John A. Tobin, S.J.

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CONTENTS

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EASTERN STATES DIVISION

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PROGRAM

TWENTIETH ANNUAL MEETING

of the

AMERICAN ASSOCIATION OF JESUIT SCIENTISTS

Eastern States Division

Held At

HOLY CROSS COLLEGE

Worcester, Mass.

September 2, 3 and 4, 1941

PROGRAM OF GENERAL MEETINGS

Tuesday, September 2, 1941, 7.45 P.M. *Room* 24, *Alumni Hall*

Address of Welcome .... Rev. Joseph J. Sullivan, S.J.

Reading of Minutes — Appointment of Committees

Presidential Address .... Rev. John A. Tobin, S.J.

Cosmic Rays and Logic

Illustrated Lecture .... Rev. Joseph G. Doherty, S.J.

The Boston College Expedition to the Lebanon

New Business — Adjournment

Thursday, September 4, 1.00 *p.m.* *Room* 24, *Alumni Hall*

Reports of Secretaries — Reports of Committees

Discussion — Resolutions

Election of Officers — Adjournment

PROGRAM OF SECTIONAL MEETINGS

Wednesday, September 3, 9.00 A.M.—3.30 P.M.

Thursday, September 4, 9.00 A.M.

BIOLOGY SECTION

Room 33 Beaven Hall

Chairman's Address .... Rev. James L. Harley, S.J.

Chlorophyll and Hemoglobin (illustrated) .... Rev. Joseph S. Didusch, S.J.

Botrytis infestans Montagne and Famine .... Rev. Joseph P. Lynch, S.J.

Phytohormones .... Rev. Joseph W. Murray, S.J.

Vegetable Reproduction by Leaves in the Brydphyllum

Mr. Eugene J. Harrington, S.J.

CHEMISTRY SECTION

Room 17 O'Kane Hall

Chairman's Address .... Rev. Albert F. McGuinn, S.J.
Biological Oxidation

Recent Advances in Color Photography (illustrated)
Rev. Michael J. Ahern, S.J.

Eyring's Prediction of Activation Energies
Rev. Bernard A. Fiekers, S.J.

The Law of Definite Proportions in the
General Chemistry Laboratory .... Rev. Gerald F. Hutchinson, S.J.

A Comparison of Photoelectric Colorimeters
Rev. T. Joseph Brown, S.J.

Molecular Weight Determination by
Isothermic Distillation .... Rev. Richard B. Schmitt, S.J.

The Electronic Theory of Acids and Bases
Rev. Joseph J. Sullivan, S.J.

Hylomorphism and Science .... Mr. Francis C. Buck, S.J.

MATHEMATICS SECTION

Room 25 Alumni Hall

Chairman's Address .... Rev. Frederick W. Sohon, S.J.
The New Mathematical Tables

The Birth and Growth of the
Ricci Mathematics Academy .... Mr. Harry W. Ball, S.J.

A Schematic Method fo rthe
Multiplication of Matrices .... Mr. John P. Murray, S.J.

A Difficulty in the Theory of
Transfinite Numbers .... Mr. Edward H. Nash, S.J.

Quasi-Moebian Surfaces—with some
Philosophical Implications .... Rev. Edward C. Phillips, S.J.

The Ratio and the Sciences .... Mr. Stanley J. Bezuszka, S.J.

A Necessary and Sufficient Condition for
Euclidean Space .... Mr. John F. Caulfield, S.J.

A Solution for an Equaton of the Form: $ax^m = x^n + b$
Mr. Joseph P. Crowley, S.J.

A Geometric Proof of the Algebraic Expression:
$(x+y)^3 = x^3 + 3x^2y + 3xy^2 + y^3$
Mr. Francis C. Jackmauh, S.J.

A Geometric Problem: To Construct a Triangle, Given
One Side, the Angle Opposite and the Radius of the
Inscribed Circle .... Mr. C. Richard McKenney, S.J.

PHYSICS SECTION

Room 24 Alumni Hall

Chairman's Address	Rev. Joseph M. Kelley, S.J.
High School Physics	
Out-of-the-rut Laboratory Projects	Rev. John P. Delaney, S.J.
The New Atom	Mr. Robert B. MacDonnell, S.J.
A Determination of the Velocity of Sound in Gases	Rev. Peter J. McKone, S.J.
Nuclear Fission and the Fate of Trans-uranic Elements	Rev. John S. O'Conor, S.J.
A Problem in Potential	Mr. Merrill F. Greene, S.J.
A Psycho-Galvanometer	Rev. John F. Fitzgerald, S.J.
The Ossipee Earthquakes	Mr. Clarence N. Blais, S.J.
Problems on Acoustics	Mr. John J. McCarthy, S.J.
Entropy	Rev. Thomas H. Quigley, S.J., Rev. Thomas J. Smith, S.J.
Jesuits in Aviation	Mr. James J. Dolan, S.J.
The Principle of Indeterminism	Rev. Joseph P. Kelly, S.J.

FIRST GENERAL SESSION

The 20th Annual Meeting of the American Association of Jesuit Scientists, Eastern States Division, was held at Holy Cross College, Worcester, Mass. on September 2, 3 and 4, 1941. The general session opened at 7:45 P.M., September 2nd in the College Physics Lecture Amphitheatre, the Reverend John A. Tobin presiding. The meeting began with a prayer by the President of the Association and was followed by the welcoming address delivered by Rev. Joseph J. Sullivan in the absence of the Reverend Joseph R. N. Maxwell, President of Holy Cross College. The reading of the minutes of the 19th meeting, held at Chicago was omitted since the complete program was published in the Bulletin. By a motion from the floor, the reading of the minutes of the 18th Meeting held at Fordham University, New York, was likewise omitted since this account was published in the Bulletin (Oct. 1939, Vol. XVII, No. 1.) Father Tobin appointed the following committees:

Committee on Resolutions
- Rev. Joseph M. Kelley.
- Rev. Edward C. Phillips.
- Rev. Albert F. McGuinn.

