ASTRONOMY

Paradoxes of the Skies

By JAMES STOKLEY

JULY—hot weather; that is the sequence of thought for most people, at least in countries of the northern hemisphere. As the July sun beats down unmercifully, there is some satisfaction, perhaps, in recalling that at this time of year it is about three million miles farther away than it was last January, in the middle of winter.

On the average the earth's distance from the sun is about 92,870,000 miles. But the earth's orbit is not truly circular, it is elliptical. Last January the earth was in perihelion, which meant that it was then nearest the sun. On July 5, at five o'clock in the evening, eastern standard time, the earth is in aphelion, farther from the sun than at any other time during the year. However, the difference between the two distances, great as it is by our terrestrial standards, is very small compared with the vast distance to the sun at all times. The slight change in the amount of heat due to the changing distance is much more than neutralized by other factors.

The sun is the nearest of all the stars, indeed it is the only star that we can see as an actual disc rather than as a mere point of light. But even so, its distance is so vast that it is hard to realize what the figure, 92,870,000 miles, really means. A projectile from a large gun travels with a speed of as much as 3,500 feet per second, or about 40 miles a minute. This would take it completely around the world in a little over ten hours, assuming, of course, that it could travel with undiminished speed. However, traveling at the same speed, the projectile would require four and a half years to get to the sun. Only 499 seconds are required by the sun's light to cross the gap separating us.

Why More Heat in Summer

Let us see just why the heat is greater in summer than in winter. The light and heat from a glowing body varies not as the distance, but as the square of the distance. Suppose you have two electric lamps, one two feet away, the other four, and you have an instrument for measuring the intensity of the radiated energy received, part in the form of heat, and part as light. You will find that from the more distant lamp you get only a quarter as much radiation as from the nearer one. The intensity varies as between four and sixteen, not as between two and four. According to this "law of inverse squares" the earth receives about seven per cent. more heat from the sun in January than now.

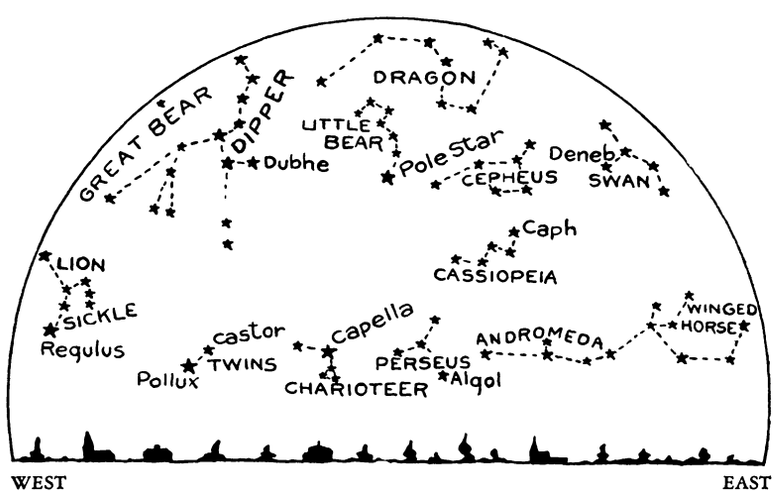
This being the case, you ask, why is it hotter now? The answer is that the figure of seven per cent. only refers to the radiation received by a certain area with the sun at the same angle in both instances. In January, the sun was closer than now, but also it was far to the south, and the rays from it struck the earth at a low angle. Imagine a beam of sunlight a yard square. When it strikes the earth at an angle of 30 degrees, as in winter in the United States at noon, the yard-square beam will cover an area of two square yards, so that the heating effect is only about half of what it would be when the sun is overhead.

Concentrating Sun Energy

Now, in summer the sun is higher in the sky. At noon it is about 70 degrees above the horizon instead of 30. As a result, the yard-square beam is confined to an area of about one and a tenth square yards of the earth's surface, so we get nearly twice the heating effect as in winter. The seven per cent. difference due to distance is much less than the difference due to the angle of the sun, and it merely serves to keep the extremes within narrower limits.

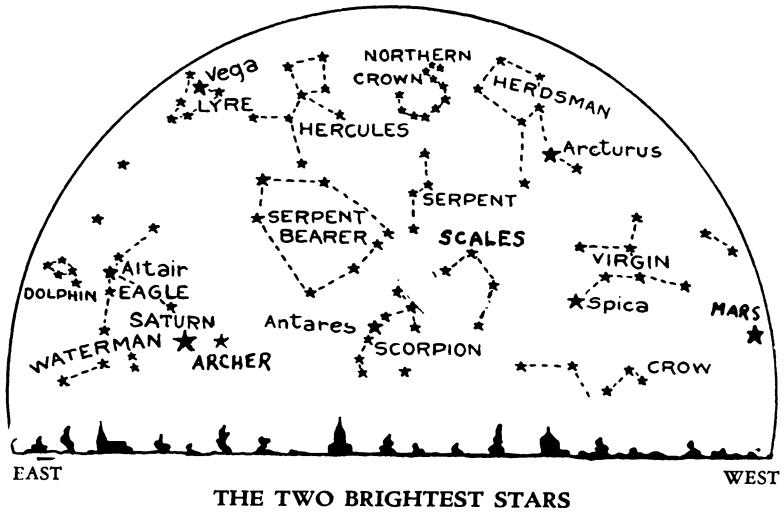
Of course, all this only applies for northern countries. In the southern hemisphere the sun is low when it is high for us, and high when low in our southern sky. Therefore they have winter in June, July and August, and summer from December to February. The seven per cent. increase in the sun's heat when nearer comes at the same time that it is hotter for other reasons, so that for southern latitudes as far south as we are north, the winters tend to be a little colder and the summers a little hotter than in the United States.

