A. M. D. G.

BULLETIN

of the

AMERICAN ASSOCIATION OF JESUIT SCIENTISTS

(Eastern Section)
(For private circulation)

Vol. II, No. 3. Weston, Mass. January-February, 1925. P.26.

THE TOTAL ECLIPSE.

The total eclipse of the sun on Jan. 24th was the outstanding scientific event of the past month. It was very fortunate that the path of totality passed through such a densely populated region in the northeastern part of the United States. The press and Radio gave great publicity to the event, and rarely has a phenomenon of nature excited so much interest. By an oversight the date of the eclipse in our last Bulletin was given as January 25th, but we are sure that no one was misled by it. A number of astronomers with instruments for special observations assembled at the observatories at New Haven, Middletown and Poughkeepsie which were quite close to the middle of the path. The main objects of inquiry seemed to have been to extend our knowledge of the corona and of the flash spectrum and also to obtain exact data regarding the moon's path. A large number of radio amateurs were enlisted to study the effect of the eclipse upon the intensity and range of radio signals. Most people were content merely to enjoy the wondrous spectacle, and large numbers journeyed to the nearest region of totality by train or auto. The New Haven R.R. sent 8 special eclipse trains from Boston on the morning of January 24th,-- 6 to Westerly, R.I., and 2 to Willimantic, Conn. Several of Our houses were well within the path. Some of the science professors of our New England colleges observed the eclipse at Keyser Island. We have received the following eclipse notes:-

WOODSTOCK.

Saturday, January 24th, the date of the eclipse of the sun which was total in New York and other parts of Northeastern United States, was cold and clear at Woodstock so that we were enabled to observe the eclipse which came to within 5 per cent of being total here. The sun's image was projected by means of the old equatorial telescope on a white screen so that all those who were brave enough to bear the biting cold might watch the progress of the phenomenon. There were about forty spectators for the earlier phasees of the eclipse including first contact and mid-eclpise: as the last contact occurred during class time, very few were able to be present. Mr. Blatchford came out to Woodstock from Baltimore to observe the eclipse and took a number of photographs. The sidereal clock was compared with the time signals sent out by radio from Arlington at 8:40 A.M. and Noon, Eastern Standard Time. The time of first contact was noted by means of a stop watch which was immediately compared with the observatory sidereal clock; the last contact was noted by means of the observatory chronograph and also by means of the stop watch and observatory clock. The predicted and observed times were as follows:-

	First Contact	Last Contact	Duration
Predicted	$7^h\ 55^m\ 29^s.9$	$10^h\ 22^m\ 38^s.6$	$2^h\ 27^m\ 8^s.7$
Observed	7 55 45	10 22 23	2 26 38
Difference	−15	15	30.7

The observed times, especially of first contact, may be in error by several seconds. The difference, however, between the predicted and observed times cannot be explained in whole by errors of observation, and it seems certain that the eclipse began somewhat later and ended somewhat earlier than was predicted for this station.

Father E.C. Phillips S.J.,
Woodstock College.

========

POUGHKEEPSIE.

The eclipse was total and conditions were favorable. Father Williams directed his gaze to the Northwest until totality occurred. It was very striking to see the area of darkness bordered by light on the North and South. The shadow bands were distinctly seen passing over the snow. The corona appeared as a ring of beautiful white light suspended against a grey background. During the totality several planets appeared quite distinctly several degrees from the sun. To me the most striking feature was the suddenness with which the totality began and ended. The darkness became very perceptible during the last 10 or 15 minutes, but the totality came on as if the moon had been pushed suddenly in front of the sun and it ended just as abruptly. Up to the time of totality a smoked glass was necessary in looking at the sun but during the eclipse one could look at the corona directly with the naked eye. It was my impression that during the totality there was more light than on a bright moonlight night and that it was much more diffused. During totality our dog "Rusty" barked quite vigorously.

Father W.C. Repetti S.J.,
St. Andrew-on-Hudson.

========

BUFFALO

Buffalo seemed to be the only place of any importance in the path of totality not favored by even a glimpse of the total eclipse. At sunrise the sun appeared as a ball of fire with all indications for a favorable observation, but just before the eclipse began a heavy bank of clouds obscured the sun, rendering any measurements or photographs out of the question. As if to prove that the eclipse was bona fide, the partially covered sun peeped out between rifts on three occasions after totality, but even these were imperfect. No photographs were secured.

A slight drop of temperature of two or three degrees was noticeable at totality. The time of its beginning or end could not be determined accurately, but the speed of the advance and retreat of the shadow was all that had been predicted of it. However, the darkness, which seemed to be drawn over the city like a pall, was not sufficiently intense to prevent reading a watch, the great quantities of snow doubtless being responsible.

Radio signals from WGR Buffalo became quite weak during the eclipse, recovering their usual volume as the sun became brighter. This

same condition was reported by a number of the boys who had made similar tests during the period.

One investigation, independent of visibility, was the determination of a possible variation in the strength of the earth's magentic field. We may have something to send you later regarding the results.

Father T.J. Love S.J.,
Canisius College.