Committee on Nominations
- Rev. John S. O'Conor.
- Rev. Joseph S. Didusch.
- Rev. T. Joseph Brown.

The presidential address 'Cosmic Rays and Logic' was then delivered by Father John A. Tobin. Following the address, Father Joseph G. Doherty gave an illustrated lecture on the Boston College Expedition to the Lebanon.

In the business session which immediately followed, Father Gerald F. Hutchinson was appointed the new Editor in Chief of the Bulletin and a vote of appreciation for the past year's work rendered to Father Anthony Carroll. A suggestion to move the General Meeting up to the morning of Thursday, September 4th was approved and passed, after which the meeting adjourned.

FINAL GENERAL SESSION

The final general session was held in the Physics Lecture Amphitheatre at 10:00 a.m. on September 4th. Reports on the results of the elections of the various sections were presented as follows:

Biology—Chairman, Rev. Philip O'Neill, S.J.
Secretary, Mr. John Schuh, S.J.

Chemistry—Chairman, Rev. Bernard Fiekers, S.J.
Secretary, Mr. Francis Buck, S.J.

Mathematics—Chairman, Rev. George O'Donnell, S.J.
Secretary, Mr. Edward Power, S.J.

Physics—Chairman, Rev. Peter McKone, S.J.
Secretary, Mr. Stanley Bezuska, S.J.

Father Joseph M. Kelley, read the Resolutions from the Committee on Resolutions:

BE IT RESOLVED: That the American Association of Jesuit Scientists (Eastern States Division) expresses its appreciation and gratitude to Reverend Father Rector and Father Minister of Holy Cross College for their cordial reception and for the gracious hospitality shown to it during its convention.

BE IT RESOLVED: That we express our appreciation to the President and to Father Joseph J. Sullivan here at Holy Cross for the labor entailed in making this meeting a success.

BE IT RESOLVED: That we express our appreciation to Father Anthony G. Carroll, and his collaborators, of the editorial board of the Science Bulletin for their generosity, despite serious impediments and adverse circumstances, in carrying thru its publication for the benefit of the Association.

Joseph M. Kelley, S.J.
Edward C. Phillips, S.J.
Albert F. McGuinn, S.J.

A financial report from Father Power stated that there was a balance of about twenty five dollars in the treasury. Father Hutchinson was called upon to address the group, and urged in his talk frequent and generous contributions to the magazine. The new membership list were then brought up to date. The committee on nominations reported the following nominees:

President Father Edward C. Phillips
Father John P. Delaney

Secretary Father Joseph M. Kelley
Father Albert F. McGuinn

Father Phillips and Father McGuinn were elected.

PRESIDENTIAL ADDRESS

COSMIC RAYS AND LOGIC

REV. JOHN A. TOBIN, S.J.

The discovery of cosmic radiation is a great tribute to the work of Father Theodor Wulf, S.J. and Dr. Victor F. Hess. Their observations, measurements and logical reasoning give us a good example of the scientific method. In all branches of science we try to train the student to observe the variations, measure the constants and reason by induction to the laws of science. If the facts are not true, then all the good logic in the world cannot give a true conclusion. When the logic is faulty then all the good experiments and measurements cannot reach a true conclusion. The history of the discovery of cosmic rays gives us many examples of false conclusions that came from false facts and good logic or from false logic and good experiments.

By Logic we mean the science which directs the operations of the mind in the attainment of truth. The same human mind may have scientific, philosophic and revealed knowledge. The scientist does not cease to be human because he makes science his lifework. Experimental science was founded on Scholastic or Realistic Philosophy. In experiments we hold there is an objective universe and that our knowledge of this objective universe is imperfect. But when you change this objective universe by a philosophy that teaches that this universe only exists in your mind, then you have changed the whole foundation of experimental work. Of course there is difficulty when an idealistic philosophy tries to explain an experimental science that is founded on realistic philosophy. As realists we admit that our instruments are imperfect and we try to find the sources of error. In the measurement of cosmic rays we cannot study these rays directly, but indirectly as we measure the results of these rays. For the interpretation of these results, the scientist who is a Positivist will employ a Positivistic philosophy, the Idealist, an Idealistic philosophy, and the Realist, a Realistic philosophy. In the experimental work, all are realists. It is only natural that scientific theories should be influenced by this philosophy. The facts of science are constantly growing, and scientists are constantly changing their theories to fit the facts. But there are certain principles from philosophy that apply to all being and do not change. The scientist has to use his reason to know truth and these practical rules of reasoning do not change. The confusion that exists today comes from lack of logic as well as from the lack of scientific observation.

In the study of cosmic rays the scientist assumes that there is a material world that is extended to him, and he assumes that he has a capacity for knowing this objective world. The knower is the person, the knowing is the act, and the knowledge is the result. What is known is the real object outside the knower. Cosmic rays act and exist independently of the mind of the observer. He does not say these rays are himself or his sensation. Knowledge is true when there is a conformity between knowledge and the external reality outside the knower. And this truth is checked by studies all over the world. The insertion of instruments and recording devices does not change the object as long as they are neutral. You cannot use a hot plate to study snow. These instruments must be calibrated and their sources of error determined. It is well to note here that the conformity of our minds with the object has many degrees. One may have common sense knowledge from his senses, or scientific knowledge from measurements and the study of proximate causes, or philosophic knowledge from the study of all being and the ultimate causes. Since all measurements are relative there is error, but that does not deny that there is some conformity.

In the history of cosmic rays one error arose from stating a universal law from a small number of experiments. Within the limits of induction we may affirm or deny that which was affirmed or denied about the particulars under this universal subject. This was called the "Argument from Experience" by the early Scholastics. The difficulty is practical rather than logical. The logical process is abstraction. A constant effect demands a constant cause. When we find the quality that is indispensable in causing the effects, it is not difficult to make the law. But the practical difficulty is the experimental elimination of all the other factors that do not cause the change. The history of the discovery of cosmic rays proves that this elimination is no easy matter. The great complexity of the order and the difficulty of making accurate observations offered many difficulties.

