

IS THE SUN HOT OR COLD?

Question Raised by a Fantastic and Illogical Argument in a Magazine.

BASIS OF A SELF-EVIDENT TRUTH

No Reason for Doubting the High Temperature of Old Sol, Especially in Summer Time—Heat Waves and Radiation.

A. W. Wood, F. L. P. R., professor of experimental physics at Johns Hopkins university, writes to Harper's Weekly as follows:

That the earth receives heat from the sun must seem to almost everyone a self-evident truth. A certain Mr. Warder, however, denies it most emphatically in a recent magazine article. The fantastic and wholly illogical arguments which the author makes use of are hardly deserving even of adverse criticism, and it is doubtful if he is taken seriously by any save the feeble-minded. I have been asked by the editor of Harper's Weekly to prepare a short article setting forth some of the arguments for and against the emission of heat by the sun.

So far as I know, no reasons at all for doubting the high temperature of the central body of the solar system have ever been found. There are in general three distinct ways in which heat can be transferred from one body to another—conduction, convection and radiation. The first two are dependent upon the presence of matter, the latter will take place across a perfect vacuum. We may receive heat from a stove by all three methods. If we place our hands upon it we receive heat by conduction; if we hold them above it they are warmed by convection, the heat being brought to them by the rising current of hot air. If now we stand in front of the stove we still feel its warmth, the sensation being brought to us by the heat waves which it emits. These waves are similar to the electric waves used in wireless telegraphy, differing from them only in their length. They bear the same relation to them which the ripples on a mill pond bear to the Atlantic ocean. With the instruments at our disposal at the present time we can measure the length of these waves, as accurately as we can measure the length of a table with a foot rule, and we can prove that they will pass through a vacuum, a plate of glass or a tank full of liquid air, without losing their ability to warm our hands. We find, however, that if we pass this radiant heat through certain substances, water vapor, for example, its intensity is diminished, owing to the fact that some of the waves have been absorbed. It is possible to determine the exact length of the waves of heat which have been removed by absorption in the vapor, and if we test the radiation which comes to us from the sun, we find that waves of this same length are absent, the water vapor in the earth's atmosphere having refused to transmit them. This fact, taken alone, is pretty good evidence that the sun and the hot stove are pouring out the same kind of energy.

Heat Atoms.
Mr. Warder tells us that heat cannot possibly penetrate the cold of space, and that it is impossible to force an atom of heat from the sun to the earth. It would be interesting to hear the definition of a heat atom. The philosophers of the seventeenth century believed heat to be a substance, but their material theory was disproved more than a century and a quarter ago. Mr. Warder appears to have raked it out of the refuse heap of science.

Experiments in the laboratory have shown that when a body is heated it emits heat waves, the lengths of which are governed by a certain law. As the temperature is increased, we get shorter and shorter waves, until finally the very short ones which we call light begin to appear, and we see the body radiating heat in the form of light. The same law which governs the emission of heat by bodies heated to a high temperature in the laboratory governs the heat emitted by the sun, and by studying the proportion in which the waves of different lengths are present in its radiation it has been possible to make a fair estimate of its temperature, which is probably not far from 6,000 degrees.

Examining the Proof.
Let us now examine some of Mr. Warder's alleged "proofs" that the sun is a cool body, sending no heat to the earth.

"Heat is not from the sun," says the author, "as is proven by the flight of meteorites, for when the meteor strikes the atmosphere they have an opposite polarity to the earth, and they create friction and generate heat." Disregarding the preposterous and meaningless statement regarding polarity, which exists only in the imagination of the author, what possible connection is there between the heating of a meteoric stone and the emission of radiant heat by the sun? It would be as logical to argue that a stove radiates no heat into a room because a penny with a hammer makes it hot.

