University of Notre Dame
and
The 1874 and 1882 Transits of Venus

by
ROBERT J. HAVLIK, LIBRARIAN EMERITUS
UNIVERSITY OF NOTRE DAME

[Note: For *University of Notre Dame and the Napoleon III Telescope* see napoleon3.htm.]

I am pleased to be able to address you at this Sixth Biennial History of Astronomy Workshop at the University of Notre Dame. One of the highlights of the Workshop has been our after banquet walk to the Nieuwland Science Building to see the 1898, Warner & Swasey remount of our 1867, six-inch Napoleon refractor. This is the latest invitation for you to come and visit our telescope which in 1867 was heralded as a "magnificent gift" from his Imperial Majesty Napoleon III.

For the past dozen years I have had the pleasure, as a hobby, to try to dig out the history of this telescope and the early history of astronomy classes at our University. I want to thank Mike Crowe and Matt Dowd for allowing me to present some of my findings during past Workshops.

We have been lucky most evenings during our visits, to have had clear skies and on occasion have been able to train the telescope on the planet Venus. This brings us to my commentaries today.

In a little less than a year from now, June 8, 2004, there will be another Transit of Venus. This is an event that occurs, at most, only twice in an astronomer's life and is eagerly looked forward to. For us in the Midwest, this will only be half a loaf in 2004, since we will not be able observe Ingress t^1 and t^2. However, I am sure the astronomers at Notre Dame will engaged in observing the transit and I am trying to arrange to utilize our old telescope in some way to commemorate the occasion.

The two previous transits were on December 9, 1874 and December 6, 1882. They occurred early during the history of our University and our telescope. While only the 1882 Transit was visible in the Midwest, the University students and faculty, as well as the general public, were interested in both Transits. From a publicity stand-point, the more important of the Transits was the one of 1874. Our telescope was still new,

one of the largest in the State of Indiana, and offered promise of a foundation for an outstanding astronomy program.

OUT OF SIGHT BUT NOT OUT OF MIND -1874

One of the leading advocates for the telescope and the teaching of astronomy was Brother Peter (John Fitzpatrick) who had come to the University in 1856, and was assigned the duties as, "Postmaster and storekeeper accordingly at the Post Office where he will sell books to the Congregation."

Because the school was small and needed all the help it could get, he also took on the duties as grounds keeper and taught surveying and astronomy classes.

The "Napoleon Telescope" came to the University in 1867 and through the efforts of Brother Peter, a temporary observatory was established for it in the garden in front of the main building. The telescope and the observatory were administered by Prof. Timothy Howard.

Brother Peter took his astronomy assignment to heart. His early interest in astronomy is noted by his construction of several vertical sun dials for the University and affiliate institutions. With the acquisition of the telescope and acquisition of several classical astronomy books, during the school year 1871- 1872, Brother Peter began to write articles on popular astronomy for several newspapers. At the time popular interest in astronomy was very high, and the approaching transit of Venus was of special interest.. The first of a series of 13 articles on the History of Astronomy were written for the University newspaper, The Notre Dame Scholastic. This collection was earlier reproduced and distributed to attendees of the 5th Workshop.[1] In it reference is made to the coming Transit of Venus and efforts in the past to calculate the distance of the sun from the earth.

In 1872 the Holy Cross Order, opened an institution for boys of all ages in Watertown, Wisconsin.[2] To help organize the school, several members of the Notre Dame Community were recruited for the faculty. On May 25, 1874, the State of Wisconsin issued a charter to the "University of Our Lady of the Sacred Heart." The institution was more commonly called the "College of Our Lady of the Sacred Heart."

At some point Brother Peter was enlisted to aid in the planning of the campus. Wishing to continue his success as a writer on popular astronomy, and further the cause of astronomy he wrote an extensive two part article on the coming transit which he managed to have published in the Watertown, Wisconsin, Republican.[3], [4]. These articles were picked up by several mid-west newspapers and contributed much to the interest in the Transit in the mid-west. As a follow-up he also published a monthly column on astronomy in the paper.[5]

Brother Peter's other love was naturally for his Church and in his paper on the Transit he pointed out that the Transit would occur one day after the second anniversary of the promulgation of the Dogma of the Immaculate Conception by Pope Pius IX. This point was duly noted by the Catholic Community in the mid-west and has not been fully recognized by historians as contributing to the popularity of astronomy at the time.

In the year 1874 the center of astronomy research between the two Holy Cross institutions was the Chicago area. On the evening of the Transit the Academy of Sciences in Chicago held its regular monthly meeting, and Mr. Elias Colbert, who was a prolific Chicago writer and amateur astronomer, aptly described what was occurring on the other side of the globe, at that very time. His remarks were duly recorded by the Chicago Tribune explaining why the sight was not viable from the mid-west.[6] In his presentation Colbert lamented that because of the Great Chicago Fire in 1871, Chicago was unable to take a part in the work on the Transit. This experience also was strangely predictive of the effect fire would have on any research programs the University might have had for its telescope during the 1882 Transit.