To understand what we mean by cosmic rays and what we mean by the difficulties of logical reasoning from the measurements it is helpful to know the history of the discovery, the four types of instruments that were used to measure the rays, and the results obtained in these measurements.

The discovery of X Rays in 1895 by Röntgen prepared the way for the discovery of radioactivity by Bequerel. In 1898 the Curies discovered radium. It was soon observed that the positive particles or alpha rays, and the negative particles or beta rays, or the radiations like X Rays or gamma rays all had the common property of making gases electrically conductive. Ions of positive and negative electricity were formed in the gas and moved in opposite directions in an electric field. This current could be measured and the number of ion pairs formed per second, in each cubic centimeter (q) could be determined. This gave the total intensity of all radiations coming into the ionization chamber. At first this was considered as caused by radioactive substances. But in 1901 C. T. R. Wilson in England, and Elster and Geitel in Germany proved that the stagnant air in a dustproof sealed vessel had the property of conducting electricity. So the cause of the ionization was not the air in vessel as the radon and its decay products die out in the time used to hold the air. Some other source than the enclosed air must be the cause. Three other sources were then known. The earth had radioactive substances, the metal of the ionization chamber had these radioactive substances, and the air surrounding the chamber had these same substances. In 1903 Rutherford and Cooke, and McLennan and Burton in Canada observed that 30% of the ionization was cut off by a lead screen of a two inch thickness. The air and the earth were removed as causes by making the measurements over the ocean. In 1905 A. S. Eve in Canada stated that the small amount of radioactive substances in the chamber could not explain the amount of ionization ~~in the chamber when the earth and the air were removed as~~ causes. If we represent the total ionization as q and the ionization caused by the earth as q_e and the ionization caused by the air as q_a and the residual ionization caused from impurities in the metal as q_o then the equation read $q = q_a + q_e + q_o$ but there was still another amount called q. For example, you find ten dollars in the cash drawer. In making out the accounts you find that there was three dollars (q_o) in the drawer for cash, one sale was four dollars (q_e) and another sale was one dollar (q_a). But there is still two dollars to be accounted for. This was the problem that Fr. Wulf tried to solve. What was the cause of this ionization that did not come from the earth, the air or the metal. For example the capacity of the apparatus was 34.6 cm. The volume was 27,000 cc. Fr. Wulf used his own electrometer, but using a Lindemann electrometer, the time to pass five divisions was found to be 89.7 secs and the value of each division was calibrated as 46 divisions per volt. From the general equation the value of total ionization was determined.

$$q = \frac{1}{ew} \times \frac{c}{300} \times \frac{n}{s \times t} = \frac{1}{27{,}000 \times 4.8 \times 10^{-10}} \times \frac{34.6}{300} \times \frac{5}{46 \times 89.7} = 5.4\ \mathrm{I}$$

In 1910 Fr. Wulf determined the ionization at the foot of the Eiffel Tower, after subtracting the residual, as six ion pairs per sec per cc or (6 I). At the top of the Eiffel Tower he found 3.5 I, where there should have been none, as the air should have absorbed the radiations from the earth. Fr. Wulf constructed his own apparatus and his own electrometer. He observed and measured. Then he reasoned logically that either there was another source of radiation in the upper atmosphere or the absorption of gamma rays by air was smaller than given at that time.

Dr. Victor F. Hess, now Professor of Physics at Fordham University, and Nobel Prize winner in 1936 for the discovery of cosmic rays, writes, "After reading the account of Fr. Wulf's experiment, I decided to attack the problem by direct experiments of my own." Dr. Hess

Dr. Hess concluded in 1912 that the observed effect could only be interpreted by assuming that a very penetrating radiation of extra terrestrial origin exists. Kolhörster in 1918 called them Weltraumstrahlung generally named cosmic Rays.

removed the second suggestion of Fr. Wulf by measuring the absorption of gamma rays in air and found that they were completely absorbed in 500 meters of air. So then Dr. Hess tested the second conclusion. He made ten balloon flights and found the following interesting facts. At 500 meters altitude there were 2 I less than on the ground, at 1500 the same as on the ground, at 3500 there were 4 I more than on the ground and at 5000 there were 16 I more than on the ground. A. Göckel, in Switzerland, had made three flights with Fr. Wulf's electrometer but instrumental errors had masked the results. The practical difficulty of removing sources or errors was studied and in 1913 and 1914 Kohlhoerster went up to 9300 meters and verified the observations of Dr. Hess. Since that time many measurements have been made and they are so clear that reason demands some new and very penetrating radiation that comes from above the ground. Here we can note from the altitude effect a bit of poor logic. Millikan and Bowen in Texas noted this altitude effect but their measurements were different from Dr. Hess. The conclusion that Dr. Hess was wrong was not true. In 1930 J. Clay observed a new effect, the latitude effect. So both measurements were correct for their own latitude. Another false induction was noticed at this time. Observers who measure the intensity from 40° to 80° North did not observe the latitude change. Their conclusion that there was no latitude effect was false. It is noticed from 40° to the equator. The world war stopped the work but in 1925 Millikan and Cameron proved from their observations at great depths in snow fed lakes that these rays are very penetrating. ~~This was the first time that they were called cosmic rays~~. In 1932 both Compton and Millikan made a study of these rays all over the earth and verified the altitude and latitude effects. As the rays were deflected in the earth's magnetic field, as noticed in the east-west assymetry effects, it was reasoned that they must consist mostly of charged particles that would be deflected in these fields. These facts removed some of the false conclusions that came from very fine logic but on the foundation that the rays were electromagnetic radiations. It is now universally admitted that these particles originate outside the earth's atmosphere. When we realize the practical difficulties of removing 80% of the radiation that comes from the earth and the instruments, and the great difficulties of measuring the cosmic rays at high altitudes, then in deep mines and then in the ocean, and the work of coordinating results all over the world, it is interesting to note how the measurements proved the logical conclusion of Fr. Wulf that there was a new radiation of greater energy and penetration than we have on this earth.

x ? 1912 - Hess

There were four methods used in the experiments on cosmic rays. The first was the ionization chamber and electroscope. The discharge method allows the current to leak from the charged electrometer.

x "Weltraumstrahlung" was in 1918 Kolhörster

In the charge method there is a flow to the electrometer. To avoid large chambers the small chamber is used at high pressures. To avoid recombination as much as possible Argon gas is used. Compton used three concentric lead shells to cut out the radiations from the earth. In high altitude work this lead shield is not necessary as the air absorbs the rays from the earth. This instrument gives the intensity of ionization but not the number of rays or the nature of the rays.