Mr. Warder next informs us that the sun's photosphere and the earth's aurora are of similar nature, a statement which is so absolutely false that one cannot but feel that he has made use of the word "photosphere" without knowing to what part of the sun it is applied. In another place he contends that the photosphere is cold, and shines by reflected light, refraining, however, from giving us his reasons for contradicting the evidence which the spectroscopic furnishes us that they consist of masses of incandescent gas. His hobby appears to be to make the entire universe cold and inhospitable—everything shining by reflected light—but he does not tell us where the light comes from by which they shine. How he imagines to be the result of a transformation of electric energy (coming originally from a cool body), in the atmosphere of our earth. Planetary bodies which are devoid of an atmosphere cannot then be heated by the sun, for he makes

the positive statement that heat cannot exist where there is no atmosphere. In spite of this ultimatum the millions of carbon filaments in our electric lamps continue to give out both light and heat. The law of gravitation is next demolished by the ambitious author, who refers all planetary motion to electricity, thereby placing himself in the same class with the peripatetic quack doctor, who loudly shouts, "Electricity is life," believing that he has explained it all.

"There is an unanswerable fact," we are told, "that proves the sun's corona is cold, like our aurora, and that is the unquestioned fact that comets have passed through without being affected in the slightest. These comets were excessively cold, and the corona must have been cold, or there would have been a disastrous explosion."

Temperature of Comets.
Assuming the comet to be cold, which is by no means certain, what evidence can Mr. Warder cite which proves that the comet was not heated to a high temperature during its passage around the sun? The substance composing the comet could be heated to a temperature of a thousand or two degrees without undergoing any change that could be detected with the telescope when the comet again came into view. It is possible to calculate the approximate temperature of bodies heated by solar radiation at different distances from the sun, and the evidence that the comet would explode is absurd, unless Mr. Warder's comets are made of gunpowder, a notion which is quite as reasonable as some of his ideas.

He makes no reference to the indisputable testimony of the spectroscopic evidence, which proves that the sun is surrounded by a dense atmosphere of metallic vapor which can only exist at an exceedingly high temperature. The presence of iron vapor in the sun's atmosphere is as definitely proven as the presence of salt in the ocean.

The electric waves which we are told come from the sun, are described as being exactly similar to the waves used in wireless telegraphy. As soon as they strike our atmosphere they are transformed into heat in some remarkable way—the precise mechanism of the transformation being left to our imagination. We are not told, however, why the same thing does not happen to the precisely similar waves used in telegraphing, which, according to Mr. Warder's theory, ought to be detected at the distant receiving station with a thermometer instead of a cadaver. It is quite true that the heat waves from the sun are similar to the electric waves, as I have already said, but we can measure their length, and we know that waves of such shortness and intensity as those coming from the sun can only come from a solid or liquid body heated to a temperature far hotter than the electric arc. Heat waves are about 1/1000th of an inch in length, while the electric waves which we employ in signaling may be hundreds of feet long.

Mr. Warder's theory, which he is so confident of, is a rather curious one. He is not saying that "it is better not to know anything at all than to know so many things that are not so."

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No pleasant mid-winter holiday trip could be planned. Details at this office. F. F. RUTHERFORD, 1222 Farnam St., Omaha, Neb.

RELIGIOUS.

St. Joseph's church, a \$50,000 edifice presented to the Italian colony of New Rochelle, N. Y., by Adrian Iselin, was consecrated on Sunday by Archbishop Farley. The papal delegate to the United States, Archbishop Falconio of Washington, will be the guest of St. Joseph's church in New Rochelle on the occasion of the dedication of the new cathedral of the immemorial Conception which will occur in mid-June.

The 100th anniversary of the death of Immanuel Kant is to be celebrated in Königsberg, Germany, his native town, on February 28. A bronze tablet will be placed in the "Dante's Keller" situated near the house in which Kant lived.

The prudential committee of the American Board of Christian Education received from the missions for the year 1904 call for \$200 more than the appropriations for 1903, but the committee is encouraged to hope that a generous response will be made to this statement.