DISASTER

On April 23, 1879, the entire Main Building of the University was burned to the ground, including the Library and all the records of Brother Peter's articles, astronomy classes, and the use of the telescope for scientific purposes. The telescope, not being in the building was unharmed, but was displaced when the observatory was used to store rescued materials from the fire. However, it marked the beginning of a dislocated history of its location on campus for a number of years.

In the process of recovery of the University, other matters took precedence over the telescope. It was not until September 21, 1879 that the observatory was cleaned out enough to use the telescope to observe "the purple spot of Jupiter." Although a new "tripod with equatorial adjustments" was made for it, and the telescope was cleaned, it was put in storage to await the building of a new observatory. Unfortunately ground was not broken for the new observatory until October 1891, well after the second transit, and other telescopes had to be used during the event.

The meagerness of comments and manuscripts on astronomy in Brother Peter's, Prof. Timothy Howard's and Prof. Arthur Stace's files in the University Archives is also an indication of the loss due to the fire. Brother Peter's articles printed here in the endnotes had to be tracked down through non-local publications and borrowed on Inter-Library Loan.

Because of the peculiarities of the orbits of Venus and the Earth, Brother Peter would have had to wait only 8 ½ years for the next Transit, but unfortunately he died on January 17, 1881.

THE TRANSIT OF 1882

Because of poor observing conditions and other problems, the Federal government expeditions of 1874 were not very successful, and interest in using future transits as a method for determining earth to planet distances faded. The publicity and popular astronomy interest in the 1882 event was much less than in 1874. This change in interests also affected Notre Dame. In 1882 the telescope was still in storage. However, a Department of Astronomy had been founded, and Prof. Stace, a trained astronomer, was put in charge of the program. The astronomy program's function, however, was primarily oriented toward mathematical instructional rather than observation. The telescope remained in the charge of Professor Howard**,** who now, in addition to his university duties, served as county surveyor for St. Joseph County, Indiana. Observation was left in the hands of students and a campus astronomy club which utilized various small telescopes on campus.

In preparation of the 1882 event the campus astronomy club organized four groups to coordinate their observations. The groups were called:

1. The Bureau of Astronomy
2. The Committee on Local Time.
3. The Committee on Atmospheric Disturbances.
4. The Committee on Parallax.

The Bureau of Astronomy was the most active of the Committees[7]

December 6, 1882, began cloudy as reported in the South Bend Tribune, but by 10:00 AM the sky cleared. The report of the Committees appeared in the next issue of the Notre Dame Scholastic:

De Venere in Sole Spectata

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MATER SAEVA CUPIDINUM - Horace

_____

Be careful, saucy Cupid, how you frisk,
And keep your garments on, and give no lip, or
Your ma'll perform a transit on your disk,
By frequent applications of the slipper.
— Ourself.

The eventful 6th of December, 1882, has come and has passed away. If the solar parallax has not been ascertained, the probabilities are that the present generation will never ascertain it.

In the Bureau of Astronomy, business commenced at an early hour. The Board was in session at half-past seven.

Some distinguished members of the Law Class were the first to make their appearance. They wanted to know if a "Stoppage in Transitu" could not be effected. The Secretary, however, promptly gave them to understand that all attempts at intimidation, legal or otherwise, would be severely frowned down. The exhibition at which they were preparing to assist was regulated by a "higher law."

The Committee on Local time were active in endeavoring to communicate with Washington by telegraph, so as to secure the necessary corroboration to the testimony of their own chronometer. But the electrician was, unfortunately, absent, and the amateurs who volunteered to supply his place did not seem to "catch on," as it were. At length, they concluded that the apparatus must be out of order.

The fateful moment was now approaching. Enthusiasm, in some cases rising to frenzy, was manifested by the crowd surrounding the telescope. Still the heavenly bodies were veiled by slowly dissipating clouds.

At nine (9) a.m. the Committee on Atmospheric Disturbances reported indications of a squall arising in the Sow-Sow-West, and a little more Sow. They hoped that this would clear the sky. On examination, however, the squall proved to be of a domestic rather than a meteorological character, being the natural result of a spanking a refractory child on Lowell Heights.

It was then proposed to ring the big bell, so as to break up the clouds. Some members of the committee were of the opinion that this would break them down rather than up. During the debate, the clouds became sufficiently attenuated to allow furtive glimpses of the sun to be obtained, and the planet was already performing her transit. At a quarter past ten (10:45) everything was serene.

Venus was looking extremely well, considering her age. Not a wrinkle appeared to mar the charming embonpoint of her exquisite contour. How much of this is natural, of course, we will not pretend to say. She never once seemed to lose her self-possession, in spite of the numberless telescopes levelled at her. Mrs. Langtry has here a formidable rival, where perhaps it was least expected.

We are happy to say that the old scandals once associated with the name of Venus are now regarded as more mythological fables. She has completely regained her social position, and moves in the highest circles. The decorum with which both she and the Sun conducted themselves on this trying occasion cannot be too much admired. There was nothing in the performance which could raise a blush to the cheek of the most fastidious.

