

The Eclipse of 1869

The Man in the Moon wears a long black dunce cap of enormous dimensions, which he always keeps pointing away from the sun. Frequently, on his journeys round the world, as if in a mood for flirtation, he draws the apex of his cap across the face of Old Lady Earth in a great sweeping curve. With marvelous rapidity the great moon shadow travels thousands of miles and then passes off into space and invisibility.

Such a lunar flirtation is more commonly known as a total eclipse of the sun. That is to say, the moon travels in a direct line between the sun and the earth and so close to the earth that it completely covers the sun. The result is that the umbra, or the moon's dunce cap, makes a great shadow path which moves at the rate of two thousand miles or more an hour across the surface of the earth.

To an observer stationed in this path the sun is completely hidden for a very brief period varying from a fraction of a second to nearly eight minutes. The average duration of the "total phase" is about three minutes, so that the whole time consumed in a century throughout the world could be computed in hours. Making allowances for bad weather, unfavorable time of day, and inaccessible locations, it would be safe to assert that less than one full day in

a hundred years is available for the observation of total eclipses. Although expeditions have gone to the ends of the earth, astronomers have been greatly handicapped in securing scientific information on account of the limited opportunity of making observations.

The width, length, and location of the shadow path — the region in which the sun is totally eclipsed — depends upon the relative distances between the earth, moon, and sun as well as the obliqueness with which the line of centers strikes the earth. It might be a mere phantom line or it might be, “under the rarest combination” of circumstances, a hundred and sixty-eight miles wide. The shadow arc might fall anywhere in the world — indeed, as a rule the Man in the Moon is a bit shy in his attentions for he seems to favor the most inaccessible and out-of-the-way places. Sometimes, however, as on January 24, 1925, he throws discretion to the winds and boldly treats populous regions to an astronomical thrill that they will not experience again in centuries.

Only once since the occupation of Iowa by white men has a total solar eclipse been visible within the borders of this State. On Saturday, August 7, 1869, occurred an eclipse that is memorable both on account of the local interest it created and the unusual opportunities afforded for scientific observation. Not until 1999, astronomers say, will such a phenomenon again be observed in Iowa.

Beginning in the Pacific Ocean east of Japan shortly after sunrise, the shadow path swept northward in a long graceful curve to Alaska, whence it took a southeasterly direction, crossed western Canada, entered the United States in Montana, and reached the outskirts of civilization in northwestern Iowa. Passing across central and southeastern Iowa, Illinois, southern Indiana, Kentucky, Tennessee, Virginia, and North Carolina, the eclipse ended in mid-Atlantic late in the evening after having travelled nearly half way around the earth.

The United States Navy coöperated with the Coast and Geodetic Survey in sending a costly expedition to Alaska to make observations. Numerous parties, both private and official, representing many academic and scientific institutions, made elaborate preparations to study the eclipse all along the path through the settled portion of the United States, while thousands watched the phenomenon through smoked glass or improvised telescopes. Iowa was almost ideally situated. The sun would be near the zenith at the time of the eclipse, atmospheric conditions would probably be most favorable at that time, and facilities were available for the transportation of instruments and other necessary equipment. Several prominent astronomers established temporary observatories in different parts of the State, and it was in Iowa that some of the most important scientific work was done.

The Franklin Institute of Philadelphia, coöper-

ating with Professor J. H. C. Coffin of the United States Navy and Superintendent of the Nautical Almanac, took up headquarters at Burlington, whence small parties were sent to Mount Pleasant, Ottumwa, and Oskaloosa. This was chiefly a photographic expedition, whose principal object was to secure as many photographs as possible during the progress of the eclipse.

At Des Moines Lord Sackville A. Cecil of England collaborated with Lieutenant Commander William Harkness of the United States Naval Observatory of Washington. The Naval Observatory likewise established a station at Cedar Falls and another at St. Louis for the purpose of determining accurately the extreme northern and southern limits of totality. Professor James C. Watson of the University of Michigan was at Mount Pleasant, while at Jefferson a party of scientists, including such famous astronomers as Sir Robert Faulkner of London, James Douglas and Commodore Ash of Montreal, and Henry Vail of Philadelphia, conducted important experiments. The purpose of working at so many different places was to avoid adverse local weather conditions if possible. The activities of the various parties were so well coördinated, however, by previous arrangements, that there was very little duplication of effort.

Professor Coffin came to Burlington several weeks before the eclipse to make preparations and determine the exact latitude and longitude of the place.

