elizabeth II, I watched, just out of curiosity, whether the Soviets might not make a few marginal remarks about the feat. I more or less expected that either *Pravda,* or else science fiction's

friend, the *Literaturnaya Gazyeta,* might fire a blast stating that, though Mt. Everest had been climbed for military purposes by two war-mongering capitalistic lackeys of Wall Street, it was a lie to say that Mt. Everest was the top of the world and this planet's highest mountain. The highest mountain, they might have gone on, is tentatively designated by the name of Amne Machin and it is, furthermore, in the Soviet sphere, located in the Chinese People's Democracy. And if anybody climbed it at all, it would be proletarians.

To the best of my knowledge, nobody lifted a cudgel or a fountain pen in Amne Machin's defense. Of course the evidence is flimsy, for the mountain has only occasionally been seen by airplane pilots who guessed that it might be 3000 or 4000 feet higher than Mt. Everest. That there is a very high mountain in Northeast China is probable because of these reports, but there isn't a measurement on record which would enable one to establish its height, even with considerable uncertainty. Nor, in the absence of definite information, is there any use speculating about it.

WHAT I do want to point out is that the two men who stood on the peak of Mt. Everest were not farther out in space than anybody else had ever climbed. This is not said to belittle their enormous skill and perseverance. It just happens that they became the victims of a natural fact.

If you say that a mountain sticks out into space and that one mountain sticks out farther than another mountain, you can only mean that its peak is farther away from the center of the Earth. But if you use this criterion, it turns out that the peak of Mt. Everest does not stick out into space farther than any other.

Because of the fact that the Earth is not a perfect sphere, the mountains near the equator reach farther into space than the mountains elsewhere. And there is quite a number of respectable mountains within one degree of latitude (north or south) of the equator. In Africa, we have the Ruwenzori at 16,784 feet and Mt. Kenya at 17,040 feet. (The somewhat taller Kilimanjaro at 19,319 feet is 3 degrees from the equator.) But in the western hemisphere, we have the Cotopaxi at 19,498 feet and the Chimborazo at 20,702 feet.

According to the Smithsonian Geographic Tables, the distance of a sea-level point near the pole from the center of the Earth is 3949.8 miles or 20,855,121 feet. The distance of a sea-level point at the equator from the center of the Earth is 3963.3 miles or 20,-

926,062 feet, so that any given mountain, if moved from the vicinity of a pole to the equator, would gain 70,941 feet in distance from the center of the Earth.

Therefore, the distance of the peak of Mt. Kenya from the center of the Earth is 20,926,062 + 17,040 = 20,943,102 feet. The peak of the Chimborazo is 20,962,062 + 20,702 = 20,946,764 feet. But Mt. Everest is 28 degrees north of the equator and the distance of its peak to the center of the Earth works out to 20,868,676 feet.

There is an uncertainty of a few hundred feet in this last figure, since the sea-level height of the mountain is still somewhat in doubt. But this uncertainty is is only a small fraction of the difference between the peak of Mt. Everest and the peak of the Chimborazo, which is actually the point farthest away from the center of our planet.

And even if that mysterious mountain in Northeast China should turn out to be higher than Mt. Everest, it still could not compete with Mt. Everest itself when it comes to distance from the center of the Earth.

Incidentally, some readers of our foreign editions will undoubtedly object that the opening of this item is propagandistic, having already done so about previous items mentioning the Soviets. Every scientist is aware that the Soviets use science, mainly through their outrageous claims of inventions and discoveries, for propaganda purposes, which are political in nature. These arrogant claims demand refutation; dismissing them as laughable would be aiding an insidious systematic lie. Lysenkoism and similar political impositions are another matter—they're tragic and I feel only pity for Soviet scientists who must submit to such nonsense or lose their jobs and even their lives.

Here, in capsule form, is the difference in viewpoint: If the Chinese mountain proved higher than Everest, the Soviets would make capital (pun intended) of the announcement; we of the West would welcome it.

NEW (OR VERY OLD) NUMBERS

THIS should really be in the questions column, but I decided to move it ahead because my answer is quite long. I received a letter from a Mr. William S. Boyd, obviously with the U. S. Air Force although no return address is given, which reads as follows: "I have read somewhere that it is possible to base arithmetics on systems of 2, 9, 12, etc. I am under the impression that all mathematics were

based on 10. I would appreciate it if you could clarify this for me; at this Air Base, the library does not have any material on it."

Well, this is a big order. To begin somewhere, I'll say first that it is not quite correct that all mathematics is based on 10, the decimal system of counting. We do have quite a number of leftovers of older, now discarded, systems. The one still most strongly in evidence is the duodecimal system, which requires counting in units of 12. There are the expressions dozen and gross (a dozen dozens), there are a dozen months in the year and two dozen hours in the day, a dozen inches to the foot, and so forth. Another old system seems to have been based on 20, which probably meant that these people counted by using both fingers and toes. The two most frequently encountered leftovers of this system are "score" in English and *quatre-vingt* (literally 4 times 20, used for 80) from the French.