We must not conclude this article without giving due praise to the various committees for the manner in which the affair was conducted. The Committee on Parallax will report as soon as they hear from the Cape of Good Hope, or some point in South America.

As you can see, the article is not as serious as the reports of the 1874 Transit. However, it reflects other newspaper reports of the time which made more jokes about the mythological Venus than reporting the scientific value of the event. An article in the South Bend Tribune is an example.[9] There is strong indication that this article was written by Professor Stace of Notre Dame for the newspaper:

The Transit of Venus

The TRIBUNE's astronomer smoked a glass instead of a cigar this morning, got a handkerchief to blindfold his eyes in case Venus went to acting anyways immodest when slipping across the sun's face, and made all other preparation's to see the sun's female minstrel show. His vivid imagination pictured his goddess of love stalking down across the Sun's face in just a garden of Eden suit, and he was as disappointed as a bald-headed man who had git a front seat, and the mayor stops the show, when he found that the morning was cloudy, and the show was going to be a sort of sick transit Venus affair. Towards ten-o'clock the clouds cleared away, as if in answer to the prayers offered up all over the country last Sunday, and the sun came out bright as a day in June. Smoked glasses, opera glasses, blue and green spectacles, telescopes and spy glasses were leveled at the "orb of day" and there was for everybody a good view of the transit. The TRIBUNE astronomer was terribly disappointed. Instead of seeing a young and lovely lady resting across the face of the sun, yum yumming, there was a mere round speck of black down near the lower edge of the orb. The sun, in fact, looked like a new silver dollar with a hole near the edge. Venus is a fraud, except to high-toned astronomers.

CONCLUSION

In conclusion I should like to say that over the past few months, messages, comments and requests have been appearing in HASTRO-L , regarding the role and comparison of popular and academic astronomy in the nineteenth century. This is truly an important topic.

The Transits of Venus in 1874 and 1882 were two dramatic land marks that took place at a nexus in the history of astronomy in the United States. The contrast in attitudes demonstrated here in a small Indiana town and small Catholic University is just a camera of what was going on in the field at the time. Other accounts will contribute further to the clarification of the situation.

We have a year to go before the next Transit of Venus. We have undergone still more changes in scientific techniques and public interest in astronomy during the twentieth century. Let's use the time still available to collect more of these nineteenth century local accounts while they are still accessible. As a result we may also have a solid base for the future analysis of our twenty first century attitudes and approaches to astronomy.

END NOTES

1. Brother Peter (John Fitzpatrick) A Minim Almagest on the History of Astronomy as published in Notre Dame Scholastic 1871-1872. Introduction by Robert J. Havlik. 2001.

2. Cullen, Franklin Sacred Heart College, Watertown, Wisconsin, 1872 - 1912, Prepared for the Eighth Annual Conference on the History of the Congregations of Holy Cross, Stonehill College, North Easton, Massachusetts, June 16 - 18, 1989. 31p.

3. Watertown Republican, November 4, 1874.

The Coming 8th of December, 1874

The 8th of December, 1874, is a day that is looked forward to with anxiety and hope, since the 24th of November, 1639. An event took place on that day which was expected by one only out of the whole human family. Mr. Horrox, a young English gentleman, who was an amateur had devoted himself to the study of astronomy, had satisfied himself by calculation that on that day the planet Venus would pass between the sun and the earth, or in other words, there would on that day be a transit of Venus across the face of the sun. He notified his friend Mr. Crabtree, residing in another part of England, and who had also devoted himself to a similar course of studies, to observe the sun on that particular day. These two gentlemen, in different parts of England, distinctly observed a small black ball enter upon the sun's face and slowly pass across his entire diameter, in the same manner as if it were an ordinary eclipse. This was the first transit of Venus that had ever been observed, and caused the name of Mr. Horrox to become famous all over Europe. Unfortunately for science, his early death in 1640 put a period to the hopes that were entertained of his future renown.

The great astronomer Kepler had predicted that there would be a transit of Venus in 1631. But no eye had seen it, and in 1639 it had not occurred to any one to use it for the purpose of discovering the distance of the sun from the earth. After the last named date, astronomers began to calculate for the next transit, and they discovered it would take place in 1761.

In 1677, when Mr. Halley, the great English astronomer, was at St. Helena for the purpose of forming a catalogue of the stars in the southern hemisphere, he observed a transit of Mercury across the sun, and from his efforts to measure its position was induced to form the opinion that if a transit of Venus could be properly observed it would afford a precise determination of the sun's distance, he knew he could not live to see the next transit, but he did the next best thing, he studied out all the conditions of the question, published all his plans, and made all necessary calculations, so as to aid, as far as possible, in obtaining the best results when the proper time arrived.

