

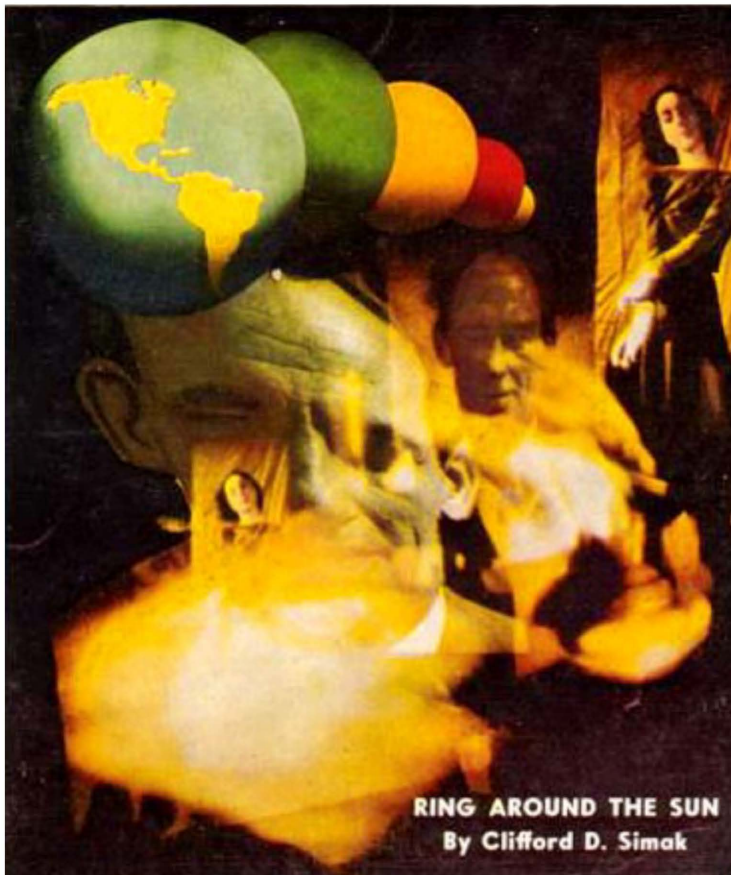
Galaxy

SCIENCE FICTION

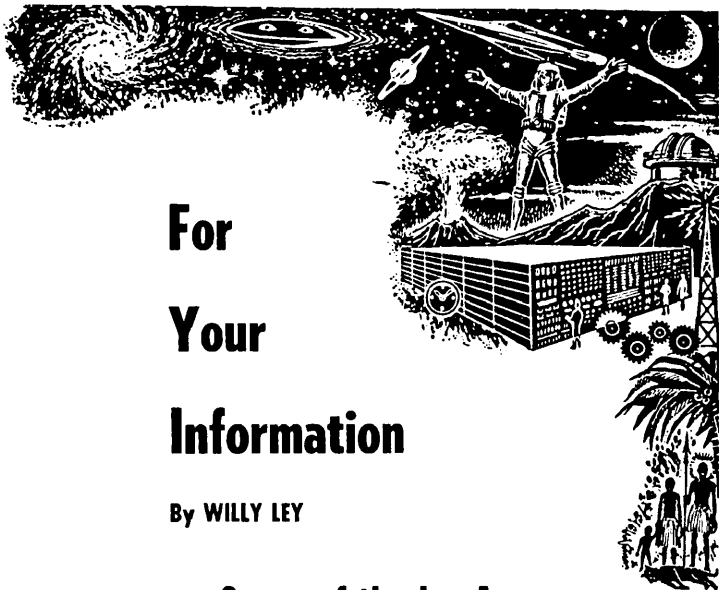
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RING AROUND THE SUN
By Clifford D. Simak



For Your Information

By WILLY LEY

Cause of the Ice Age

THE proper season is now approaching for the discussion of a problem which brought several letters to my desk during the hot summer months. These letters asked questions about the Ice Age, specifically about the

cause of the big glaciations which, as we now know, once buried large portions of North America and most of northern Europe under thousands of feet of glacier ice.

There is hardly another prob-



lem in the realm of Natural History about which so many people have written so much with so little success as that of the causes of the Ice Age. Nor is there another problem for which so many "explanations" have been advanced. Some of them now make us shake our heads in wonderment.

In order to understand the story of these hypotheses, we have to remember that the first traces of the Ice Age were found in Europe.

For centuries, people could not help noticing that almost everywhere in northern Europe—north of the Alps and east of the Rhine—the flat sandy plain was strewn with boulders, small, middle-sized and large. Except for a few more or less local legends which accorded full credit to the devil or some demons, the boulders went unexplained until the Englishman Charles Lyell, the father of modern geology, advanced an ingenious explanation. This plain, he stated, had once been flooded by a shallow sea and the boulders had drifted southward from the North, carried in icebergs which gradually melted.