The direction of the rays and the number of rays are determined by the Counter Telescopes. A single Geiger-Miller counter responds to rays in all directions. But when three counters or more in a line are actuated simultaneously, and the pulses from these counters are fed into a recording system that ONLY registers when ALL THREE are actuated simultaneously, then the direction of the counter shows the direction of the rays. As only cosmic rays have the energies to pass through all the counters, the counter telescope does not respond to any other rays, and we can then measure the number of cosmic rays. The Geiger-Miller counter consists of a Pyrex glass tube containing a copper cylinder about 20 cm. and 1 cm. in diameter. This copper cylinder is connected to the negative terminal of the high potential of 1000 volts. Through the center of the cylinder runs a small tungsten wire that is connected to the positive of the high potential through a high resistance of 10^8 ohms. The electrodes are held in place by a glass envelope that is sealed when filled with a mixture of 94% Argon and 6% Oxygen at a pressure of one-tenth of an atmosphere. The passage of a cosmic ray causes ions in the counter and these ions collide and cause other ions, and precipitate a discharge across the electrodes. The negative ions move to the positive thin wire, and cause an excess of electrons on one side of the condenser. The other side then becomes positive and this makes the grid negative in a 57 tube. This pulse is then amplified by the usual methods. The discharge of the counter is not continuous but intermittent. When the counter is exposed to a known source of radiation and the number of pulses are plotted against the applied voltage, the curve shows a threshold voltage, a plateau voltage where the counting rate is independent of the voltage, and then the glow discharge. The tube is then operated in some section of the plateau voltage. If the tube should be actuated at the instant that the tube is recovering, or at the time that the recording device is recovering, there is a source of error. This error is considered by the laws of probability. Another error would creep in from the chance that three different rays come from three different directions. To avoid this error, duplicate sets of counters are placed in the walls and so connected to the recording device that the apparatus does not register when these independent rays actuate the counters simultaneously. These cosmic ray telescopes proved that cosmic rays were electrically charged particles, as photons could not actuate the three counters simultaneously. By these telescopes the altitude and latitude effects were studied. A beam of particles is like an electric current, and a current in a magnetic field has a thrust on it the same as the thrust on the wire in the armature of a motor. As the rays that are bent in the magnetic field of the earth have to pass through more atmosphere, they are absorbed near sea level. It is found that the intensity is 10% greater at Vancouver than at the equator. Since more rays move perpendicularly to the earth's magnetic field at the equator than anywhere else, fewer charged particles should get through in that region, and Clay found the decrease from 40°S to the equator and likewise 40°N to the equator. At an altitude of 40,000 feet, however, Swann and Locher of the Bartol Research Foundation found many rays that were horizontal. These counters then tell us the direction of the rays and their number.

The third method is used to study the nature of these rays. The Wilson cloud chamber makes visible the ion path by means of droplets that condense around the ions. When the cloud chamber is placed in a strong magnetic field, the particles are bent into curved paths according to the nature of their charge and their mass. Anderson detected the positron as it had the same mass as the electron but an opposite charge. The energies of these cosmic rays were studied as the energy in electron volts could be measured by the product of 300 times the radius of curvature and the strength of the magnetic field. A most interesting combination of counters and a cloud chamber was used to study cosmic rays. If a cosmic ray actuated the counters above and below the cloud chamber, then that ray could be photographed in the cloud chamber. The pulse in the counters was used to actuate the plunger in the cloud chamber and also at the proper time to photograph the tracks that were visible. In this way there were pictures of cloud tracks on the film. In these pictures the cosmic ray showers were studied and the existence of a particle that was 200 times heavier than the electron was discovered. These particles called mesotrons have great penetrating power. This third method gives facts about the nature and the energies of these particles.

The fourth method was developed by Wilkins in Rochester. He made a study of tracks in the silver bromide of photographic plates. By determining the grain spacing and the number of particles per cc that have been blackened by the path of cosmic rays, he determined the types of particles and their energies. This method verified the results about the nature of the particles studied in the cloud chambers.

From the history of the discovery of cosmic rays and the use of the above four methods in the measurements, we have the following results. The intensity of these rays vary with the altitude. These rays also vary with latitude. There is the east-west assymetry of 10% more positives than negatives. The intensity varies with changes of pressure and changes of temperature. There is a monthly change which indicates a 27.9 day period. There is a daily period with a maximum at noontime. Then there are variations due to magnetic storms. There is need of more experimental evidence for a complete induction about these daily, monthly and irregular variations of the cosmic ray intensity.