As the year 1761 approached, Halley's computations were closely criticized and such alterations made in them as were warranted by the advance in science and the improvements in instruments called for. The various Governments of Europe gave their aid and ships to convey the observers to distant parts of the globe. One hundred stations were selected, and great expectations were formed of the results; but all was to end in sad disappointment. There were wars in those days, and observers were refused permission to land at some far-distant ports. Cloudy weather interfered with observations at these stations, while at others, almost at the point of contact, the observers had their instruments set, their eyes to the glass, the black spot was seen to approach the edge of the sun, in a moment more the instant of contact would have been noted, when on a sudden a black wedge-like shade passed between the sun and the observer, shutting out the moment of contact. When this mysterious shadow passed away, Venus has advanced from 12 to 15 seconds of time on to the sun's face; the great point of the expedition was defeated. The observer was confounded and disheartened, but he consoled himself with the reflection that others might have done better, and that he alone was unfortunate; Alas! It was not so. All had met the same fearful disappointment. Skill, labor, time, money, all spent to but little advantage. The only consolation that could be given was that in eight years more there would be another transit, and bu that time some means would be devised that would secure success in the future.

In 1769 the stations were an numerous, the Governments' aid as liberal, the instruments

were thought to be more perfect, and the observers as enthusiastic and careful as before, and perhaps more skillful from their experience. But, again, all in vain! The world of science was doomed to another and more bitter disappointment. More bitter from the fact that 105 years must pass away before a third opportunity would offer to clear away the mystery of that dark veil, with the nature of which astronomers are not to this day agreed. Every precaution then known to science was employed to secure success. Again the black ball was seen to approach the edge of the sun, and while at a distance of ½ its own diameter, the disk of the sun seemed to tremble and a dark streak or band seemed to interpose between them like a black cushion; as they pressed against it, the curved outlines of their edges seemed to be pressed back or flattened, as if by the resistance of the cushion, and lose their normal shape. There was a pause in the onward movement, a quivering motion and then by a convulsive jump like that of two drops of water coalescing into one, Venus was seen to have entered some way into the disk of the sun. The resulting uncertainty was even greater than that of the former observations; it was held to reach fully twenty seconds.

When they afterwards undertook to calculate from such observations the distance of the sun, some made it not more than 87,890,780 miles, while according to others it reached 108, 984, 560 miles the majority finding intermediate values. On the whole, it did not appear that there was much improvement on the estimate made by Cassini a century and a half before, - viz.: that it was not less than 85,000.000 miles.

The records of observations were scrutinized and weighed, and the calculations based upon them repeated and criticized. The great Encke, in 1824, after several years of special study of them, summed all up and gave as the best result attainable 95,274,000 miles. The scientific world, hopeless of anything better, seemed for the time to acquiesce, as there could be no sensible doubts of its accuracy.

But its accuracy has since been impunged, and on very strong grounds. It was known that light travels from the sun to the earth in 8 minutes 13 seconds. Experiments carefully made Arago, Foucault, and Fizerau, show that light travels at the rate of 186,000 miles per second. This would give the distance about 91,400,000 miles. Le Verrier, the discoverer of the planet Neptune, and Mr. Stone, made it 91,730,000; while Hansen the Dane found it 91,659,000 miles.

This is the position of the question now, and our astronomers aim to obtain a yet more precise and definite result. Will they succeed? They are full of confidence now. What will they say a year hence? Time, learning, skill, energy money, everything that man can give, will be devoted to ensure success in the astronomical work to be done on the 8th of December next.

The astronomers will follow two methods, known as that of Halley and Delisle. They each require two stations, so far apart on the surface of the earth as to give a satisfactory base line. In fact the farther apart the better, all things else being equal. For Halley's method, the two stations lie as nearly north and south as may be. For Delisle's they lie east and west.

Let us suppose two stations to be chosen, on or nearly on the same meridian of longitude, and 6,000 miles apart. From each of these places the planet is seen to traverse the disk of the sun, like a dark spot moving steadily across an illuminated dial-plate. The lines as seen so far apart are sensibly different. What the observers first seek to know is the apparent distance between these lines, and the angle they form when seen from the earth. Were both seen at once from the same station, with the same telescope, it would not be difficult for a skilful (sic) observer to measure the angle directly; but at each station only one line is seen, if indeed we may give that name to the course of the black spot that passes on and leaves no trace behind. Each observer must determine the correct position of his line across the face of the sun, in order that it may be afterwards compared with the other line similarly determined by calculation.

The English observers are now assembled at Greenwich Observatory, in London, undergoing a course of training for the grand day. They have a *fac-simile* of the sun and Venus, which are made to move in such a manner as to give as exact a representation of the transit as

possible, and they practice observations on this artificial transit. It is said that even in this *fac-simile* the black band has shown itself, and that one important lesson now being learned is how to judge of the instant of contact despite this obstacle.

There is, however, another and still better safeguard - the use of photography. The transit will record itself more minutely and more accurately than any other observations for measurement could do. The stereoscope comes in also, to aid in determining with the utmost precision the moment of contact.

It is confidently expected that by some one or by all of these methods the mistakes of 1761 and of 1769 will be avoided, and that the instants of the commencement and conclusion of each line of the transit may be so accurately determined that for neither of them will the error of their duration exceed one second.