A number of geologists seem to have felt uneasily that this explanation did not cover all the observed facts. In Switzerland, for example, the glaciers had obviously been much larger at some

time in the past. And there were other indications which pointed to ice rather than water. But Lyell's shallow sea was the "easy way out" and the idea lingered on until the head of the Swedish Geological Society, Otto Martin Torell, finally disproved it in 1875.

Meanwhile, those who thought of ice rather than water tried to explain the ice. In fact, the term Ice Age had already been coined, interestingly enough in a poem, which, however, was written by a professional geologist, Schimper by name. At first things seemed simple enough—maybe the land connection between North and South America had been broken at the time when Europe had its large glaciers. With the isthmus of Panama open, the Gulf Stream would flow into the Pacific, hence Europe would freeze. The simple thought was ruined by reports from North America, saying in so many words that there was evidence for a North American glaciation, too.

IT looked as if the Earth as a whole had been cooler periodically and the logical consequence was a whole batch of theories with an astronomical basis. Obviously, if the whole planet had been subjected to a calamity, the cause had to be somewhere in space.

For a while, the reasoning of Dr. Eugène Dubois, the Dutch physician who had entered the Colonial Service in order to go to the East Indies, where he intended to discover the ancestor of Man (actually finding *Pithecanthropus erectus*), held full sway.

His reasoning was that all our energy comes from the Sun. The Sun is a star like other stars. Any look at the sky shows us that there are blue stars, presumably the hottest; yellow stars, like our own; and red stars. And any picture of our sun shows that it is beginning to age. There are the sun spots, harbingers of the red phase. At present they are relatively small in numbers, but as the Sun continues to age, they will increase in number. Presumably, they had been more numerous in the past, and that was the time of the Ice Age.

As most recent research has shown, he continued, the Ice Age had been a succession of four or maybe five glacier advances, separated by interglacial periods. For reasons still to be found, the Sun had gained strength again. But since we are obviously in just another interglacial period, the Sun will darken again and the ice will come back.

It was all very impressive and had a somber moral at the end. It was not Dr. Dubois' fault that stellar astronomy was in its in-

fancy and that nobody knew anything about atomic energy, for his book appeared in 1893. Now we know that the hot blue stars are not the youngest, but relatively old stars, and that the red stars, at least the Red Giants, haven't started contracting yet. And while we don't know the cause of the sun spots, we are absolutely certain that they are not a sign of old age.

What really discredited Dubois' theory, even before atomic energy was discovered, was the geological discovery that the so-called Ice Age had not been the first glaciation. There had been another one during the Permian period, followed by some 250 million years of the Triassic, Jurassic, Cretaceous and Tertiary periods, all of them warm enough to grow corals in the North Sea and palm trees in Labrador. And much further back, at the time when life had not even yet climbed out of the seas, there had been another glaciation. If the Sun had been "red" enough during the Permian period to permit a glaciation and had then "recovered" for a very long time, there was evidently something wrong with the whole concept.

NOT that some people did not try to save this concept by means of another erroneous astronomical theory which was

around at the time. The belief of at least some astronomers was that space was not completely empty. Modern astronomers say the same thing, but they have something different in mind. The idea then was that there was enough resistance in space to slow down the planets. At the same time it was also believed that the Sun renewed its energy by slowly contracting, aided by a constant bombardment of meteorites.

Taking both these ideas together, with a view of explaining the glaciations of the pre-Cambrian and the Permian periods as well as the recent one, the following picture was formed:

The Sun derived its energy from both contraction and meteoric bombardment. But that was not quite enough to balance the budget. Losing more energy than was received, the Sun slowly turned reddish and then red. On Earth, and presumably on the other planets, too, there was an Ice Age as a result. But just at that time, the innermost planet of all had contracted its orbit more and more because of the resistance of gases in space, and finally it grazed the solar surface. This, of course, was the end of that planet, but its comparatively large mass added so much energy to the Sun that it was restored to full yellow splendor.

Thrice in the past, the theory

said, the crash of the then innermost planet had saved the Sun and the other planets. Next time Mercury would be the planet coming unwillingly to the rescue. Then it would be Venus's turn, and after that Earth would fall into the Sun to end an Ice Age on Mars.

It was all very dramatic. It was also highly incorrect.

Now, of course, you cannot reason that the stove must be going out just because you feel less heat. It is also possible that you are farther away from the stove or else that there is a screen between you and the heater. In astronomical terms, bent upon explaining the Ice Age, the former theory meant that the orbit of the Earth might have changed. At present, the Earth's orbit is an almost perfect circle. What would happen if it were a more eccentric ellipse? According to Kepler's Second Law of Planetary Motion, the Earth, in a highly elliptical orbit, would move very fast when near the Sun and dawdle when far from the Sun. This would mean short, hot summers and long, cold winters. Hence a glaciation, for the hot summer would be too short to completely melt the ice which had accumulated during the long winter.