There was once a system based on 60, which is why we still have 6 times 60 degrees in a circle. In Germany, before the first World War, agriculture products were often sold by the *Mandel,* which meant 15, indicating that this was once the basis of a system of counting.

Even in mathematics itself, you do not always stick to the base of ten; you have two sets of logarithms, one based on 10 and another based on the figure *e,* the numerical value of which begins 2.71828183. These logarithms are known as the "natural logarithms" and in many cases they prove to be far more useful than those based on ten.

IT is correct that we *express* everything, including natural logarithms, in the well-known decimal system, which has its origin in the fact that we have ten fingers. A close examination of the decimal system will show how we could express it differently if we wanted to. When we count 1, 2, 3, 4, 5, 6, 7, 8, 9, we use a different sign for each word. But then, when we *say* ten, we suddenly use two signs and write 10.

We have agreed that moving a figure one position to the left means that this figure is multiplied by ten. The zero just has the purpose of indicating that the figure has been moved one position. When we see a figure like 567, we know by training and habit that the 5 in this position does not mean five but five hundred and the whole is simply a condensed way of writing: "five times hundred plus six times ten plus seven times one."

BUT we could count, as suggested by F. Emerson Andrews in his book *New Numbers* (New York, 1935 and 1944), 1, 2, 3, 4, 5, 6, 7, 8, 9 as usual. The next figure, the present ten, would still be written with just one sign; F. E. Andrews suggests using the X (the Roman ten) and pronouncing it *dek*. The present eleven would follow, also written with one sign—Andrews suggests a specially shaped E—and pronounced *el*. The first figure requiring two signs to write would be the *do* (from dozen and pronounced accordingly) which would look like this: 10.

In this duodecimal system, the movement of a sign by one position means that it has been multiplied by 12. Consequently the duodecimal figure written 100 would mean a dozen dozens and the duodecimal figure 12 would be one dozen plus two ones, the 14 of decimal notation.

Now what would have happened if people had used only one hand for counting? Then we would have a system based on five and requiring only five signs, namely 1, 2, 3, 4 and 0. If a figure were moved to the left by one position, it would mean that this figure has been multiplied by 5, hence the decimal five would be written 10. In this "one-hand-system," our six would be written 11.

I hope these examples show that all that is required is a firm agreement on what a movement by one position is supposed to accomplish, whether it is supposed to mean multiplication by ten, or twelve, or five, or whatever.

Of course you may agree on a system of just two, requiring only the signs 1 and 0. Gottfried Wilhelm Leibnitz, the mathematician and philosopher, insisted that such a system had once been used by the Chinese. Whether Leibnitz was right or not is relatively unimportant, but this so-called binary system is the only one an electronic computer can handle and for this reason there is now much activity with and around the binary system. Every problem to be solved by the big computers first has to be translated into the binary system, or else the machine can't handle it. In this binary system the figures from one to ten would have to be written: 1, 10, 11, 100, 101, 110, 111, 1000, 1001, 1010.

A quarter of a century ago, before there were any electronic computers to make this system necessary, one Dr. Theodore Wolff amused himself by presenting some everyday information in the binary system. The information concerns Mr. Joshua Lehmann whose address is 75 X-Street, Apt. 4 C, and who was born in 1879. At the age of 50,

he was married for 25 years, had six children and a yearly income of $10,000. In the binary system, the address of Mr. Lehmann is No. 1,001,011, Apt. 100 C. His birth year is 11,101,010,111 and during his 11,001 years of marriage his wife bore him 110 children which he has to feed and clothe on a mere $10,011,100,-010,000 per year!

ANY QUESTIONS?

Frequently one hears of fish that live at great depths in the ocean as having burst while they were brought to the surface for study. This is supposed to be due to the sudden release of pressure under which they live normally. Another point along the same lines is a passage in Arthur C. Clarke's Childhood's End *where an ichthyologist is described as "peeping through a microscope into . . . a pressure capsule containing some specimens of deep-sea life, swimming around under its normal tons-to-the-square - centimeter conditions." Water is supposed to be incompressible, so how could there be such a high pressure in the capsule? And why do the deep-sea fish die?*

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It seems to me as if there are two different reasons for the maintenance of pressure in Arthur C. Clarke's so far hypothetical pressure capsule and damage to the tissue of deep-sea fish which are brought to the surface. To begin with, when books state that water is incompressible, this is not to be taken absolutely literally. With enough pressure, several tons to the square inch, one can compress water by a *small* fraction of one per cent of its surface volume. So if one sealed a pressure capsule 2000 fathoms below the surface, the pressure would be maintained in the capsule, since the strength of the capsule's walls would substitute for the weight of 2000 fathoms of water.