=======

WESTON

The philosophers at Fairview, Weston, Mass., followed the eclipse with great interest. We were 42 miles north of the path of totality and the sun's disk at the maximum was 99 per cent covered. The morning was cold and clear, whit the exception of a few clouds which however did not interfere very much with the seeing. Several small telescopes, smoked glasses and photographic negatives, and two surveyor's transits, by means of which the sun's image was projected upon screens, were employed. No attempt was made to determine the times of contacts, the first of which occurred at about 8:05. Thermometer and barometer readings were made at intervals from 8:00 A.M. to about 10:00 A.M., the former by Mr. H.J. Sullivan, the latter by Mr. R.H. Anable. The temperature at the first contact was [illegible].3° F. It then dropped 1°, rising again after the maximum which occurred at 9:17. The barometer fell during the eclipse, but as it dropped quite steadily during the whole day it is not likely that any special significance can be attached to this fact. The darkness at the maximum was less than was anticipated, the snow on the ground helping to diffuse the light. It was greatest toward the northwest, and resembled that preceding a storm. The cresent was not fine enough to show Baily's beads. A replica grating held before the eye clearly showed numerous curved lines in the solar spectrum. Brother Conroy reported that as the light diminished his chickens stood about idly in their quarters but made no attempt to go to roost. Pigeons were observed to return home. The darkness was sufficient to render the planets visible but on account of some clouds about the sun only Venus was seen.

Various attempts were made to obtain some permanent record of the eclipse. Sketches were made by Messrs. E.S. Brock, A.V.P. Dowd, and J. Killenn. Mr. J.J. Dolan made some photographs wich a small hand camera. Mr. T.D. Barry obtained pictures by attaching a small camera to the eye piece of the telescope of a surveyor's transit. A series of photographs were also made by Messrs. L.C. Gorman and J.C. Murray. A beam of sunlight was brought into the darkened science lecture room in Bapst Hall by means of a Porte-lumiere with a total reflecting prism. A single lens 2 1/2 in. in diameter and of about 12 ft. focal length was placed in the path of the beam with an aperature of 1/4 in. and a graflex camera with the lens system removed was placed at its focus. Films were used and a few preliminary pictures were made and immediately developed in order to determine the best time of exposure. Solar images 1.16 in. in diameter were obtained.

THE LAWS OF MOTION.

(The following paper was read at last summer's Baltimore meeting by Mr. F.W. Sohon S.J., who was professor of Chemistry and director of the Seismological Observatory at Fordham University last year, and is now studying theology at Valkenburg.)

Einstein's mechanics is strange, but the mechanics of Newton when dressed up after the curious fashion set by Einstein is scarcely less wierd. We propose to find out how much of Einstein's novelty is due to his doctrine and how much is really due to his manner of presentation.

Let us begin with the time-space continuum. We need three variables x, y, z, to determine a point in space, one variable t, to determine an instant in time; hence to determine a coincidence, which occurs when two things are at the same point at the same instant, we need four variables. We can, therefore, picture the flux of events as a graph of four dimensions. Of course, we cannot see all four dimensions at once---you cannot see the opposite sides of a house at once ---but we can take them two or three at a time as we need them. This picturesque concept of the universal flux of events in which by a concomitant phantasm of an immutable four-dimensioned graph the local and temporal relations are emphasized it is proposed to convey by the designation the time-space continuum.

If we choose some point to be at rest, that is, if we measure its position in such a way that at different times it always has the same position, then this point we may picture to ourselves as a straight line or trace perpendicular to our x, y, and z axes. This trace we call the axis of rest. Any point whose trace in the time-space continuum is parallel to the axis of rest will appear to be a point at rest. If the trace of the point makes an angle with the axis of rest, then its position with reference to the rest point will be different at different times, and the point will be in motion. The apparent velocity of the object will be equal to the trigonometric tangent of the angle which its trace makes with the axis of rest. If an object has uniform motion in a straight line, its trace will be a straight line. If the motion of an object is accelerated, its trace will be curved. (Illustrations)

The first law of motion tells us that unless an object is being acted upon by a force it persists in a state of rest or in a state of uniform motion in a straight line. In fact it is quite impossible either <u>a pirori</u> or <u>a posteriori</u> for us to say that any one given object is absolutely at rest and some other object has uniform motion in a straight line for the simple reason that these two states have identical physical properties. This means, then, that instead of taking our original trace as a rest axis, any straight trace might be chosen instead, and should this be done our old rest point will have a uniform velocity in a straight line, with reference to our new rest axis. Before the advent of Einstein this fact used to be stated by saying that translation is relative. The new way of asserting the ~~t~~ thing is to say that the rest axis can be rotated in the time-space continuum.

We have imagined our rest axis to be perpendicular to the x, y, and z axes. These axes are space axes or axes of simultaneity, because all coincidences occurring at different points along them are simultaneous. If an axis should make an angle other than 90 degrees with the rest axis, the trigonometric tangent of this angle would be a finite quantity. As the tangent of this angle is in every case the velocity of the point, an axis at any angle except 90 degrees with the rest axis would be the trace of a point moving with finite velocity, and would thus represent positions that are successive and not simultaneous. It necessarily follows that in any system of mechanics an axis of simultaneity must always be perpendicular to the rest axis, however the latter axis be chosen.