Just in case that any of this may remind some readers of Velikovskiy, I want to make clear

that I am talking about ideas advanced prior to 1900. Evidently some of these old books provided him with "inspiration."

So this meant that the Earth had traveled in an eccentric orbit at least three times, in between returning to the circular one it has now. What had caused these changes? Well, the authors hesitated at that point and started hedging with statements like having to accept facts even if we cannot explain them. Or saying that all the laws of Nature are not yet known. Or suggesting passing stars.

THese ideas, evolved mostly on the basis of a theory along these general lines first advanced by the Scotsman James Croll, received a severe setback for an entirely unexpected reason. A Dr. Schmick, by profession a high school teacher in Cologne, pointed out that a change in eccentricity of the orbit must necessarily influence the Earth's rotation—in other words, the length of the day.

The thought was in itself correct. When Earth is running in a more elliptical orbit, the tides caused by the Sun should increase in intensity and slow the rotation down. What would happen then? Obviously there would be less centrifugal force along the equator, hence the waters would

spread out more, in the direction of both poles.

Sir Charles Lyell had, on occasion, remarked that equatorial land—as distinct from equatorial seas—should improve the climate of the Earth as a whole. Equatorial land would absorb more of the solar heat, while equatorial water would simply evaporate, be carried to the poles and cause more snow and ice there. In short, Lyell had said that an Ice Age was more likely when the equator was very wet. But a wet equator went with a near-circular orbit, which is what we have now.

For quite some time, there was an extensive discussion about what a wet equator would do, the three main contributors to the fight being the American geologist Becker, the Norwegian botanist Axel Blytt, and the German professor Max Hildebrandt. In the course of the discussion, the original question about the eccentricity of the Earth's orbit was soon lost; it became primarily a question of whether a wet equator was enough cause in itself.

Mostly because of the reasonably wet equator of our day and the non-Ice Age climate, it was decided that there had to be an additional cause. Becker thought that the inclination of the Earth's axis had to undergo changes; Blytt and Hildebrandt were more interested in tall and large (and

hypothetical) mountains. The high evaporation rate would do good only if in the high north and far south there were large mountain chains on which the moisture could condense and form glaciers.

As can be seen, these ideas, although they started in the realm of astronomy, became more and more terrestrial as the debate went on. The shifts in the Earth's orbit quietly dropped out and were replaced by polar mountains or high plateaus.

This was watched with some glee by a considerable group of geologists, both amateur and professional, who had never dabbled with the Cosmos, but had stayed on the ground with their theories.

But the mail is heavy right now and I have to postpone examination of this second set of theories until next month, when the weather will be even more suitable for such discussion.

—WILLY LEY

ANY QUESTIONS?

(1) *When mass is created from energy, how long would it take the gravity of that new mass to act upon objects some distance away?*

(2) *What is it that makes homing pigeons home?*

Hartley M. Thompson
545 W. 112th St.
New York 22, N. Y.

If anybody could really answer the first question and prove that his answer is correct, he should be awarded the Nobel Prize in Physics for several years running. The question should be stated, "What is the propagation velocity of gravity?" and the answer is that we don't even know yet whether gravity has a propagation velocity.

As regards homing pigeons, most ornithologists previously agreed that the birds orient themselves by eyesight. This answer was rendered plausible by the observation that the bird takes comparatively short flights at first, which are gradually extended both in height and in distance.

Some twenty years ago, however, reports came in which seemed to indicate that homing pigeons get confused about direction when near a large radio station. It was then concluded that the birds may have a "magnetic organ" and that they orient themselves with reference to the Earth's magnetic field. If that were the case, a nearby radio station might well produce misleading signals in such an organ. But recently this has been disproved by the simple expedient of attaching tiny magnets to the pigeon's wings. In spite of the magnets, the

birds homed without the least confusion.

So eyesight seems to be the answer, after all.

Do any of the asteroids have satellites?

*Jerome Pierce
275 McMane Ave.
Berkeley Heights, N. J.*

Of the dozen or so largest asteroids which are comparatively easy to observe, it is definitely known that they do not have satellites. But it is quite possible that a number of the small asteroids which are below the limit of visibility of small and middle-sized telescopes revolve in pairs; i. e., that two small asteroids of about equal size revolve around each other in their course around the Sun. No such case is actually on record, but it is a possibility.

The continued reference to "no weight in space" baffles me. If your ship had attained a velocity away from the Earth faster than the Earth pulls you back, you can't have achieved weightlessness because the Earth still is pulling you back.