Not only these variations in intensity, but the nature of the particles have been studied in the last ten years. Rossi in 1932 showed by an arrangement of three counters in a vertical plane with as much as a meter of lead between them, that about 40% of the charged particles coming down vertically at sea level are able to penetrate through this material. These must be particles as photons cannot pass through. When cloud chambers were interposed between the thickness of lead these cloud chambers operated by the coincident pulses from the counters the density of ionization showed the paths to be those of fast and penetrating electrons. The Rossi curves showed a maximum of counts at about two centimeters thickness of lead. As the thickness increased the number of counts decreased. This hump in the curve is also noted in the altitude intensity curves. So besides the penetrating particles there are less penetrating ones. These particles cause showers that can be photographed. The counters can be arranged so that a photon cannot cause the pulse in the first counter and we know the showers come from charged particles. This cascade process can be explained by the PRIMARY electron striking non-radioactive matter and sending out a PRIMARY photon as in the X Ray tube. Then this primary photon in striking an atom sends out an electron pair. These SECONDARY electrons of the pair can cause SECONDARY photons. These SECONDARY photons then produce the TERTIARY electrons in pairs. The low energy of these electrons dies out in collisions and they are easily absorbed. This low energy part of the cosmic rays explains the hump on the Rossi curves and the increase in ionization due to altitude up to 16 kilometers and then the decrease. The high energy electrons entering the atmosphere cause this shower effect and the increase of intensity. However after the equivalent of 2 cm of lead the thickness of the atmosphere absorbs these low energy electrons and the intensity decreases down to sea level. Many false conclusions came from the study of these low energy electrons that come from the showers. If you merely study this part of the energy spectrum then the incomplete induction about the nature of cosmic rays is misleading, as the penetrating electrons and mesotrons are omitted.

From photographs in the Wilson Cloud chambers we find that the earth is being bombarded by high energy particles that measure up to 20 billion electron volts. This is a thousand times higher than any source that we have on earth. Hundreds of these particles go through our heads every minute. A particle that has an average energy of a billion electron volts will pass through a thickness of 10 cm. of lead in a straight line. These particles have unit charges, are almost equally divided, with an slight excess of positives. Protons have a mass 2000 times that of the electron, and neutrons have this same mass but are not deflected in the magnetic field. These neutrons are detected when they bombard parafine and send out alpha particles that ionize the gas. This gives us the cosmic ray family of electrons and positrons of small mass, mesotrons of intermediate mass, and protons and neutrons of large mass. At present the great work is to study the energy of these particles.

From the history of cosmic rays we see how the careful measurements of Fr. Wulf, S.J., and his logical conclusion that some other agency, then unknown, must have been the cause, and the careful work of Dr. Hess in searching for this unknown cause of ionization lead to the great work in this study. It is an object lesson in both the scientific method and logic. The difficulty was practical. Nature only whispers her secrets and the scientist must listen carefully. He must realize that his mind is finite and he must be humble and not generalize from some few facts. We do not know how these high energy particles are sent out, and we do not know where they come from in the universe except it must be far out in space and free from matter.

(The above lecture was illustrated by many slides.)

BIOLOGY

CHLOROPHYLL and HEMOGLOBIN (Illustrated)

(Abstract)

REV. JOSEPH S. DIDUSCH, S.J.

It has long been known that green plants manufacture carbohydrates from the raw materials, carbon dioxide and water. But the nature of the process is still far from being fully understood. In 1870, von Baeyer suggested that first the carbon dioxide is split into carbon monoxide and oxygen. The water is, at the same time, broken down into hydrogen and oxygen. The carbon monoxide and hydrogen then unite to form formaldehyde, six molecules of which condense to form glucose. Seven years later, Erlenmeyer modified von Baeyer's hypothesis by supposing that the first product formed in photosynthesis is carbonic acid. This is reduced to formic acid which, in turn, is reduced to formaldehyde. In the beginning of the century Bach thought to improve on this hypothesis by assuming that the carbon dioxide is oxidized to a peroxide, while water and free carbon are formed which combine to produce formaldehyde. The oxygen is supposed to be split off from the peroxide to form an additional supply of formaldehyde.

In these earlier attempts little or no thought was given to the part played by chlorophyll in the photosynthetic process. To Willstaetter and Stoll (1912) are due credit for determining the chemical composition and properties of chlorophyll of which they found two kinds in green leaves, chlorophyll A and chlorophyll B. Associated with these are the yellow pigments, alpha- and beta-carotin, and xanthophyll. On the basis of these discoveries, Ewart (1918) advanced the hypothesis that chlorophyll, carbon dioxide and water react to form xanthophyll and glaucophyllin, with the elimination of oxygen. This oxygen combines with carotin and water to form phytol, glucose, levulose and formaldehyde. The glaucophyllin in the first reaction combines with phytol and carbon dioxide to re-form chlorophyll and release oxygen. The xanthophyll in the first reaction is also reduced to carotin. In this hypothesis formaldehyde is not a part of the process but only a by-product. Moreover, the specificities of the two chlorophylls are not taken into account. This was attempted by Baly, in 1928. He would have chlorophyll A combine with carbon dioxide to form chlorophyll B and formaldehyde. Chlorophyll B unites with carotin and water to re-form chlorophyll A and to form xanthophyll, the latter being reduced to carotin by some enzyme.

Not all investigators are of the opinion that formaldehyde is necessarily formed in photosynthesis. Thus, according to Spoehr and McGee (1924), carbon dioxide unites with protein in the leaf as it unites with hemogoblin in the blood. From this protein compound the carbohydrates are split off without the formation of formaldehyde or carbonic acid.

Formaldehyde is destructive of plant life. The proponents of the various formaldehyde hypotheses strive to minimize its deleterious effects by claiming that it is quickly converted into sugar and is not formed in large quantities. The claim is open to doubt. Bach showed that formaldehyde could be produced in vitro from carbon dioxide and water, in the presence of sunlight. Usher and Priestley, in 1906, extracted chlorophyll from green leaves and exposed it in thin gelatinous films, to sunlight. After an hour a trace of formaldehyde could be detected, but the chlorophyll had lost its color, it had been decomposed. The formaldehyde was formed, not by photosynthesis, but by the decomposition of the chlorophyll.