This is not the only curious astronomical effect due to living south of the equator instead of north. For one thing, the man in the moon appears upside down, for the moon, like the sun, shines in the northern, and not the southern sky. Also, we think of the sun and the moon as crossing the sky from left to right. We see these bodies to the south, and when we face that direction the east is on the left, and the west to the right. But a person in New Zealand, for example, looks to the north to see these bodies. They still cross the sky from east to west, but the east is now to the right. This is normal for the New Zealanders, but to a person from northern countries, things seem to be backwards. The New Zealander, on the other hand, feels that things run backwards when he comes north.



NORTHERN SKIES DURING JULY

Containing in their center the well-known Pole Star whose position remains fixed while other stars change places from month to month.



THE TWO BRIGHTEST STARS

Vega and Mars are found in the southern July skies, the first high in the east and the second low in the west

Jupiter, the planet that was so brilliant in the evening sky in recent months, is now close to the sun and invisible. Saturn succeeds to its place as the conspicuous planet. On the thirteenth of the month it is directly opposite the sun, and then it rises at sunset. Thus it is visible low in the eastern evening sky. Its steady light, brighter than any nearby star, makes it easy to identify. Of the stars now visible, only Vega, shining high in the east, and Arcturus, high in the west, exceed it in brilliance, and even they are only slightly brighter. A second planet to be seen these July evenings is Mars, low in the west. It can be located by its steady, red light.

Six first magnitude stars are to be seen in the evening sky this month. Brightest of all is Vega, in Lyra, the lyre, nearly overhead, to the east of the zenith. Below Vega is Cygnus, the swan, sometimes known as the Northern Cross. The cross is lying on its side. The bright star Deneb, at the northern end, also marks the tail of the swan. High in the southeast is the constellation of Aquila, the eagle, containing the bright star Altair.

In the south, near the horizon, is the ruddy Antares, marking the group of Scorpius, the scorpion. The tail of the animal runs from Antares to the southeast, curving at its end in a very realistic manner. High in the western sky is the constellation of Bootes, containing Arcturus, second brightest star now in the evening sky. Below this group is Virgo, the virgin, in which Spica shines.

After reaching the phase of last quarter on the seventh of the month, the moon is new on the fifteenth. By the twenty-second it reaches first quarter, when it is directly south at sunset. It is full on the 29th, so the last two weeks of the month will be favored by bright moonlight evenings.

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PHYSICS

New Process Cheapens Ultraviolet Glass

DEVELOPMENT of a completely automatic process of manufacturing window glass of high ultraviolet transparency has made possible the production of this glass in quantity at about one-fourth the cost under old methods. The new glass has been described by Donald E. Sharp, glass technologist.

The new process has been installed in a large commercial plant in which, during the first month of operation under the new system, approximately 200,000 square feet of ultraviolet transmitting glass were manufactured. Production for the remainder of the year is expected to reach nearly 2,000,000 square feet.

While methods of making ultraviolet transmitting glass have been known for years, Mr. Sharp explained, it has been possible to make glass of workable commercial quality only in relatively small amounts with much hand labor and at great cost. Although glass made under the new process still costs two or three times as much as ordinary glass, it is cheaper than plate glass and about 75 per cent. less than it was six months ago.

Technical difficulties involving composition, crystallization, and annealing are overcome by the new process, Mr. Sharp stated. It was explained that a special variation of the Fourcault window glass system, which permits the drawing of large, continuous sheets, is used. As is generally known, this glass must be almost entirely free of iron.

"Up to the present, attempts to make ultraviolet transmitting glass in this country by automatic means have resulted only in the production of glasses which in ordinary thickness had an ultraviolet transmission of only two or three per cent. for the ultraviolet wavelength known as 302 millimicrons. The new process produces a glass that will transmit permanently through the standard thickness of about eight one-hundredths of an inch, more than 50 per cent. of the ultraviolet light it receives from the sun."

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METEOROLOGY

Atmosphere Said to be Very Hot Fifty Miles Above Earth

JUST A MERE fifty miles above our heads the temperature is between a thousand and two thousand degrees Fahrenheit, according to a new theory of the earth's atmosphere presented by Prof. B. Guthenberg of the California Institute of Technology. This extremely hot weather a few miles up comes as the result of Prof. Guthenberg's novel theory that the atmosphere is practically the same in composition throughout and not exclusively helium in some high layers, as other physicists have concluded. Although the temperatures are high in the heights of the stratosphere, the air is very diffuse and thin. Only a rocket could actually penetrate the atmospheric heights to bring back evidence of what actually exists there, Prof. Guthenberg said. The shells of the long range gun used by the Germans in bombarding Paris probably traveled in a highly heated region.

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