*Phil Davis
1751 So. Victor
Tulsa, Oklahoma*

It is true that the Earth still is pulling you back, but the

state of weightlessness (more properly called "zero-g condition") is not due to being outside a gravitational field of measurable intensity. The zero-g condition will result anywhere, even deep in a powerful gravitational field, provided the pull of gravity is not resisted. If you imagine a freely falling ship, you'll realize that the ship, the crew, and all the contents of the ship fall in the same direction with the same velocity. Hence a chair will not support a man, a floor will not support a chair, etc., etc., and everything will seem weightless.

How will an atomic-powered airplane operate?

*J. O. Curtis
(no address given)*

Nothing has been said officially about atomic-powered airplanes except that one is being designed. It is virtually certain, however, that the principle will be the same that is utilized for the atomic propulsion of a submarine. That principle is that you run an atomic pile hot enough to boil a "working liquid" which might be simply water, but could be something else, for example mercury. The vapor of the "working liquid" then drives a turbine, is condensed and then returned to the pile to be evaporated again.

The turbine could drive a propeller directly, or else drive a generator which produces current that is fed into the drive motors, similar to the Diesel-electric drive of modern locomotives.

In short, we deal here with a kind of steam turbine, with an atomic pile replacing the old firebox. Quite apparently, the atomic-powered airplane will have to be large and, for this reason, is likely to be a flying boat. This conclusion is reinforced by the fact that the airplane manufacturing firm in charge of the design work is known for this type of aircraft.

Why don't they use cartridges in big naval guns? It seems so cumbersome to load powder bags by hand.

*James Brook
11 Cranberry St.
Brooklyn 2, N. Y.*

If a big gun fires at a target four miles away, it obviously needs less powder than for firing at a target twenty miles away. Loading bags is a method of adjusting the powder charge.

It is not the cost of the gunpowder which is under consideration, but the life of the gun. If cartridges were used, they would be charged for maximum range and therefore exert maximum strain on the gun barrel

with every round, causing maximum wear. For hand weapons this is unimportant, but large-caliber guns are much less expendable.

A great many science fiction stories have spaceships going to other planets accelerating all the way. Since there is nothing in space to hinder a ship, couldn't it stop accelerating after escape velocity has been reached?

*Peter Salus
1967 Andrews Ave.
The Bronx 53, N. Y.*

The answer is yes, of course. The reason for the continuous acceleration used by many writers is that they want to reduce the duration of the trip as much as possible. The more than 200 days required for a trip to Mars or Venus, if the motors are cut as soon as escape velocity has been reached, are usually a dead interlude in the story. With continuous acceleration of 1 g, the trip would be cut to about two weeks. Fictional characters don't grow old in transit that way—but they would if they had to pay the fuel bill.

On a certain planet, the people have a saying: "It's not the humidity, it's the heat." Can you describe this planet and its people?

Edward Wellen
167 Centre Avenue
New Rochelle, N. Y.

This question came in in August when I was on vacation and was, therefore, unable to look up the galactic coordinates. It is obvious, however, that the inhabitants must be reptilian in nature, since reptiles have no sweat glands and therefore suffer heat strokes easily. On the other hand, no reptile ever felt an aversion to mud, so presumably humidity won't bother them. Although Dr. E. E. Smith did not record such a saying, it might be Velantia you have in mind. As regards transliteration of the original sounds, please query L. Sprague de Camp. That's his specialty.

How far from the Earth is the point where both the Earth and the Moon exert the same gravitational pull on a rocket?

M. M. Fried
144-16 Jewel Avenue
Kew Garden Hills, N. Y.

That point is about 90 per cent of the way to the Moon. The average center-to-center distance of the Earth and the Moon is 239,000 miles, so the "neutral point" would be, in round figures, 25,000 miles from the center of the Moon. Since the distance Earth-Moon is not always precisely the same,

the distance of the "point" shifts a little, too.

Wouldn't it be possible to measure the diameter of Pluto by occultation of a star?

John Westfall
507 Kenmore Ave.
Oakland 10, Calif.

Of course, that would be possible, but there are certain difficulties. Pluto is so far away from the Earth that it is what astronomers call a "difficult object." It does not show a disk except in the largest instruments. For the same reason, it is less likely to cover (or "occlude") a star than the large planets like Jupiter and Saturn or our own moon, which is not large, but near. The likelihood of a star occultation by Pluto has in all probability been checked and if there is one, astronomers will surely allot time on a big instrument for this purpose.

What happens if a venomous snake bites (a) a venomous snake of another kind and (b) one of its own kind?

Lucy Cores
Larchmont, N. Y.

They'll probably die or at least get very sick. Venomous snakes are *not* immune to their own poison.