But I do not believe that this explanation applies to the deep-sea fish that burst when hauled up fast. Cell walls are not steel and the tiny amount of expansion should be easily absorbed by them. Even if we make the obviously silly assumption that the cell walls do not "give," they are not impermeable to water. However, the bodies of deep-sea fish indisputably are often destroyed and torn. This is caused not by the very slight expansion of the body fluids of the fish, but by the gases disolved in the body fluids under high

pressure and released as the pressure drops. The death of a deep-sea fish is then an extremely exaggerated case of "the bends," which has the same cause.

What does plutonium look like? I have not been able to find this fact in declassified literature.

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This is something I had not seen mentioned anywhere, either. But I felt quite sure that there was no reason to keep the outward appearance of plutonium classified, so I queried the Atomic Energy Commission. The answer might be slightly disappointing to many people, for the AEC replied that "plutonium is quite similar to lead in appearance."

I have read the book about Dr. Wernher von Braun's plan about a space station, but there is something I do not understand. Dr. von Braun says at one point that the rocket ship from Earth, bringing up supplies, would move in the same orbit as the space station, but a few hundred feet away. The supplies would then be ferried across. How is this possible? According to the tables in the book, the third stage of the rocket ship, as it gets to the space station, weighs 66.4 tons. The weight of the space station is not stated anywhere, but it must be well over 400 tons. How can these two move in the same orbit with the same speed if one weighs more than six times as much as the others? Please explain.

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2207 West 77th Street

This is a question I have been asked repeatedly after lectures. The answer is that the whole question is wrong because the orbital velocity (in a given orbit) does not depend on the weight, or rather mass, of the orbiting body. But I also know from lecture experience that this answer is usually received with a considerable amount of distrust, so I'll try to make my readers visualize why this is so.

If you still have the December 1953 issue of *Galaxy* on hand, you'll find a reply having to do with the motion of our moon. I said there that if the Moon and Earth were of equal mass, both bodies would revolve around their common center of gravity, which would be halfway between them. But since the Moon has a much smaller mass than Earth, the common center of gravity of the two bodies is much closer to

the center of Earth.

In fact, this "barycenter," to use the technical term, happens to be inside the Earth, a thousand miles below the surface. If you imagine that the diameter of our moon were only 216 miles (instead of the 2160 miles which is the true figure), the barycenter of the Earth/Moon system is likely to be a short walking distance from the center of our planet.

In short: the smaller the mass of the body revolving around the Earth, the closer the barycenter to the center of the bigger body. In the case of a space station of a few hundred tons, the barycenter of the Earth/Space station system will, to all intents and purposes, coincide with the center of the Earth. In the case of a rocketship of 66.4 tons, the barycenter will also coincide with the center of the planet. Hence the station and the rocketship will both be able to revolve around the Earth at the same speed in the same orbit, even though their masses are decidedly different. But neither of their masses amounts to anything when compared to that of the Earth.

Is there any truth to the rumor that scientists have discovered a new planet beyond Pluto?

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I haven't heard any such rumor and I doubt that I ever will, for such a discovery would not be rumored — it would be announced. The possibility that one or two yet unknown planets might move around our sun beyond the orbits of Neptune and Pluto is generally admitted.

As you may know, the planet Neptune was discovered a little over a century ago as a result of careful calculations based on the deviations of Uranus from its predicted orbital movement. This discovery set the pattern for Pluto, for it was found the same way. The surprise was that Pluto was much closer to the Sun that had been assumed. Part of its orbit is actually inside the orbit of Neptune. Pluto also seems to differ from the physical pattern that is the rule for the outer planets, and the thought has been advanced that Pluto may once have been a third moon of Neptune.

The general feeling is that the "Trans-Neptune" that astronomers had been hunting is still unknown. There are two reasons for this assumption: Neptune does deviate from its calculated orbit in a manner indicating an unknown planet bigger than Pluto; and a number of comet orbits are such that they indicate the existence of a planet at about twice the distance of Neptune from the Sun.

Are there any metals known with melting points higher or lower than those of tungsten and mercury (which I take to be the extremes)? Do non-metals show more extreme melting points than these metals?

G. Schwaber
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Mercury and tungsten (wolfram) still represent the known extremes, the former having a melting point of -39° centigrade (-38° Fahrenheit) and the latter probably at 3382° centigrade (6119° Fahrenheit).

As for your second question, the answer is emphatically yes. Helium has a melting point somewhere near 1 degree absolute, while metal carbides have higher melting points than metals. The highest reported is for a mixture of 80 per cent tantalum carbide and 20 per cent hafnium carbide, which was established to be 3930° centigrade or 7110° Fahrenheit.

—WILLY LEY