Here we have a crucial difficulty. The axis of simultaneity must be perpendicular to the rest axis in each case. If the axis of simultaneity does not rotate when the rest axis rotates, then we have one axis of simultaneity perpendicular to every rest axis in the same plane. This contradicts the theorem which says only one line through a point can be perpendicular to a given line. If may be answered, however, that time and space are essentially different, and that where along one axis are measured intervals of time, and along another intervals of space we have no right to assume that Euclid's geometry will hold. In fact, it is asserted, the geometry of the time-space extension is non-euclidean and in such a way that every triangle having one side along the simultaneity axis is an isosceles right triangle having two right angles and one acute angle. This startling postulate is the essence of the classical, that is the Newtonian mechanics, and can be summed up in three words: simultaneity is absolute.

It is easily seen that the geometry of the time-space continuum must necessarily be non-euclidean. In the first place if it were euclidean and a man were to walk v_1 miles an hour on a train going v_2 miles an hour, the resultant velocity of the man should be given by the formula for the tangent of the sum of two angles showing that the time-space continuum of classical mechanics must be non-euclidean. Furthermore, in a euclidean system there would be no real distinction between future and past. Let Peter and John be born on two trains moving very rapidly in opposite directions, and let each die on the same train on which he was born. Having indicated these four events, let us take John's trace for the rest axis, and we find that Peter dies before he is born. Or suppose Andrew wants to undo something he did yesterday. Let him board a rapidly moving train whose trace is nearly perpendicular to his old rest axis. If he can now run fast enough he may be able to throw his trace back into the second quadrant and thus be carried into thepast. On account of these and similar considerations we may say that it is certain that the geometry of the time-space continuum is non-euclidean, and the only question will be whether it is to be non-euclidean the way Newton says it is, or whether it is to be non-euclidean the way Einstein says it is.

Instead of assuming simultaneity as absolute, Einstein assumes on the basis of experimental evidence which he hopes will be produced that the velocity of light is absolute. It can easily be shown that if a parallelogram is made whose sides are parallel to the traces of the backward and forward velocities of light, rest and simultaneity will be the diagonals of the parallelogram. In this way it can be shown that as rest rotates, the velocity of light being invariant, simultaneity also rotates, but always in the opposite direction. There is a different axis of simultaneity for each rest axis, but there is no confusion of future and past unless something can be found to travel faster than light, and in such a case the whole Einstein system falls to the ground. Einstein and Newton agree in calling for a non-euclidean time-space continuum, and in postulating an absolute orientation in this continuum. In the Einstein system this absolute orientation is assigned to the traces of the backward and forward velocity of light and the axes of simultaneity rotate between these traces. If we imagine these two traces pinched together until they become one and the same straight line, we have the Newtonian system with absolute simultaneity.

One of the remarkeable properties of relative simultaneity is the shortening of objects as their speed increases. This is due to cutting the traces of the extremities of the length on a bias. If the

time-space continuum were euclidean an object would be lengthened in the diection of motion because the perpendicular is the shortest distance betweentwo parallels. In the Einstein system the perpendicular is the longest distance measured along a straight line between two parallels, and hence the man who is at rest with respect to the object finds it longest.

Passing on now to the second law, we wish to show that the variable mass of Einstein is due to a false analogy between the Newtonian and the Einstein mechanics. The second law says that the rate of change of momentum is proportional to the impressed force, or in the language of the calculus

$$f = d/dt \quad (\text{momentum}).$$

In the classical mechanics the momentum is equal to the velocity of the object multiplied by some constant. As this constant happens to be invariant and addative it is necessarily proportional to the amount of substance in an object, and therefore aptly called the mass of the object. For the sake of simplicity it is usual to perform the differentiation indicated and we get the simple form

$$f = d/dt\ (mv) = m\ dv/dt = ma\ .$$

As this happened to be the more familiar statement of the second law, Einstein pooposed to use it for his definition of mass. As it gives rise to a difficulty it is better to write the equation in a slightly altered form so as to separate the tangential and centripetal accelerations

$$f = m\ dv/dt = m\ d/dt\ (vu) = m\ (u\ dv/dt) + m\ (v\ du/dt)$$

where $u\ dv/dt$ is the tangential and $v\ du/dt$ is the centripetal acceleration.

In order to keep the principle of conservation of linear momentum, Einstein has to give to the momentum an expression as follows

$$\text{momentum} = m_0 v / \sqrt{1-v^2/c^2}$$

Separating the components and differentiating we get

$$f = d/dt\ (m_0 v/\sqrt{1-v^2/c^2}) = d/dt\ (m_0 vu/\sqrt{1-v^2/c^2})$$

$$= (m_0/(\sqrt{1-v^2/c^2})^3\ (u\ dv/dt) + (m_0/\sqrt{1-v^2/c^2})\ (v\ du/dt).$$

We see, therefore, that in choosing $f = ma$ for his defining equation Einstein will have one coefficient for his tangential accelaration, and a different coefficient for his centripetal acceleration. He solved the difficulty by introducing two masses, a longitudinal mass equal to

$$m_0/(\sqrt{1-v^2/c^2})^3$$

and a transverse mass equal to

$$m_0/\sqrt{1-v^2/c^2}\ .$$

Einstein's mass is no longer the measure of the amount of substance in an object, though it still measures the inertia of the object. Had he

defined it from the momentum without differentiating it would have be a definite scalar property of the moving system, but taken as it stan it is a pair of coefficients for a mathematical equation.