Did the time occupied by Venus in making the transit, as seen at one station, differ from the time as seen at the other by only one minute, the uncertainty would be less than two per cent., but in fact the time will differ by 15 minutes, and by skillfully choosing the places a difference of twenty minutes may be obtained; in that case the error or uncertainty would be less than one per cent. For the present, the scientific world will be satisfied with that degree of exactness.

(To be continued) Watertown Republican, November 4,

4. Watertown Republican, November 11, 1874.

Transit of Venus

(Continued)

While each of the before-mentioned methods require at least two stations, a greater number would control and support each other, and allow us to take the average result of a greater number of observations. Four stations at the corners of a large quadrangle on the surface of the earth might give two sets of stations for each method. But this year the stations may be nearer to one hundred. Careful preliminary studies have already determined on what portion of the earth the transit will be visible. The most available points will be turned to account for stations. Some of the best points too, seem almost inaccessible, still there is a vast line of posts determined on in the northern hemisphere, and quite a number to correspond with them in the southern. Beginning at Alexandria in Egypt, the line stretches northward and eastward through Palestine, Georgia, Siberia, Tartary, Middle Asia and Northern China to Yeddo in Japan; perhaps to Honolulu in the Sandwich Islands. Along a great part of this line the Russian telegraphic wires will give exact longitudes, thus affording a fine field for the use of the Delisle's method. In the southern hemisphere, the line may be set down as commencing at the Cape of Good Hope, bending southeastwardly to the lately discovered Antarctic lands, passing south of Australia, then turning upwards towards the equator, and terminating at Nukahiva in the Sandwich Islands, in the south Pacific Ocean.

Southeast of the Cape of Good Hope, and lying in about the 48th degree of latitude, and on an east and west line, are situated the islands of Prince Edward, Crozet, St. Paul, Reunion and Kerguelen Lands; and further south if the southern summer will have sufficiently melted the snows, and driven back the ice-barrier to allow the observers to land and work, at Campbell' Land in New Caledonia, and in other places, stations will be placed, between which are corresponding stations in the northern line in Central Asia, north of the Himalaya Mountains, Halley's method will be carried out. The distance between several of these northern and southern stations will exceed 6,300 miles on the same line of longitude, while the distance on an east and west line from the shores of the Black Sea to Yeddo in Japan, will give 7.000 miles on which the principles of Delisle can be tested to their utmost limits, being aided by the Russian telegraph

through the Amoor country and Southern Siberia. It is not alone the determination of the distance of the sun from our earth that it is hoped to establish by these stupendous operations, but that the distance of some of the stars may also thereby be determined. To know the size of a star, its distance must be determined. The problem given to astronomers to solve in determining the distance of the stars was one of stupendous difficulty. It was to be determined by observations made in different parts of the earth's orbit, separated by 180 millions miles of space. All stars except nine or ten remain unchanged in direction. But what must be their distance when a change of 180 million miles in the place of observation causes no perceptible change in their direction.

The star Alpha Centauri is 210,000 times more distant than the sun. Another star, 61 Cygni, which was estimated to be three times the distance of Alpha Centauri, astronomers have since found not to be three times, but twice the distance. Now here was an error of 210,000 times the distance of the sun from the earth, and yet their error in instrumental measurement was so small that it could scarcely be appreciated, for at the present there is no way known to tell the size of a star, only by measuring its light. The star Alpha Centauri has been found to shine with the 17-millionth part of the sun's brightness. If the sun were removed to the distance of that star, it would be the 40-millionth part of its present brightness. That star would shine three times as brightly as the sun does if it were placed beside it, and its surface is five times that of the sun's. All this supposing the surface of the same intrinsic brightness as the sun. Centauri is 15 degrees east from the Southern Cross, and 30 degrees from the South Celestial Pole. The king of stars, Sirius or the Great Dog Star in "Canis Major" is 100 times as bright as the sun, and its volume exceeds that of the sun 2,000 times. But how do we know that these stars are suns like ours? -that these stars are vaporous? By the method of the spectroscope it could be shown that the stars give a rainbow tinted streak, crossed by dark lines; and this proves that these stars are like our own.

Wonderful as are the discoveries that have been made in the science of astronomy within the present century, it is confidently believed by those who are capable of forming a judgment on the subject that if the operations to be carried out on the 8th of December next are successful it will be an event of greater importance to the science of astronomy than any that has ever taken place.

The interest taken by the learned of all nations - the talent, influence and wealth now being employed, exceeds that brought to bear upon any other scientific subject ever before sought after. There is no art of science so vitally interested in the advancement of astronomy as that of navigation, and it is for the advancement of commerce, and the success and safety of their subjects engaged in navigating the most remote regions of the globe, even to the efforts made to reach the North Pole, in which attempt daring men at this moment engaged, that induce Governments to be so liberal in giving their assistance.