The Franklin Institute party, numbering fifteen in all, were given free transportation from Philadelphia to Burlington. They brought a car load of apparatus which included two Munich equatorial telescopes of six-inch aperture equipped with clock work to move them with the sun, a Dolland four-inch telescope equatorially mounted, several spectroscopes, and considerable photographic apparatus. The larger telescopes were borrowed from Philadelphia High School and Pennsylvania College at Gettysburg, while the smaller instrument belonged to Pennsylvania University. Upon arriving at Burlington the city council extended the courtesy of the city to the "distinguished astronomers who come here to represent the United States government." Some of the men remained in Burlington but the others proceeded to the stations farther west where they had been assigned.

On arriving at their destination the first efforts of the scientists were directed toward the selection of a suitable site for making their observations and the housing of their equipment. In some instances an advance agent did this work of reconnoitering. An elevated position was usually selected, from which the view would be unobstructed by trees or other objects, and to obviate the interference of a low-lying haze or fog during the precious moments of totality. There was also some hope that a glimpse of the fleeting shadow of the moon might be caught from the heights, by those who might have time to

watch for it. Nor was an elevated position entirely necessary for the observance of the eclipse, which occurred in mid-afternoon at an hour when the sun was plainly visible from almost any convenient spot. Indeed, in Des Moines, the observatory was located on the site of the present courthouse which is on the flood plain of the Des Moines River. The eclipse stone marking the exact latitude and longitude of the spot still remains in the courthouse yard.

At Burlington a square of open ground was selected on South Hill, then owned by H. W. Starr and now included in South Hill Park. A suitable shelter for the telescopes and other paraphernalia was erected near the southwest corner of the tract. This building, which was typical of those constructed elsewhere, contained a main room ten by twelve feet in dimensions. That portion of the roof covering the telescopes was portable, so that it might be lifted off, set aside, and replaced again at the close of the day's operations. As pictures were also to be taken at this station two small dark rooms and a larger developing room were provided at one end in addition to the main room. These cramped quarters served as laboratories for the photographers, whose work in those days of wet plates was of a very exacting nature, requiring the highest type of training and skill. It was necessary to coat each plate with a special gelatine preparation, which in turn was impregnated with the silver nitrate solution, placed in the plate-holder in one dark room, passed out to the

operators who exposed the plate in the camera and returned it to another dark room where it was developed, passed through the fixing bath, washed twice, flowed with glycerine, and placed in the rack to dry.

These photographic parties consisted of four or five men — one or two who prepared the plates, one who operated the camera, another who timed the exposure, and the last who operated the developing room in which the process was completed. The very highest grade of work on the part of each man was required to insure the success of the entire undertaking, as a blunder on the part of any one of them might prove disastrous. They drilled themselves in team work, so that during the eclipse they might work with the alertness and precision of a machine gun crew. So well did they coöperate that at Burlington forty-one perfect negatives were secured out of forty-two exposures made. Indeed, the dark-room operators were the heroes of the occasion. Some of them journeyed hundreds of miles at their own expense for the purpose of observing the eclipse, and returned again to their homes, scarcely having caught so much as a glimpse of the total phase of that marvelous phenomenon, except for that which came to them through the medium of the precious sensitized plates with the development of which they were intrusted.

Miss Maria Mitchell, a noted astronomer of Vassar College, brought to Burlington a class of eight girls interested in the eclipse. Dressed in the height

of fashion, with their wide hoop skirts and tiny parasols, and schooled in ladylike demeanor, they lent a touch of romance to the occasion. No doubt they won the admiration of the young gallants of Burlington and became objects of envy on the part of neglected local maids.

At Jefferson, several days were employed in making a minute topographical survey of the vicinity before a site was selected east of the old fair grounds, on a hilltop beyond what is now the north end of Chestnut Street. The observatory building in Ottumwa was erected on a high prominence in a plot proffered by John Devans. For years thereafter the place was known locally as "Observatory Hill", in the vicinity of High Point Chapel on Elm Street.

At Oskaloosa a small party of scientists went out into the open country adjacent to town, keeping their instruments in a small brick dwelling a short distance west of "Oskaloosa College", while another local party viewed the eclipse from the roof of a new three-story skyscraper which had just been completed at the northwest corner of the public square.

It is not known for certain just where the main parties were located in Mount Pleasant. Some of the visitors stayed at the home of their old friend, J. H. Whiting, at the corner of Lincoln and Henry streets and made use of the flat deck roof of his dwelling for their instruments. Prof. E. C. Pickering, of the Massachusetts Institute of Technology,

connected with the party sent out by the Nautical Almanac, conducted his experiments from the corner room on the third floor of the four-story Brazelton House which afforded an unobstructed view to the west. On the roof above, astronomers labored at one corner, while at another place sat a small group of religious fanatics, "arrayed in their ascension robes of spotless white", silently awaiting the end of the world.