There is however a much more fundamental objection to Einstein's procedure in choosing his definition of mass, in as much as i does not really follow out the analogy between the Newtonian and the Einstein systems. If we draw the triangle of differentials for the Newtonian system instead of having

$$ds = \sqrt{dx^2 + dt^2}, \text{ we get } ds = dt.$$

This means that the acceleration

$$a = d^2r/dt^2 = d^2r/ds^2 = c$$

, is equal to the curvature of the trace. We ought, therefore, to write the second law f = mc if we are to insist on the concept of the time-space continuum.

(To be continued) Mr. F.W. Sohon S.J.

MARKING IN BIOLOGY.

In connection with the system outlined in the last issue of the Bulletin for checking laboratory work in biology, Mr. Reardon evolved a special marking system. His method of giving marks was based strictly on the laboratory work and proved very satisfactory to both instructor and student. The system sounds rather complicated in a description, but actually is simple enough. It enables the teacher to give a true mark without racking his brains when correcting the drawings.

As mentioned last time whenever a section of work was finished the student must call the instructor and identify for him the parts dissected or studied, and answer a short quiz. In the course of a period a student usually gives one or two identifications, although there might occasionally in a very difficult dissection such as the vago-sympathetic system, be none, and again in easier work I have had as high as four identifications from one man in a single period.

At each identification the student is given a mark of 6 or less according to the thoroughness and skill of his dissection, plus 4 or less according to the accuracy of his identification and grasp of the matter. The ratio of 6 to 4 would be inverted in cases where less skill was required but more effort must be expended to understand the work done. This mark was immediately jotted down on the instructor's check slip. Thus for the identification of the hepatic portal system would appear a mark of 5-4 or 5-3 or 3-3 or often 6-4, etc. The mark never totalled more than 10.

Then when the drawings were corrected, the instructor in consulting his check slip to see if this particular piece of work had been checked, sees the mark given in the laboratory. If the drawing is satisfactory the mark can stand, but if sloppy or incorrect, one or two points more will be deducted. This mark is then entered in the record for the month. In the event of more than one identification, the mark entered in the record should be the mean of these given in the laboratory.

The advantage of this seemingly complicated system of markir lies in this. The student is marked strictly on his work, not on his drawing, which only too often, in spite of the greatest safeguards, is a direct copy, or at least taken by memory from some book. And when an instructor has twenty or more under his supervision it is no easy matter for him to remember just what the work of each student was wort The drawing is too apt to be the deciding factor.

Mr. John A. Pollock S.J.

THE GENERAL CHEMISTRY COURSE AT THE ATENEO DE MANILA.

There are at the present time three courses being conducted in chemistry at the Ateneo de Manila, namely a course in General, a course in Qualitative, and a course in Organic chemistry. Those who have to take the course in General chemistry are the Freshmen Pre-medical, Sophomore A.B., Sophomore B.S., and Sopho,ore Pre-law students. They pursue this course for a whole year, during which they have two lecture periods and two laboratory periods every week, thus giving them two hours of lecture and five hours of laboratory each week. The laboratory periods last for two hours and a half. The reason for making the laboratory periods so long is that we desire to have our course correspond as closely as possible with the course given by the Government University in Manila, in which they give two hours of lecture, one hour for a test, and six hours of laboratory work every week for a whole year. Thus the Government University devotes nine hours each week for a whole year to General chemistry, while we at the Ateneo give seven hours a week for a whole year to the same subject.

The text book used in this course is Newell, and we cover the whole book, devoting two lectures to a chapter as a general rule. The laboratory manual used is also Newell's, and from the experiments contained in this manual we select 150 which we require each student to perform in a satisfactory manner before we will credit him with four semester hours in laboratory work.

Thus our work in General chemistry at the Ateneo is exactly the same as is performed by Colleges in the States, and although we do not allow as much time for this course as they do in the Government University at Manila, still we accomplish just as much work. This is due to their careless way of supervising the laboratory work, for although they say they require about 220 experiments from McPherson and Henderson's Manual, yet I know from actual examination of reports of their students that only about 150 are performed. The reason why their students can get credit without actually performing the 220 experiments is that they skip many without being detected,-- of course their last experiment is numbered 220, but there are many missing in between. To avoid such an oversight we at the Ateneo keep a chart on which we check off the work of each student.

Our reason for insisting on a definite number of experiments is to insure four semesters of work being done by each student without having the bother of checking up the late comers, the absentees, or those who run out for a smoke, etc. The one objection to setting a definite number of experiments, is that the students will have the one desire to get them done as quickly as possible without much thought of what they are doing. In fact at the Government University several students copy three or four experiments and hand them in without even attempting to perform them and thus they get their credits. To avoid this difficulty we do not allow the students to hand in two or three experiments at the end of the laboratory period, but we keep going around the laboratory collecting their experiments just as soon as they finish one. What we aim to accomplish is first that each student should actually every experiment himself, secondly that he should write it up neatly and correctly, and finally that he should understand the experiment thoroughly. To obtain these objects we tell the students that just as soon as they perform an experiment they are to write it up, study it from the text book, and keep their work till an instructor comes around to their desk, when they hand their report to him and show him their actual work. Then the instructor corrects

THE GENERAL CHEMISTRY COURSE AT THE ATENEO DE MANILA.