In the later part of May, orders were issued by the American Government to place the sloop of war Sumatra in commission, and at the disposal of the gentlemen having the superintendence of these vast scientific operations, which involves the entire length of the Pacific ocean, from the ice bound shores of Campbell's land, within the 68th degree of South latitude, to the Straits of Bering on the verge of the Arctic Circle, in 68 degrees north latitude, including 136 degrees of latitude, or some 9,400 miles for a base line.

Eight parties of astronomers have been toled off to occupy many stations. The official list has just been published; each party is to consist of one chief astronomer, or director, one assistant astronomer, and one chief photographer and a first and second assistant, making 5 officers and a proper number of mechanics for assisting in the erection of the necessary observatories and structures. The following is a list of the names of the gentlemen who are appointed to direct each party, and of the station to which is appointed. It would be advisable to preserve this list, as it will be very interesting to refer to it hereafter, when the work performed at each station will be examined with the deepest interest by the ablest mathematicians and astronomers in the world.

Vladivostock, Siberian Russia, has been assigned to Prof. Hall, U.S. Navy, as chief; his

assistant astronomer is O. B. Wheeler, of Detroit, Michigan. Nagasaki, Japan - chief of party, Prof. George Davidson, U.S. Coast Survey, with O. H. Titman, U.S. Coast Survey, first assistant. Peking, China - Chief of party, Prof. James C. Watson, of the Ann Arbor, Michigan, Observatory; assistant astronomer not yet named. Crozet Island, southeast of the Cape of Good Hope - chief of party, Captain C. W. Raymond, U.S. Engineers; assistant astronomer, First Lieutenant S. E. Tilman, U.S. Engineers. Kerguelen Island, east of Crozet Island, latitude 50 South, longitude 70 East from London, - for chief Lieutenant, Commander G. T. Ryan, U.S. Navy; assistant astronomer, Lieutenant Commander C. T. Train, U.S. Navy. Hobart Town, Tasmania - chief of party, Prof. William Harkness, U.S. Navy; assistant astronomer, Leonard Waldo, Commercial College, New York. Bluff Harbor, New Zealand - chief Dr. C. F. Peters, Hamilton College, New York Observatory; first assistant First Lieutenant, E. W. Bass, U.S. Army Engineers. Chatham Island - chief, Edwin Smith, U.S. Coast Survey; assistant astronomer, Albert H. Scott, U.S. Coast Survey.

It will be seen by the above that the observations to be taken over the whole of the North and South Pacific, a space covering nearly one third of the surface of the globe, have been assigned to American astronomers. But Americans need not fear for the honor of their flag when it is carried by such men as Prof. Watson, of Ann Arbor, Michigan, and Pro. Peters of Hamilton Observatory, for these two names are known over the astronomical world, and right gallantly will they be supported on the day of trial by their countrymen, although separated from them by distances so vast that it causes one to doubt the possibility of such an event as the taking of observations of the same object, at the same instant, from points situated at from six to seven thousand miles distant, or from points the most remote that can be occupied upon our earth at the same time.

The most powerful instruments of the most celebrated observatories of the world will be taken down and removed to those distant regions, where the erection of even temporary structures will be attended with great trouble and risk, for a very slight accident to any of the principal instruments would render ineffectual all the labor, expense and hopes connected with, not that particular station alone, but with the two other stations with which it was in connection - one lying nearly the same latitude and the other in nearly the same longitude.

Great reliance is placed on the use of photography and three gentlemen prominent in that science have been selected to accompany each party. New and very elaborate instruments have been brought into requisition, and the most able operators in the Union have been selected, three of whom are from Indiana.

An event occurred on the 8th of December, 1854 which has caused it to be a memorable event, to the end of time. This was the promulgation of the Dogma of the Immaculate Conception of our ever Blessed Mother, Immaculate by our venerable and holy Pope Pius IX, when surrounded by all the princes and bishops of the Church, the most numerous council that ever assembled even in venerable Rome. May the blessed Mother of our Devine Redeemer look on with favorable eye and bless the endeavors of her children in seeking to develop the wonders of the firmament, so as to increase man's reverence for his Almighty Creator.

It is truly wonderful to observe the total indifference with which the mass of mankind observe marvels passing nightly before their eyes, - the boundless firmament, the starry heavens sweeping majestically and unerringly past. The most learned men and the most profound thinkers, have spent the most valuable portion of their lives in contemplating, naming and mapping every star in the Heavens. Two famous German astronomers spent 18 years in the observation of the planet Mars. And years were spent in observing the motions of the little double star No. 61 Cygni, (in the constellation of the Swan) with the greatest advantage to science.

If the smallest star visible even with the telescope should disappear, it would be missed as was the case at the time of the discovery of the planet Neptune, by M. Le Verrier in 1845. In this

case the evidence of Mr. Walker, of the Washington Observatory decided the question, that, where there was a star several years ago, there is now a vacancy, and that by its movement it has proved itself to be a planet.