At Cedar Falls observations were in charge of Dr. Asa Horr, of Dubuque, President of the Iowa Institute of Science and Arts, assisted by Wm. I. Anderson and W. W. Wormood. As the object of this party was to determine the extreme northern limit of totality, a line perpendicular to the path of the eclipse was established with the greatest of care, passing through the cupola of the old Soldiers' Orphans' Home. Using this cupola as a starting point, competent observers were stationed at intervals of one-half mile in both directions. It was their duty to obtain the exact duration of totality in seconds, by means of a stop watch. Thus the approximate dividing line between the total and partial phase of the eclipse could be determined.

W. S. Gilman, of New York, equipped with a four-inch telescope, made observations for the Washington naval observatory at St. Paul Junction, near Sioux City. At Cherokee, J. Blickensderfer took amateur time observations with unusual care, using a telescope with a three and three-tenths inch aper-

ture. William Pilger of Burlington, who still resides at 715 Elm Street, used to good advantage a two-inch telescope on North Hill. In Linn County J. W. McClellan, superintendent of the public schools at Marion, made some valuable investigations on his own responsibility, toward ascertaining the north line of totality. He determined that this line ran diagonally through section 16, township 85, range 6, west of the Fifth Principal Meridian.

In every community and at almost every fireside for weeks in advance the coming eclipse was a common topic of conversation in Iowa. The event was also freely discussed in the columns of the newspapers, and much valuable information as well as some misinformation was disseminated concerning nature's free exhibition. The interest created by witnessing the eclipse started more than one young Iowan upon a career of science.

In nearly every city, groups of citizens met for the purpose of viewing the phenomenon. Such telescopes as were available were used, while field glasses and surveyors' instruments were likewise pressed into service. Many watched the eclipse with the aid of a piece of colored glass, amber or violet being commonly employed, while the "rank and file" used only a smoked glass made by coating a fragment of broken window pane with the soot from a lighted candle or the flame of a kerosene lamp. These makeshifts sufficed to shield the eye from the intense light of the sun, and in fact afforded the ob-

server about as good a view of the eclipse as might have been obtained with more elaborate paraphernalia.

At Keokuk many house-top parties assembled to witness the eclipse; an especially notable one taking advantage of the broad roof of the Estes House, while at least one group went far afield to secure a suitable hill for their observations. Like distant pastures, each hill beyond seemed a little higher, and so the party strayed on and on through "fields of fragrant clover" until the eclipse was upon them before they realized it. Without a moment's delay they were compelled to set up their instruments hastily upon the spot where they were, having passed many superior locations.

While the eclipse was in progress the sky changed from its usual azure to a livid purple or violet tint. "The color of the surrounding objects", one authority stated, became "yellowish or of a light olive or greenish tinge", and the figures of persons assumed an "unearthly cadaverous aspect". The reflections of the sun falling through the leaves and branches of the trees upon the ground or upon the sides of buildings, changed gradually from their usual circular form to the shape of the crescent, caused by the moon overlapping the sun. As the eclipse advanced, a marked decrease in temperature was noticed. At Des Moines a drop of 13° Fahrenheit was registered by J. R. Eastman and at Mount Pleasant the temperature fell from 40.8° centigrade

to 24.7° centigrade, while at Cedar Falls a light dew was precipitated as a result of the cooling of the atmosphere. Just before the moment of totality strong air currents were felt — also the result of the rapid cooling of the air within the area of the shadow path.

A few minutes before obscurity, as well as at the close of the total phase, remarkable wavering “shadow bands” were observed. From an elevated position, the moon’s shadow could be seen sweeping across the landscape and in an instant enveloping all in its uncanny darkness. At Keokuk, a local observer reported that he was able to discern one of the brighter stars for a period of ten minutes after the close of the total phase.