There are at the present time three courses being conducted in chemistry at the Ateneo de Manila, namely a course in General, a course in Qualitative, and a course in Organic chemistry. Those who have to take the course in General chemistry are the Freshman Pre-medical, Sophomore A.B., Sophomore B.S., and Sophs. ore Pre-law students. They pursue this course for a whole year, during which they have two lecture periods and two laboratory periods every week, thus giving them two hours of lecture and five hours of laboratory each week. The laboratory periods last for two hours and a half. The reason for making the laboratory periods so long is that we desire to have our course correspond as closely as possible with the course given by the Government University in Manila, in which they give two hours of lecture, one hour for a test, and six hours of laboratory work every week for a whole year. Thus the Government University devotes nine hours each week for a whole year to General chemistry, while we at the Ateneo give seven hours a week for a whole year to the same subject.

The text book used in this course is Newell, and we cover the whole book, devoting two lectures to a chapter as a general rule. The laboratory manual used is also Newell's, and from the experiments contained in this manual we select 110 which we require each student to perform in a satisfactory manner before he will credit him with four semester hours in laboratory work.

Thus our work in General chemistry at the Ateneo is exactly the same as is performed by Colleges in the States, and although we do not allow as much time for this course as they do in the Government University at Manila, still we accomplish just as much work. This is due to their careless way of supervising the laboratory work, for although they say they require about 110 experiments from Brownlee and Henderson's manual, yet I know from actual examination of reports of their students that only about 100 are performed. The reason why their students can get credit without actually performing the 110 experiments is that they skip many without being detected,-- of course their last experiment is numbered 110, but there are many missing in between. To avoid such an oversight we at the Ateneo keep a chart on which we check off the work of each student.

Our reason for insisting on a definite number of experiments is to insure four semesters of work being done by each student without having the bother of checking up the late comers, the absentees, or those who run out for a smoke, etc. The one objection to setting a definite number of experiments, is that the students will have the one desire to get them done as quickly as possible without much thought of what they are doing. In fact at the Government University several students copy three or four experiments and hand them in without even attempting to perform them and thus they get their credits. To avoid this difficulty we do not allow the students to hand in two or three experiments at the end of the laboratory period, but we keep going around the laboratory collecting their experiments just as soon as they finish one. What we aim at accomplishing is first that each student should actually every experiment himself, secondly that he should write it up neatly and correctly, and thirdly that he should understand the experiment thoroughly. To obtain these objects we tell the students that just as soon as they perform an experiment they are to write it up, study it from the text book, and keep their work till an instructor comes around to their desk, then they hand their report to him and show him their actual work. Then the instructor corrects the experiment at once, examines the work, and questions the student to see if he understood what he has done. If all is satisfactory the instructor makks the grade on the report and puts his O.K. on it and retains the experiment which will be stamped, entered on the chart and filed away after the laboratory period. If, however, the student has thrown away his work he must repeat the experiment at once; if he has not written it up correctly he must rewrite it at once; if he has his work and written it up correctly but does not understand it he must study it at once from the text book.

This system does not prevent a student from writing up his experiment outside of the laboratory nor from copying another, yet it certainly makes him do the experiment himself and understand it, which after all is what we are after. However, whenever we see that the experiment was copied we tear it up. True, this system takes time, but we consider it time well spent and not time lost either for the student or for the instructor. Even in large classes this system will work very smoothly, as the writer has used it also in Boston College. According to this system it sometimes happens that a student has completed two experiments and all his apparatus is tied up, and he can not go on to the next experiment, nor can the instructor come to him as yet. In such a case the student goes to the instructor and tells him about it and then the instructor will come at once, quickly examine the work and determine whether the student has really performed the whole experiment, and after putting his secret mark on the report returns to the former student. Then the other student may throw away his work and start his next experiment and when the instructor finally reaches him, the instructor will see the mark indicating that the work was satisfactory and so will only correct the report and examine the student to see if he understood the experiment.

Frequently during lectures, five minutes are given to problem work. The student merely puts down the equations and the different steps without actually working out the answer. Once a week the chemistry note book is handed in, containing an outline of the two lectures, which was usually placed on the board before each lecture, and also the questions and answers which the student makes up from the outline and the notes he takes in class. Besides these questions, problems are usually assigned. These note books are graded and the marks are kept in the instructor's mark book. Thus from this mark book and the laboratory chart it is very easy to make up the monthly marks of each student.

Mr. H.I. McCullough S.J.,
Woodstock College.

The two preceding papers together with those by the same authors in the last Bulletin are of interest because they bring out some of the special problems met with in teaching science in the Philippines and the methods employed in solving them. They should prove helpful not only to those who may be called upon later to take up science work in Our distant Mission in the Far East but also to those teaching here in the United States. We hope to receive other papers on the science courses in Colleges outside Our home Province.