The primary function of chlorophyll is the production of carbohydrates in green plants. Hemoglobin does not manufacture food, it distributes food in the animal body. Still, these two substances are quite alike in some respects. They are both conjugated proteins. They are both pigments. They both exist in dual form, chlorophyll A and chlorophyll B in green plants, and hemoglobin and oxyhemoglobin in animals. If chlorophyll is treated with an acid and then with an alkali, the result is phylloporphyrin. If hemoglobin is treated in a similar way, the result is hematoporphyrin. The only difference between the two substances is that hematoporphyrin contains two atoms more of oxygen. The iron in the hemoglobin is removed in the same way as the magnesium is removed from the chlorophyll. Besides, these two porphyrins yield the same decomposition product, hemopyrrol. The chlorophylls are esters of an acid, chlorophyllin, and an alcohol, phytol. The addition of an acid to oxyhemoglobin results in the formation of hematin. The only difference between chlorophyllin and hematin is the element at the center of the molecule. In chlorophyllin it is magnesium, in hematin it is iron. Iron is necessary for the growth and development of green plants, though its function is not understood. Lastly, both pigments are concerned with the transfer of oxygen.

In 1930, Dr. Hans Fischer announced that he had for some time used chlorophyll in the treatment of anemia with promising results. In 1940, more extensive investigations into the therapeutic properties of the green plant pigment were carried out by Gruskin and his associates in the Temple University School of Medicine. Of twelve hundred patients treated, about a thousand suffered from various forms of rhinitis and sinusitis, skin diseases, including impetigo contagioso, Vincent's angina and pyorrhea. The other two hundred clinical cases included osteomyelitis, varicose ulcers, post-operative infections following removal of gall-bladder and appendix, gangrenous appendicitis, empyema, brain ulcers, fracture of the femur with suppuration, lesions of the vagina and rectum, and carcinoma. In the surgical cases the chlorophyll was applied in the form of water-soluble derivatives. In other cases it was used as an ointment made by mixing either finely ground chlorophyll A or chlorophyll B with lanolin or monolene. Unlike other powerful antiseptics and germicides, it is non-irritant.

BOTRYTIS INFESTANS AND FAMINE

(Abstract)

Rev. Joseph P. Lynch, S.J.

This is the fungus that caused the great Irish Famine of the last century. The social conditions of Ireland at the time and the devastating havoc the fungus produced were reviewed briefly. Montagne in 1845 was the first one to notice the association of this fungus with the potato blight. The difficulties that he and the other early research workers had in establishing this relationship are recounted. The work of Clinton, on the wintering spores, de Bruyn and others on the fertilization of this fungus, its life cycle, methods of control complete the paper. Anyone interested in a bibliography may obtain the same from the author.

VEGETATIVE REPRODUCTION BY LEAVES IN THE BRYOPHYLLUM

(Abstract)

Eugene J. Harrington, S.J.

The Bryophyllum is a plant that propagates both sexually and vegetatively. This plant has large, succulent, notched leaves. The latter when cut off from the parent plant and placed on moist soil are able to produce a new plantlet at every notch. These new plantlets do not develop from mature cells in the parent leaf but are rather the development of definitely defined embryos in the notch region. When the parent leaf was little more than a couple of millimeters in length, a group of meristematic cells were put aside in the crenations of the leaf and here they remained more or less dormant. When the parent leaf has matured these cells exhibit the organization of a growing point and need only the presence of the moist soil to arouse them to activity.

Further investigations found that plantlets could be made to grow while the leaf was still attached to the parent plant by injecting repeatedly very dilute solutions (0.01-0.05%) of acetaldehyde, ethyl alcohol or pyruvic acid. New plantlets could be produced, too, by exposing the plant to a temperature of 30-35° C for eight hours.

CHEMISTRY

BIOLOGICAL OXIDATION
(Abstract)

Rev. Albert McGuinn, S.J.

The last twenty years of research in the field of biological oxidation have led to the discovery of a large number of enzymes which act as catalysts in the intricate reactions involved. The progress in this field has been dependent on methods for isolating and purifying the enzymes and intermediates, in order to make quantitative studies of these isolated systems. With this information it has been possible to reconstruct the chain of events in the vital processes of fermentation and respiration.

The electronic concept of oxidation is best adapted for explaining the mechanism of oxidation of the organic metabolites, but the transfer of hydrogen by means of hydrogen carrier systems is found in all the schemes proposed for cellular oxidation. Among the known enzymes which catalyze the transfer of hydrogen from metabolite to oxygen are the vitamins, thiamin, riboflavin and nicotinic acid, which are present in tissues in nucleotide combination, and this furnishes the first indication of how the vitamins function in the organism.

The enzymatic chain of reactions is inhibited by any factor which breaks one link in the chain, and this fact has been widely used in studying the step wise process, and in isolating the accumulated intermediates.

Most significant of recent developments has been the discovery of an important role of organic phosphates as accumulators and carriers of energy liberated in cellular oxidation. The oxidative break down of one molecule of glucose is coupled with the formation of about twelve molecules of adenosine triphosphate containing energy rich phosphate bonds. This energy may then be released to furnish energy for the contractile system and to drive various synthetic reactions.

The picture of biological oxidation as drawn by biochemists shows a complex system of enzymatic reactions, of almost incredible intricacy, finely coordinated and balanced, and yet proceeding in the simple one-celled organism with perfect precision.

RECENT ADVANCES IN COLOR PHOTOGRAPHY

(Abstract)

REV. M. J. AHERN, S.J.

Recent new developments in color photography are based on the fact that certain dyestuffs act as developers, and simultaneously with the reduction of the latent image to silver, deposit a colored dyestuff in exact proportion to the quantity of silver reduced. There are two kinds of developers of this type, which are known as: Primary Color Developers; Secondary Color Developers. An example of the first is indoxyl. Two molecules of indoxyl react with four molecules of silver bromide to give one molecule of indigo, four atoms of silver, and four molecules of hydrogen bromide. If the silver is dissolved the image remaining will be indigo blue.