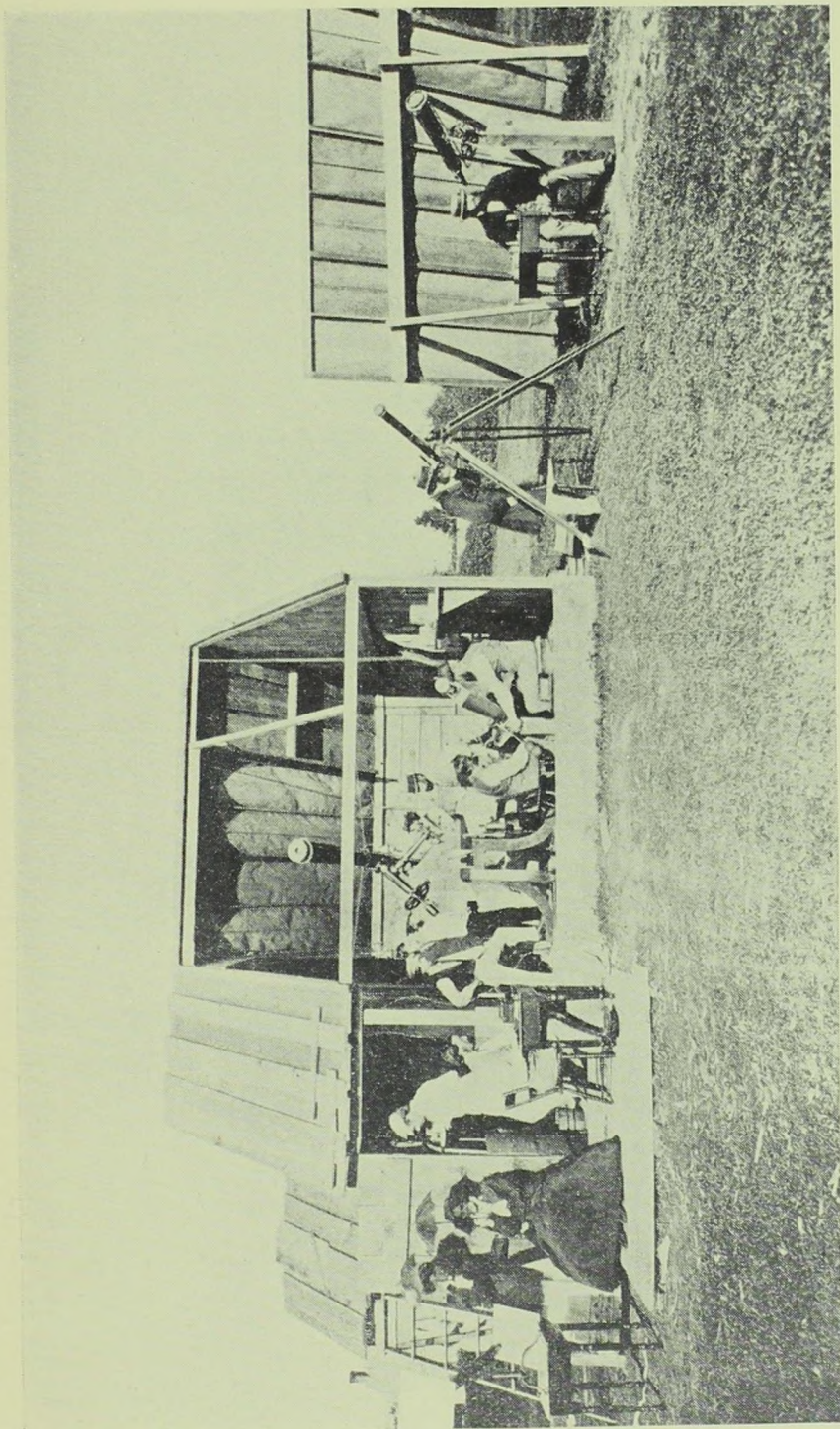
The darkness, however, was somewhat less intense than that which prevails at night in the presence of a full moon, though it appeared greater on account of the sudden transition from day to night. The twilight of the eclipse resembled but little the darkness of night. It was attended by unnatural, ubiquitous gloom tinged with green, red, or yellowish crimson. The sky in Iowa was clear and bright at the time so that no light was reflected from clouds to destroy the full effect.

At Des Moines the duration of the total phase, as registered by T. H. Safford of Dearborn Observatory, was two minutes and fifty-two seconds. A discrepancy of from six to twenty-two seconds was noted in the time of the various phases as calculated

at Washington years in advance. A part of this difference might be accounted for by an error in securing the time, which was taken by telegraph from Springfield, Illinois.

It is safe to say that of all the phenomena of the heavens, there is none that has so engaged the attention of mankind as have solar eclipses. In ancient times, their prediction and observance was made a matter of state policy in order to operate upon the fears of the ignorant and impose upon them a superstitious regard for the occult wisdom of their rulers. Even among civilized and enlightened people a total eclipse of the sun is an awe-inspiring spectacle, capable of filling all who are privileged to witness it with a feeling of wonder and foreboding. In this respect the eclipse of 1869 was no exception to the rule, particularly in rural or frontier communities such as Iowa.