Rev. J. J. Kuendig, pastor of St. John's German Lutheran church of Reading, Pa., has insisted upon a reduction of \$20 in his salary, the money to be added to the salary of his assistant, Rev. Philip J. Kirchner, who will receive \$1,000 a year. Rev. Kuendig is the oldest pastor in point of service in Reading.

ETCHINGS OF LIFE IN BOGOTA

Capital of Colombia Remarkable for Its Location and Other Things.

PERCHED IN THE HEART OF THE ANDES

Bullfighting a Highly Popular Diversion, and Sometimes Takes On an Extraordinary Form—Characteristics of the City.

A former resident of Bogota, capital of Colombia, relates in the New York Tribune some of the notable characteristics of the city. The most remarkable thing about the town, he says, is its location. Away off in the heart of the Andes, nearly 8,000 feet above the sea, at the end of a route comprising 600 miles of the treacherous Magdalena river and 100 miles of wild mountain trails, almost cut off from the rest of civilization, who would expect to find a city of 125,000 inhabitants—many of them dressed in the latest European fashions, with fine streets, houses, parks, public buildings, carriages, tramways and electricity—in a word, a modern city? The transition from a rude mountain inn, where travelers have been forced to lunch, to the Bogota Teatro Colon on the night of an opera, where he may spend that evening, is little short of startling.

Bogota is on a smooth tableland, about thirty by sixty miles in extent. This mesa is only 20 miles from the Pacific, but the great ridges of the Andes lie between, and the entire journey must be made in a saddle along primitive mule trails. The plain contains a number of towns besides the capital, the principal of which are Facativata and Zipaquira, with railroads to each. At the latter town is a large salt mine which supplies most of the country with the article, while here by are famous emerald mines—owned by the government, but leased to a French company, which supply the finest specimens of this stone to be found in foreign markets. The plain also abounds in iron and coal, and the development of La Pradera iron works, near the city, is on account of the difficulty of importing heavy machinery, such as railroad materials, a matter of great importance to the progress of the country.

The Country Around.

The ground is fertile and is laid out in haciendas, or farms, where are grown wheat, maize and the other staples of the temperate zone; while on market days men, women and pack animals come up from the adjoining valleys, laden with the produce of the tropics. Market day at Bogota, with its picturesque booths and heterogeneous throng, is, indeed, an interesting institution. A few street vendors to accommodate the multitude of buyers and sellers are among the projected improvements delayed by the recent costly civil war. This part of the country is very healthy, being free from the fevers of the valleys, though on account of bad sanitary conditions there is considerable typhoid in Bogota.

The temperature is about the same all the year around. "Winter" is the rainy season and "summer" the dry; there are two of each, and two crops can therefore generally be raised in each year. Numerous herds of cattle, horses and sheep find good pasturage on the plain, and hides are among the principal exports. The streams, as is natural at such a high altitude, are small but the Rio San Francisco, after flowing through the city, joins with the Bogota, and they together form a river of considerable size, indeed a torrent in the rainy season. This river flows over the side of the plain and drops 700 feet into an adjoining valley. This is the magnificent cascade of Tequedama, one of the greatest and most beautiful falls in the world. The Senores Samper, who are among the most prominent and enterprising of Colombian business men, have installed a plant in the rapids above these falls, to supply the city with electric power and when the country resumes its normal condition we may expect to hear of a complete electric light and trolley system in the Colombian capital. The streams on the other side of the ridge back of the city make their way by various tributaries to the Orinoco and the Amazon.

Mountain Peaks Around.

Bogota is picturesquely situated at the side of the plain in the shadow of Guadalupe and Monserrate, peaks rising 11,000 feet above the sea and so steep that it seems a stone could be thrown from either summit into the Plaza Bolivar. There are curious old churches on these heights, and the story runs that in the good old time the priests of the city required penitents to carry a stone up one of these mountains for each sin. When there were enough sins the churches were finished.

The city has a population which varies from 120,000 to 130,000, the shifting population being composed mainly of farmers, hunters and traders, who at certain periods bring their products to the capital, which is the great distributing center of that part of the country.