A SIMPLE DEMONSTRATION APPARATUS FOR SHOWING THE PATHS OF THE ALPHA PARTICLES. Designed by Father Th. Wulf S.J., of Valkenburg.

The apparatus is an adaptation of Wilson's Condensation experiment (with improvements), to class room demonstration.

THEORY. 1. When supersaturated air is ionized, the water vapor condenses around the ions as nuclei and a fog is formed.

2. The alpha particles (helium) which are emitted from radium compounds travel several cms. through the surrounding air before veing stopped, ionizing the air as they pass through it.

3. If a radium compound is placed in supersaturated air, the ions left by each emitted alpha particle in its path, cause the water vapor to condense, and the wake of the alpha particle becomes a line of fog.

APPARATUS. K is the condensation chamber containing the radioactive salt on the needle N. This chamber can be cut off completely from flask I by turning stopcock H. At T in flask II we have a three way stopcock connecting the flask to an exhaust pump or the free air at will.

MANIPULATION. With stopcock H closed, the air is exhausted from flask II until the water in flask I sinks from A to B. If stopcock H be now opened with a quick motion of the hand, the air (already water saturated) rushes out from the condensation chamber K, the sudden expansion of the remaining air causing it to cool and the water vapor condenses on the ions left in their tracks by the alpha particles radiating from the needle point N. The latter will appear as the center of numerous streams of fog. If the room be darkened and a strong beam of light projected through the side of the flask K, the fog ~~str~~ streams can be seen beautifully through the end of the flask. If flask II be now connected with the air again the water returns to A and the experiment can be repeated. The fog streamers shoot out from the needle point just as soon as the stopcock H is turned, hence the room should be darkened etc., before this last stroke of the experiment is performed.

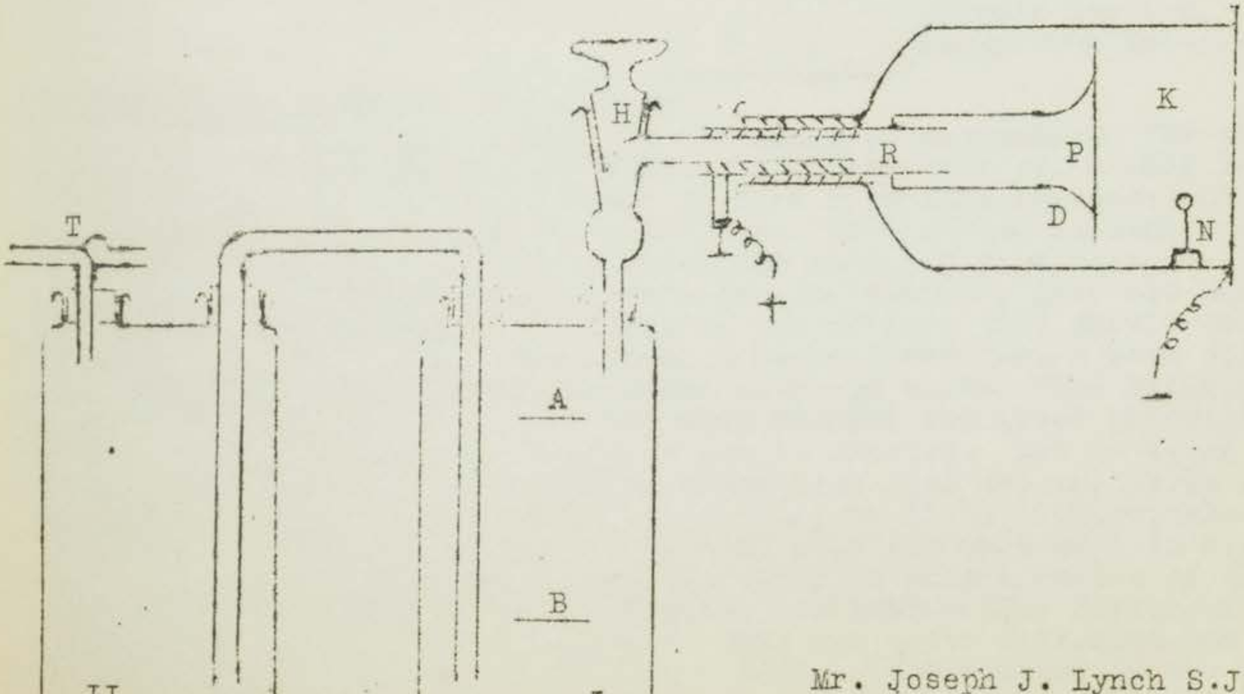
DETAILS OF CONSTRUCTION. The apparatus has been put on the market by Messrs. Leybold of Cologne, but the details of Father Wulf's home made apparatus are as follows. Flasks I and II are about 1.5 to 2 liters in volume. By marking levels A and B on flask I the same expansion can be assured each time, hence once a suitable expansion has been found to work, it can always be reproduced. Stopcock H should have an opening of at least 1 cm. to allow of free expansion. The condensation chamber K is an old liter flask thathad come to grief. The edges were smoothed off and a glass plate 3 or 4 mm. thick replaced the bottom. Before sealing(with pitch or sealing wax) this glass plate, the following details must be inserted in the flask. To remove the ions set free before expansion, an electric field is necessary, about 100 to 500 volts (Bbatteries might come in handy). Father Wulf uses a leyden jar charged by a few turns of an Influence machine. (An indicator can be connected in parallel to insure the presence of sufficient charge). The glass plate S constitutes one pole of the field, the conductor being a fine wire grid (mesh 10 mm., thickness 0.1 mm.) laid upon it. The delicate grid can be supported by a stouter wire ring and cemented in with the glass. A lead can be taken out through the pitch or sealing wax. This arrangement is an improvement on Wilson's gelatined plate, which was found to become fogged by the formation of germ cultures thereon. The wire grid does not obscure the vision much. The other pole of the field is the metal disk P fitted into the flask so as to leave a free air space of 2 to 3 mm. all around. It is supported by 3 or 4 right angled pieces