An example of Secondary Color Development also called "coupler" development—is shown when one molecule of dimethyl—p—phenylene diamine reacts with four molecules of silver bromide and one of alpha napthol to give indophenol blue, four atoms of silver and four molecules of hydro—bromic acid. Other developers would be:

Cyon blue = 2:3:4-trichloro-a-napthol.
Yellow = p-nitrobenzyl cyanide.
Megenta = Ethyl acetoacetate.

These and similar reactions are the chemical basis of Kodachrome, Agfa-color, and Defender Tri-Pack methods of color photography. Developers are called "coupler developers" because the two dyestuff developers unite to give the color.

REFERENCES:

Photo Technique: May 1941, pp. 63-65; June 1941, pp. 64-65; July 1941, pp. 62-64.

How to Make Color Photographs: pub. by "Photo Technique", New York City; McGraw, Hill.

Kodachrome: pub. Eastman Kodak Company.

Professional Kodachrome Photography: pub. by Eastman Kodak Company.

EYRING'S PREDICTION OF ACTIVATION ENERGY

(Abstract)

REV. BERNARD A. FIEKERS, S.J.

This paper was based on Eyring's fundamental contribution: J. Am. Chem. Soc., 53, 2537-2549, (1931) and the method was outlined for the simplest case of the three particle symmetrical complex in the reaction: para to ortho hydrogen. For the sake of briefest

possible introduction to the topic potential surface considerations could be omitted by considering activation energy of very concept, "some kind of minimum." Calculated and actual data were offered. Ensuing discussion dealt with discrepancy in this data; with application rates; and, with the validity of Eyring's partition of Morse potential energy values into ten percent "coulombic" and ninety percent "interchange" energy.

THE LAW OF DEFINITE PROPORTION IN THE GENERAL CHEMISTRY LABORATORY

(Abstract)

Rev. Gerald F. Hutchinson, S.J.

A perusal of the Inorganic Chemistry Laboratory Manuals seems to indicate that there are no completely satisfactory experiments for the various weight relationship theories occuring at this stage of the course. Therefore a detail study of some of them was undertaken with the following results.

The reduction of silver oxide. The average of eleven determinations gave an atomic weight of oxygen, 18.4. The formation of copper sulfide. The average of eight determinations gave an atomic weight of sulfur 33.2. The decomposition of potassium chlorate. The average of four determinations gave a percentage of oxygen, 39.65. (Theory 39.2).

The conclusion was drawn, that, all things considered, silver oxide would be the best experiment if a convenient method could be found to convert the silver back to the oxide. All three may be used for different principles, and thus obtain the advantages and technique of all.

MOLECULAR WEIGHT DETERMINATION BY ISOTHERMIC DISTILLATION

(Abstract)

Rev. Richard B. Schmitt, S.J.

Introduction. The fundamental principle of this new method of determining molecular weights is based upon isothermic distillation of volatile solvent of a solution of lower molarity to one of higher molarity. In a closed system this produces measureable changes in the volumes of such solutions. The volume changes are determined by following under a low-power microscope the changes in position of the meniscuses of the two solutions contained in separate capillaries. By appropriately pairing standard solutions of known concentrations

of a test substance and tabulating the ensuing changes in the volumes of the standard solutions, the molarity of the solution of the test substance is ascertained.

The apparatus was shown with the methods of reading, recording and interpreting of the results with calculations. Last year's results were given where ethyl alcohol was the solvent used and always under reduced pressure.

New developments were reported using other solvents than alcohol, but under reduced pressure. Then followed a report of the results with low boiling solvents at *atmospheric* pressure with actual experimental readings and calculations.

Finally, the application of this method to substances with high molecular weights. The example used was rubber (vistanex) dissolved in carbon disulphide at atmospheric pressure and the results obtained were given. Showing that this method is applicable to such substances.

(Lantern slides were used throughout.)

THE ELECTRONIC THEORY OF ACIDS AND BASES

(Abstract)

Rev. Joseph J. Sullivan

Historical:

Acids:

Boyle (SCEPTICAL CHEMIST, 1663)—Dissolve many substances, precipitate sulfur from its solution in alkalies, change blue plant dyes to red, lose all these properties in contact with alkalies.

Lavoisier (1790) oxygen theory of acids. Disproved by Davy.

Liebig (1830 circ.) vs Berzelius: substance containing easily replaceable hydrogen atoms.

Arrhenius (1883): hydrogen compound ionizing in water solution to give hydrogen ions.

Exaggeration of importance of ions . . . Harry Jones (Elements of Physical Chemistry, circ. 1904): "We have already reached a point where we can say that nearly all, if not all, chemical reactions are due to ions, molecules as such not entering into chemical action."

Present Theories:

1. *Arrhenius*: H-ions and OH-ions in water solution.

    Obj. Neutralization in org. solvents—no ions.

    cf. Folin and Flanders J. A. C. S. 37, 774 (1912)

2. *Solvent theory*: Begun by Franklin (1905)

    Acid + Base → Salt + Solvent

    $OH_3Cl + NaOH \rightarrow NaCl + 2H_2O$

    $NH_4Cl + NaNH_2 \rightarrow NaCl + 2NH_3$

Acid: solute which gives rise to a cation characteristic of solvent.

Base: solute which gives rise to an anion characteristic of solvent.

Obj. acid-base phenomena limited to solvent systems, undue emphasis on ionization.

3. *Bronsted-Lowry theory* (CULT OF PROTON, G. N. LEWIS) (1923)

Acid: proton donor Base: proton acceptor

Obj. Many acids contain no protons, eg SO_3

4. *Electronic theory* (Lewis, 1923)

An acid is an acid because it can accept an electron-pair to form a coordinate bond.

A base is a base because it can donate an electron-pair to form a coordinate bond.

Neutralization—formation of coordinate bond.

N. B. This theory seems most comprehensive and inclusive.

HYLOMORHISM AND CHEMISTRY

(Abstract)

F. C. Buck, S.J.

The problem of change is of importance to the philosopher and to the chemist. The solution of Aristotle and Aquinas is still the most adequate that has been proposed. The findings and facts of chemistry do not disprove but support this solution, if Aquinas' teaching concerning the predisposition of matter is borne in mind.