The general appearance of the city is picturesque and quaint to northern eyes, though some of the principal streets, such as the Calle Real, with their fine stores, tramways and bustling throngs, have a metropolitan aspect. The houses are generally built of adobe and have a thick, white stucco finish. The first impression of the town is that it is neat and trim, yet it must be admitted that useful hints could be given to the street cleaning departments of all Spanish-American cities. There are three delightful little parks in town, and these of us to whom "music in the park" is an important Sunday institution would not have to forego this pleasure in Bogota. All Bogotanos are fond of music, and these concerts by a good military band form a rendezvous for people of all classes. Another weekly or bi-weekly police band concert, particularly for the foreign colony, is the postoffice on the arrival of the foreign mail. The way the poor news-starved Americans devour the New York papers is pitiful.

Public Buildings.

The cathedral, Capitol and public buildings are all in the central Plaza Bolivar, which contains a fine statue of "the father of five countries." There are a number of grand native houses and a battery of restaurants in town, and the Italian restaurant near the opera is a pure joy to the travelers, who have been unable to take things as they came at the wayside inns. There are many churches throughout the city, all Catholic, with the exception of one American Protestant church, presided over by an American pastor. The city, indeed, in common with most Spanish-American towns, is a stronghold of Catholicism, and the priests are both preachers and teachers. While there is no obvious union between church and state there is freedom of religious worship, yet church and state are much more closely allied than with us. The president and high officials often march in the great religious processions—most interesting functions, which are viewed by the populace with reverence and veneration.

It is well for foreigners to follow the custom of removing the hat when one of these processions is passing, whether they believe in the creed or not. The writer once observed a foreign dignitary curiously viewing one of these spectacles from the curb, with his high hat firmly planted on his aristocratic head. The instant the procession had passed the hat was even more firmly planted, but the head was not so much in evidence. An outraged Colombian

had very properly jammed the hat well down over the ears.

The proportion of Spanish blood is greater in Bogota than in other portions of the country, though the Indians and mixed breeds still largely predominate. The lower class dress in the native costume, the distinctive features of which are a large cap, the Panama hat and the sandals. The people of the upper class usually dress as do New Yorkers, high hats and dress suits being in particular favor; and, like some American women, many of the fair Bogotans import their gowns from Paris. French is commonly spoken among the educated people, and English to a large extent. Indeed, many of the wealthy residents send their sons to the colleges of this country and England. This is more to show them the outside world than because the educational facilities of Bogota are inadequate. It is superior to most South American cities in this respect, having a university, several colleges, a school of music, and various schools of the arts and trades, in addition to the public schools. Attendance at the public schools is free, but not compulsory. The astronomical observatory is one of the highest and finest in South America. Those residents who can afford the luxury have villas in the hot country. It seems odd to a New Yorker to go away in the summer to get warm. The most popular and convenient of these warm valleys is Villita. This custom of going into the hot country once or twice a year to "temporarily," as it is called, can, indeed, hardly be called a luxury, for the climate of Bogota, although very invigorating at first, is so equal that it at length becomes trying.

The business of the city is, to a large extent, carried on by foreigners, the English and German interests being most important. Americans, possibly because they have more room at home, have not as yet secured a very strong foothold in Colombia, but it will be well for Uncle Sam to keep his eye on this coming country. There is little manufacturing in Bogota, almost all manufactured articles being imported. Cheap grades of cloth are made, two glass works were built after the mule trail had become pretty well covered with broken bits of the imported product—and the enterprising German who, a few years ago, started a brewery in Bogota and educated the natives in the manipulation of steins is now a millionaire.

Home Hospitality.

It is difficult for foreigners to gain admittance to the native social life. The old Spanish reserve and dignity have not by any means worn away in the Colombian; but one who has had the privilege of being invited to a native home, and the enthusiastic about the charm and hospitality of the Colombian home. The foreigners in themselves form a good sized colony, and the foreign ministers, who constitute the aristocracy of the plaza, keep virtually open house.