of wire 1.5 mm. thick (D) soldered to a piece of brass tubing R which fits into the neck of the flask and projects a little beyond it. From this projection the second lead is taken off to the source of potential The disk P also performs the more important function of replacing Wilson's more expensive device for preventing the formation of eddy currents, etc. (Later modifiers caused the air to pass through a number of small metal grids, but these were found to rob the air of its moisture so that after a few successive experiments the apparatus refused to function.) When the stopcock H is opened, the air rushing out from K to the flask below causes a cyclone between P and H but an anti-cyclone in the chamber to the right of P since the air from this part can only radiate out around the edges of P. Such an anti-cyclone is not at all conducive to the formation of eddies. The plate P moreover forms a good background for the fog streamers.

The radium preparation (radium sulphate) is supported on a pin head, the pin being stuck in a piece of cork cemented to the bottom of the flask. It is important to use an insoluble radium salt. The bromide and chloride preparations quickly dissolve in the moist air which K naturally contains.

When the apparatus is used for the first time, H should be removed and a funnel inserted -- water being poured in to a few cms. above the level A. The air can then be sucked through the outlet T until the U-tube is filled and the water in flask I sinks to level A. H is then replaced and the apparatus is ready for use.

When not in use, the condensation flask may be swung around so as to come over T and clamped in this position, thereby taking up less space. The apparatus can then be stored away (filled with water) ready for immediate use.



Mr. Joseph J. Lynch S.J.,
Valkenburg, Holland.

SEISMOLOGICAL INSTALLATIONS.

Increasing interest in geophysical researches has materially encouraged the installation of seismological apparatus. Recently several requests have been received at this Observatory for suggestions on the placing of this type of apparatus and this has suggested the feasibility of offering the readers of the Bulletin the following items.

Unless for very special reasons seismographs should not be located above ground level. When they are to be placed in buildings already established, the cellar should be considered the most suitable location. Moreover that part of the cellar furthest removed from all forms of jarrings should have first choice. Instruments should never be attached to the walls of these cellars. Caves, of course, are the fittest housings for these delicate recorders. These shouls be at least two thirds their height below the surface. Always locate seismographs of the horizontal type on piers, isolated by air cushions, of one to two inches in width, from the flooring of the room. These pier should not be too deep, four feet at a maximum and never less than one and a half feet. Piers should be made as massive as possible, thus eliminating pendular movement in them. In the construction of these piers reinforced concrete is the preferable material to be used. Brick and stone shouls be avoided. There seems no reason for insulating piers on which vertical instruments are to be mounted. Many vertical instruments, if not all, call for the most delicate temperature regulations. Where surface water is apt to lodge about piers, heavy oil should be used on the surface to prevent dampness. Dampness generally can be met by including in the cases about the instruments fused calcium chloride. Annoyances caused by insects can be eliminated by a periodic spraying of caves with one or other type of insecticide.

Laboratory rooms, developing rooms, etc., should never abut on the instrument shelter.

Father Francis Tondorf S.J.,
Seismis Station,
Georgetown University.

MEETING OF THE AMERICAN ASSOCIATION.

The Christmas Meeting of the American Association for the Advancement of Science anf affiliated societies took place this year at Washington,D.C. A fair number of Ours from this Province and from the Missouri Province were in attendance. The opening session was hel in Memorial Continental Hall at which the retiring president, Dr. C. W. Walcott, Secretary of the Smithsonian Institution, gave his address on "Science and Service". He spoke of the virtues that should characterize the scientist and declared that he believed that a good scientist should be a Christian. He ended with the words, "The Pilgrim Fathers knew little of science but they brought the great principles of law, truth, freedom and faith in God to America. Are we doing all in our power to perpetuate them in connection with the multiplex activities of the world of today?" Secretary of State, Hughes, also mad an excellent address. A large number of sessions were held in different parts of the city and it was necessary to make a choice of those which promised papers of most interest. An instructive featureof the meeting was the scientific exhibit. This was quite extensive and well worth a visit. SCIENCE for Feb. 6th gives a good account of the meeting and of the exhibit.

PUBLICATIONS.