- Brother Peter
College of The Sacred Heart

5. Watertown Republican, December 2, 1874

Astronomy

In our issues of the 4th and 11th, of November, we published an article written by Brother Peter, lately of Notre Dame University, Indiana , on the Transit of Venus. As we predicted, it has been copied largely and favorably commented on by the press.

This learned gentleman, ever solicitous for the advancement of science and education, to which he has for the past twenty years exclusively devoted himself, has kindly consented to furnish us monthly with an article illustrative of the 12 signs of the Zodiac, and of the appearance of the heavens, and the position of the chief stars in each of the constellations as they pass our meridian, following nearly the same plan as that which he has observed in the very able article, which we publish in our present issue, on the general appearance of the heavens, and particularly to that glorious array of stars which the heavenly or illuminated mile stones.

This article should be taken as the first of the series, as it begins at the starting point of all astronomical calculations. The point *Aries*; or the vernal equinoctial point, which every one who reads the article can locate when it is at all visible above the horizon.

"Tis wonderful how much this most useful and interesting science is neglected in the United States; it is a shameful and criminal neglect on the part of School trustees and directors; no other study has so refining and elevating an influence on the human mind and heart as the contemplation [sic] of these mighty orbs, the smallest of which is hundreds of times larger than our own earth.

The geography of the heavens is taught in all respectable schools in Europe, it is very popular with the ladies as during their starlight promenades, they have every opportunity of tracing out in the heavens those forms and constellations they had previously learned in their schools.

If the press of the state of Wisconsin, will second the efforts now being made by Brother Peter, whose advent we hail to our community, and of whose patriotic motives we heartily approve, the germ of a great improvement in our school system is about to sprout up to maturity, but to the advocacy of the public press, will success be chiefly attributable.

6. Chicago Daily Tribune. December 9, 1874.

ACADEMY OF SCIENCES
Remarks of Mr. Colbert on the Transit of Venus.

The regular monthly meeting of the Academy of Sciences was held last evening at their rooms, No. 263 Wabash avenue, the President in the chair.

THE TRANSIT OF VENUS

Mr. E. Colbert stated that he wished to call the attention of the Academy to the fact that the presentation is being held at one of the most important scientific epochs in the worlds history.

He said:

The transit of Venus over the sun's disk, as seen from the earth, occurs to-night; it is now in progress. At 2 minutes before 8 o'clock the planet impinged on the northeastern edge of the sun, as seen by observers to whom the phenomenon is in the zenith; and it will pass out at the northwestern edge about 36 minutes after our midnight. At the present moment very many scientific eyes are watching the little black speck on the surface of the sun. More than a hundred telescopes are pointed at it, and scores of trained observers are reading off the distances of the spot from the nearest point on the luminous disc, as determined by the micrometer. Several dozens of sets of photographic apparatus have been examined and adjusted for the last time, and are now being used at a rate which ticks off a photograph of the God of Day for each second of time. The heliometers are being set and read, and set and read again, to the barely audible ticking of the chronometer. In short, the work for which so many men have been in training for months past, for which so many instruments have been made, so many journeys taken, so much money expended, and so many calculations and speculations indulged in, is now being performed.

The sun and the planet are both below our horizon. They will be below it till after the transit is over. Not only we, but the whole of the American Continent, is excluded from a view of the phenomenon, except that those who occupy the western tip of the Alaskan Peninsula may view the beginning of the transit just before the sun sets, and see him sink beneath the waters of the Northern Pacific as the shade of Memnon was called away just as it had begun to reveal the secrets of thee Egyptian pyramids. It will also be visible, for a few moments only from Cape Horn; but neither of those points will be available for purposes of scientific observation, because the refraction of our atmosphere near the horizon distorts the image of the sun too much to permit of accurate measurement.

The nearest of the observers is, therefore, several thousands of miles distant from Chicago. Many of them are not far from our antipodes. .But this very fact rather adds to our interest than diminishes it. We cannot join them in watching the gradual stealing of that little dark speck across the face of the sun; but we can follow them in their anxieties and efforts to obtain the quantities which will enable astronomers to solve the problems of the nineteenth century. Nay; our interest is even increased by distance, as the fond parent thinking of a child lying sick in some distant city, is tenfold more anxious than if by the bedside of the loved one. We may picture to ourselves faintly the intense disappointment of those who have sailed around a large part of the globe only to find themselves clouded at the critical moment, and love's labor entirely lost. Neither can one forget the possibility that not a few of the observers have awaited the event with a trembling expectancy which has unstrung their nerves, and rendered them incapable of watching the phenomenon with that philosophic calmness that is so essential to accuracy in the result deduced from their work.

As a professedly scientific body, which recognizes only the operation of natural law in the causation of natural phenomena, we cannot pray that the observations may be blessed with calm minds and clear skies; and even if we did not so feel, seeing that the transit is already partially over, we may say that "it is past praying for." But we cannot help wishing them success; and that so strongly that the effort will be scarcely less than devotional, if we accept the definition that-

> Prayer is the soul's sincere desire,
> Uttered or unexpressed;
> The motion of a hidden fire,
> That trembled in the breast.