The brightly uniformed Indian soldiers—the officers alone being to any extent of Spanish blood—give a touch of color to the streets. It is a great mistake to think that the Colombian army is purely ornamental and that it is composed of "play" soldiers. The contrary is demonstrated by the fact that in the "late unpleasantness" 50,000 men were either killed in battle or died in camp. If the survivors are the fittest, then the present Colombian army is composed of hardened veterans, well trained in tropical warfare and immune to its dangers.

There are several gambling houses in Bogota, licensed by the government. Roulette is the favorite game, but the stakes are low and the amount of play in a month would not equal that in a night at Paris. Gambling, however, the government has also leased lottery privileges, but this industry became too popular and was suppressed. The Bogota cockpit is famous throughout the country. Much attention is given to the breeding of the birds. Semi-weekly mains are held, and the betting on these blood battles is much more spirited than at the gaming tables.

The Bogotanos are enthusiastic theatergoers and the two theaters of the city are crowded during the visits of the opera and dramatic companies. The Teatro Colon, built by the government at a cost of \$500,000, presents an appearance on the night of a popular performance which can favorably compare with that of any theater in New York. This theater is situated in the finest street in Bogota. A few steps away is the president's palace, a dignified and imposing mansion. The people often visit the president in a body and call on him for a speech, which he generally makes from a little balcony in the second story. In the present excited condition of Bogota over the Panama affair one may imagine the wrought-up crowds that daily crowd the street before the palace.

The Bull Fight.

But the function which most appeals to the heart of the Colombian is the bull fight. On holiday and Sunday afternoons the bull ring, on the outskirts of the city, is a common meeting place. It is built after the regulation pattern, a little balustrade—over which the bull fighter can vault when hard pressed—running around the ring and forming a little alley, beyond which the seats rise tier on tier to the boxes. The president's box is fitted up gorgeously and is generally occupied by the chief executive or some other official. A little boy dressed as a herald and mounted on a magnificent Andalusian horse enters the ring through a gate opposite the president's box and rides once around, to the applause of the expectant multitude. The bull fighter, in splendid array, then appears and is led by the herald across the ring to the president's box. Here the matador makes an elaborate speech, going through the formality of asking permission to proceed, and finishing by dedicating the performance to his excellency and tossing his cap to the people.

A whistle blows, a door at the side of the ring slides open, a bull rushes through, receiving from above two gaudy darts in the side of the neck, which make him lank in the middle of the arena, almost as one bound; the bull fighters distributed about the ring, tense and alert, watch his every movement; the bull looks from one to the other, uncertain which to charge. Finally one waves a bright scarf, the bull, with a snort, plunges at him and the fight is on. Sometimes the bull won't charge. In which event another animal is brought in, or a bucket of beer may be used to arouse the necessary fighting blood. These fights are conducted as are those in Spain, except that they are, naturally, on a smaller scale, and with the further exception that horses are only used on gala occasions. Horses are far too expensive and necessary an article in Colombia to be treated lightly. Human life, indeed, appears to be held far more cheaply.

While bull fighting appeals to all classes of Bogotanos, the lower element is particularly enthusiastic over the sport, and when there is no regular troupe of fighters in town the people often get up a fight of their own. This may be termed a "free-for-all" affair. One of the plazas in the suburbs is roped in, and a circle of enclosure is built. Anyone is at liberty to fight it, and at times over 100 men and boys will be in the enclosure at once. I witnessed one of these extraordinary spectacles from a conservative position up a tree. The bull charged back and forth through the crowd, tossing the people right and left; indeed, the plaza was so crowded that it was impossible for all to keep out of the way. Some would lose sight of the animal entirely. One man, thinking he was running away from the infuriated animal, suddenly found himself in the grasp of the bull's horns. Before I could get away a boy was also killed and many others were trampled and gored. It is a most curious sport.

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