Father F.A. Tondorf has an article in the January issue of the SAVE THE SURFACE Magazine entitled "Seismograms". We also notice a full page portrait of Father Tondorf beside one of his seismographs in Vol. II of THESE EVENTFUL YEARS published by the Encyclopedia Britanica Company. Mr. R.J. McWilliams has an article entitled "Lafitau: Father of Modern Ethnology" in the January number of the CATHOLIC WORLD Supplement No. 24 of the MONTHLY WEATHER REVIEW, July 1924, which is devoted the West Indian hurricanes and other tropical cyclones of the North Atlantic Ocean quotes Father J.J. Williams' vivid description of the hurricane of Nov. 1912 of which he was a witness in Jamaica. TYCOS-ROCHESTER for January has an article entitled "A Famous Typhoon Outlook in the Philippines". It is a description of the Manila Observatory and its work with a picture of the Observatory and of its distinguished Director Father Algue. There is also a picture of the new seismic observatory at Fordham with a brief notice. TYCOS-ROCHESTER is an interesting little quarterly published by the Taylor Instrument Company of Rochester, N.Y. While the subscription is 1.00 a year, schools, colleges and libraries are added to the list without charge. The SCIENTIFIC AMERICAN for February has a picture of the Fordham seismic observatory showing Mr. J.S. O'Conor who is in charge and his assistant.

N.B. Father Joseph Lafitau, referred to in the above article by Mr. McWilliams, was a French Jesuit born in 1671. He labored as a Missionary in Canada among the Indians, and published at Paris in 1724 his famous work "Moeurs des Sauvages etc.?" The principles and methods outlined therein form the basis of the article. Lafitau died in 1746.

ANNOUNCEMENT.

The Editor wishes to announce a series of articles on photographic processes as a teaching help in scientific and literary class work by Father J.A. Brosnan of Fairview, Weston, Mass. They will be practical in nature and will be of interest to all who make use of photography in their teaching or who wish to avail themselves of its valuable aid. The following are some of the topics to be treated:

1. Darkroom necessaries, chemical and apparatus.
2. The exposure room, the camera and stand, lenses, object board, backgrounds, lighting and exposure.
3. Negative making, the plates and films best adapted for different objects, developers and fixing bath.
4. Examination and "doctoring" of negatives, intensifying and reducing, spotting out.
5. Slide making by contact and with camera, reduction, colors, brushes and coloring.
6. Color copying, orthochromatic plates and films, filters and their uses.
7. Developing papers and their manipulation.

Suggestions and questions on the above topics will be welcomed.

DEATHS.

Members of our association were saddened by the news of the deaths of Father W.R. Cullen and Father J.A. Daly. Father Cullen was

professor of physics at Georgetown University and died at the University Hospital on January 5th. He had taught physics with great success both as a scholastic and as a Priest at Holy Cross and did post-graduate work at Johns Hopkins last year. Father J.A. Daly died at Woodstock on February 8th. He was ordained last June and was in his fourth year of theology. During his regency he taught chemistry at Fordham. Both Fathers were lovable characters and enthusiastic teachers and will be much missed by their brethren. R.I.P.

NOTES.

Mr. V.A. Gookin writes from Georgetown: "I attended the meetings of the chemistry section of the American Association but found little to report. The old question of the place of the electron in chemical education was brought up in one of the papers, but the reader seemed to report such differences of opinion that we were left without any conclusion. I do not know the opinions of our readers, but it seems to me that some of the teachers who were asked for an opinion met the question logically in replying that time is fleeting, chemistry text books are lengthening, and the status of the electron is beyond a certain point wavering so much that it has no place in the class room. Freshmen are not research workers and they have some A B C matter to learn and to learn well before they begin to study and discuss electrons. One sometimes wishes that teachers who talk so much about the heights to which their classes soar would HONESTLY tell us just what they do and just what results they get. A number of college teachers at the American Chemical Society meeting last April in Washington made a plea for common sense and honesty even at the risk of being called "old fashioned". To hear men who are Heads of chemistry departments at Universities plead for essentials of chemical teaching was reassuring after the alarms set up by others that unless we are talking like a Millikan or a Langmuir to our regular freshman classes we are behind the times.

Dr. James F. Norris, President of the American Chemical Society, was a guest at dinner at Georgetown recently, on the invitation of Father Coyle who is associated with him in the work of the National Research Council.

Father Coyle was named a member of the Program Committee of Washington Chemical Society for the coming year."

Father M.J. Ahern of Holy Cross spoke to the members of the Boston Rotary Club on Feb. 11 on the subject "What a Scientist-Theologian Thinks of Evolution". Father J.A. Brosnan of Weston gave an illustrated lecture before the Philomatheia Club of Boston at Boston College on Feb. 15. His subject was "Moths and Butterflies and Their Larvae".

According to THE CATHOLIC STANDARD AND TIMES of Philadelphia for Feb. 14th., Dr. Paul Heyl of the Bureau of Standards speaking from the Station WCAP in Washington on the subject "Weighing the Earth" gave an extended account of the work of Father Karl Braun of Austria along this line. Of course, Father Braun's main purpose was the accurate determination of the gravitational constant from which the weight of the earth can be deduced.

L. D. S.