I had not proposed to weary the Academy with a dissertation on the way in which the transit will be used to solve the grand problem of the sun's distance, not to speak of the scientific advantages that will ensue, if the most sanguine expectations are realized. The subject has been already "done to death" in the newspapers and magazines; and I scarcely know whether to be

more astonished at the intimate knowledge of the matter displayed in some of the articles I have read, or the lamentable ignorance of the first principles of astronomical science which has cropped out in the dissertations of some who have written the most confidently about it. Between the two sets of writers I am left with nothing to say that is new, and could scarcely say a foolish thing about it that has not already been put in print. But I have been requested to explain the phenomenon.

[The speaker here referred to a series of diagrams which he had prepared, and occupied about half an hour in showing in a very simple manner how the observations will enable astronomers to find the length of the unit of star measures. He continued.]

The results of the patient watchings of tonight will not be known for several months; perhaps not in a year from now; and they will probably be affected with a larger possible error than is generally anticipated. It will be some weeks before the telescopic measures taken at all the stations can be known, even if transmitted by telegraph, because many of these stations are far removed from any ocean cable at present in existence. At many of the stations the chief dependence will be on photographic views, and the "negatives" cannot be transmitted by means of the lightning flash; they can only be carried by the slowed steam to the observatories where they can be submitted to the measurements with the micrometer. Then all the results obtained at separate stations must be compared, and many laborious calculations be made before the value of the solar parallax can be known.

I have called your attention, at former meetings, to the difficulties which will be encountered in the attempt to reconcile these observations; difficulties arising from, 1. The irregular shape of the earth, which is not a true oblate spheroid; 2, the irregular contour of the sun, his surface being in a state of perpetual commotion; and 3, the errors of observation, which may be regarded as an extended kind of "personal equation." Summing the probable averages of these three factors of error, I conclude that the astronomical world will be fortunate if it is able to reconcile all the observations so as to make it certain that the accepted average is not more than100,000 miles in error, or one part in 900 of the whole distance.

There is no reason to doubt that we already know the distance of the sun to within 300,000 miles. I speak not now of my own calculations of this quantity, but of the extremes claimed by others. If we assume 91,700,000 miles as the average, this estimate will not be more than 300.000 miles from the 92,000.000 miles of Newcomb, or the 91,430,000 miles of the English computers. This is one part in 300 of the whole distance. Hence, the probability is that observations of the transit of Venus in 1874, one which more than one million dollars have been expended, and involving the equivalent of not less than 200 years of labor on the part of one man, will only reduce the uncertainty to about one-third of its present magnitude. But this will be no mean achievement. It is not saying too much to claim that this result will be worth at least ten times the money and labor expended to obtain it.

The Great Fire of October, 1871, is responsible for the fact that Chicago is taking no part in the work of tonight. But for that catastrophe, our city would undoubtedly have been represented in the corps of observers of the Transit of Venus. Less than two months before we were overtaken by that calamity, I canvassed the subject with several members of the Astronomical Society; and, only a few days previous to the time when the best part of our city was laid to ashes, I finished a communication, intended to have been said before the Society, proposing that it should be represented at or near Peking, in China, and that the subject be referred to a Committee of Ways and Means. It was then understood, and afterwards known, that the Government of the United States would furnish transportation and rations free; and it would not have been difficult to raise the money necessary to meet the other expenses incident to the undertaking. But the fire burned up the document and the means of the Society, and it was impossible to pursue the subject farther. It is, however, matter for congratulation that the station then recommended is occupied tonight by Prof. Watson and Young, two of the closest observers

the world can boast, and that the observations, now in progress will be numerous to insure the greatest attainable accuracy, notwithstanding the failure of Chicago to take part in the work.

Mr. Colbert received a good deal of applause at the conclusion of his address.

In early December the Bureau of Astronomy issued the following scientific announcement.

Official Announcement

Bureau of Astronomy,
Notre Dame University, Dec.1, 1882.

At Notre Dame, Lat. 41° 42' 12." 7, Long. W. from Greenwich 86° 14' 19".3, the transit of Venus across the solar disk will appear as follows:

DEC. 6TH, CIVIL TIME:

"First contact at 19 minutes past 8 a.m.
Internal contact at ingress at 20 minutes to 9 a.m.
Internal contact at egress at 2 2/3 min. past 2 p.m.
Last contact at 23 2/3 minutes past 2 p.m.
Venus will first touch the sun's disc at a point 33 1/2° from the South point towards the East, and, passing over it in a northwesterly direction, will leave it at a point 57° 2/3 from the South point towards the West.

By order of the Board,
J. P. O'Neill
Secretary

8. Notre Dame Scholastic, December, 1882, pg. 217.

9. The South Bend Daily Tribune, Wednesday evening, December 6, 1882, pg.2.


Author Robert Havlik describes the history of the Napoleon III telescope to University of Notre Dame visitors.

Images and text provided courtesy of Robert Havlik.
www.transitofvenus.org