Live stock early sensed the approach of the eclipse, and the cattle went bellowing about in an uneasy, restless manner seeming to fear the approach of some impending danger. As the eclipse advanced, they gathered in groups as if in preparation for nightfall or made their way toward stable or shed according to their custom. Birds flocked together and, flying ceaselessly back and forth, uttered shrill calls to each other as if in conference before autumn migration. Chimney swifts, circling about their chimneys, finally dropped in one by one as for the night. Poultry also became noticeably



THE BURLINGTON OBSERVATORY

disturbed by the weird effect of the oncoming darkness. Old hens ran about frantically, clucking their alarm to their distracted chicks, and gathered their broods under their wings as if making ready for the unexpected night. Chickens, turkeys, and other barnyard fowl sought their roosts, wondering no doubt who moved up the clock and compelled them to go to bed on half empty gizzards. In some instances dogs, creeping close to their masters, barked or howled pitifully. Finally, as darkness advanced and the temperature fell, the chirp of the crickets added to the weirdness of the scene and the call of the whip-poor-will came from the distant woodland.

Fifty years earlier in Iowa the eclipse of 1869 would have witnessed naked savages dancing in circles, furiously beating their tom toms, shooting burning arrows at the great, open-mouthed dragon about to devour their sun, or chanting incantations imploring the intercession of the Great Spirit. Instead, it is alleged, strong, rugged, self-relying, often blasphemous pioneer men suddenly became reverent. Some of the women of more timid nature became hysterical, while crying children tugged frantically at their mothers' aprons. Older children in the country, who were playing or gathering berries in the timber, ran "straight for home", stopping neither for rail fences, bushes, nor creeks in their haste to reach a haven of refuge, while the "town kids", more sophisticated than their country cousins, exhibited great hilarity, emulating in their

vociferous yelling the cheers of their elders on the house tops.

The occasion was not without its humorous aspect and many amusing incidents are told. A corpulent old colored mammy seen running up an alley toward her home in a very disheveled condition was asked where she was going in such haste. She paused long enough to shout, "The good Lord hab' sent fo' us an' I'se a gwi'an." An observer at Mount Pleasant narrates the case of a man who went about town for days beforehand, denouncing the impiety of the scientific preparations, asserting that the astronomers were profanely attempting "to pry into God's secrets", and that He had "veiled His sun in order to baffle them". The cloudy weather which continued up to the day of the eclipse seemed to give some support to his opinion, but, notwithstanding his declaration that "God would keep His rain a-going" and prevent the use of their "irreligious telescopes", the day was perfectly clear. Another local prophet announced that "the eclipse was a judgment upon the world for its abominations, and that the path of its shadow over the earth would be marked by utter blight."

The eclipse made a deep impression on those who viewed it. Important family events were often spoken of as occurring so long before or after the great eclipse. Only a few, perhaps, of those who witnessed the event remember the exact date, or even the year, but nine out of ten in speaking of the

subject begin by saying, "That was the time when the chickens went to roost". Of all the impressions associated with the eclipse, that was the one thing most indelibly stamped upon their memories.

The eclipse of 1869 is chiefly noteworthy for the scientific discoveries that were made. Conditions for observation were almost ideal in Iowa. The sky was clear and totality occurred in the afternoon when the sun was in a very desirable position. Photography, crude as it was, probably contributed most in revealing new information to physicists, astronomers, and chemists. The Hover Brothers of Mount Pleasant working under the direction of Professor Pickering, J. C. Browne and W. J. Baker at Ottumwa, and Mr. Libby of Keokuk obtained clear pictures of the corona — the first ever taken in America. Partly from these photographs and from other data it was definitely ascertained that the corona is a permanent object definitely associated with the body of the sun. The existence of coronium, a hypothetical element in the corona, was described by William Harkness at Des Moines and Professor C. A. Young at Burlington. Young also observed that the principal corona lines coincided with certain aurora "iron" lines.

At Ottumwa, the first authentic photograph of the phenomenon known as Baily's Beads was secured. This is an illusion observed just before the precise moment of totality, and is caused by the light from the narrow rim of the sun being broken into small

sections by the mountains of the moon. The light, shining down the valleys of the moon, appears as a "strand of a glorious necklace of pearls".

But while the scientists were making the best of the splendid opportunities for which they had made such elaborate preparations, thousands of men and women, unconcerned with astronomical problems or the interpretation of the spectacular event, watched with reverence and fascination the obedience of the two great luminaries to the eternal laws that govern them.

BEN HUR WILSON