MATHEMATICS

THE NEW MATHEMATICAL TABLES

(Abstract)

REV. FREDERICK W. SOHON, S.J.

This paper described the mathematical tables compiled by the Federal Works Agency Work Projects Administration for the City of New York under the sponsorship of the National Bureau of Standards. Three volumes produced by this agency were discussed: publication No. 2, Tables of the Exponential Function; publication No. 3, Tables of Sines and Cosines for Radian Arguments; and publication No. 4, Tables of Circular and Hyperbolic Sines and Cosines for Radian Arguments.

The speed and convenience of any table is determined by the ease with which it can be interpolated. Methods of interpolation for use with the W.P.A. tables were suggested.

THE BIRTH AND GROWTH OF THE RICCI MATHEMATICS ACADEMY

(Abstract)

HARRY W. BALL, S.J.

The Academy founded four years ago by Fr. Eiardi and a group of freshmen at Boston College has contributed a notable amount each year to the cultural and social life of the collegians. Begun with enthusiasm and foresight this extra-curricular activity has met with a minimum of difficulties, and has carried on its work in a spirit of interest. Two of the obstacles never completely subdued are the determination of a suitable meeting-time, and the acquiring of continuous publicity. The Academy has had the fullest cooperation from the deans and the faculty. We publish a Journal; and we are one of the clubs belonging to the Greater Boston Association of College Clubs. The meetings are varied and instructive. Our success may be in part measured by the splendid work completed by our first graduates in June.

A SCHEMATIC METHOD FOR MULTIPLYING MATRICES.

(Abstract)

John P. Murray, S.J.

The schematic arrangement for a matrix product AB,

where $A=\begin{pmatrix}2&-1&2\\4&5&-8\\3&-2&1\end{pmatrix}$, and $D=\begin{pmatrix}4&3&-4\\4&-3&2\\1&2&5\end{pmatrix}$

has the following form:

$$\begin{array}{cc|cc|cc}
 & 4 & & 4 & & 1\\
 & 3 & & -3 & & 2\\
 & -4 & & 2 & & 5\\
\hline\hline
2 & & -1 & & 2 & \\
4 & & 5 & & -8 & \\
3 & & -2 & & 1 &
\end{array}$$

This schematic arrangement consists in placing the multiplier (i.e. A) in the lower portion of the diagram, and then placing above it the multiplicand (i.e. B) whose rows are now written as columns.

Rules:

1. To get the elements of the results, we multiply and sum the individual products of the corresponding elements in the multiplicand and the multiplier rows.

2. If the row of the multiplicand (in any single operation) denotes the column-element of the result, and if the row of the multiplier designates the row-element of the result, then any given element of the result may be put down by performing the operation of multiplying the correct row of the multiplicand by the desired row of the multiplier.

Therefore, $AB=\begin{pmatrix}6&13&0\\28&-19&-46\\5&17&-11\end{pmatrix}$

The general process also applies to rectangular matrices.

If

$$C=\begin{pmatrix}4&2&-1&2\\3&-7&2&-8\\2&4&-3&1\end{pmatrix}, \qquad \text{and} \qquad D=\begin{pmatrix}2&3\\-1&0\\3&5\\4&1\end{pmatrix}$$

$$\text{then } CD=\begin{array}{cc|cc|cc|cc}
 & 2 & & -1 & & 3 & & 4\\
 & 3 & & 0 & & 5 & & 1\\
\hline\hline
4 & & 2 & & -1 & & 2 & \\
3 & & -7 & & 2 & & -8 & \\
2 & & 4 & & -3 & & 1 &
\end{array}=\begin{pmatrix}11&9\\-13&11\\-5&-8\end{pmatrix}$$

A DIFFICULTY IN THE THEORY OF TRANSFINITE NUMBERS

(Abstract)

EDWARD F. NASH, S.J.

The difficulty consists in this, that there appear to be, on the premises of the theory, two classes which are cardinally similar and not cardinally similar. The two classes are: a) the finite integers greater than O; and b) the groups of these integers.

The dissimilarity is proved by the impossibility of enumerating one of the groups, that consisting of the excluded enumerators, as the enumerator of this group would have to be at the same time excluded and included.

The similarity is shown by arranging the groups in an enumerable series, the norm of arrangement being the ascending order of the highest integer contained in the groups, and within the ranks of those containing the same highest integer, the ascending order of the second highest, and so on.

A comparison of the two proofs shows that the class of excluded enumerators would not be contained in the series, as it would not have a finite number of integers or any highest integer, whereas any term in the series would. In this group, therefore, the contradiction centers, and either the series is inadequate to represent the class of groups, or the group in question is chimerical. The paper declared for the latter view.

QUASI-MOEBIAN SURFACES— WITH SOME PHILOSOPHICAL IMPLICATIONS

(Abstract)

REV. EDWARD C. PHILLIPS, S.J.
Georgetown University

In a brief historical introduction an account was given of the discovery and general properties of the "Moebian Band" or ring (first published in 1865 by Augustus F. Moebius, of Leipzig). The specific property (definition) of a *unilateral surface*, to which class the "ideal" Moebian surface belongs, was discussed in relation to the accepted philosophical definition of "surface" in general as "the limit of a body" or, abstractly, as "the boundary of a portion of space." This age-old definition seems to be incompatible with the class of "unilateral" surfaces which by their nature cannot bound or limit a body or a portion of space, since any surface enclosing a body or a

portion of space must of necessity have two aspects, the outside and the inside, from either of which it is impossible to pass to the other without piercing the surface, just as we cannot, in a plane, pass from the outside of a circle to the inside without piercing or going through the circumference. It was noted that the bounding surface of any physical Moebian Band or ring is neither a single Moebian (unilateral) surface nor a combination of two such surfaces, which it seems to be on first sight. The conclusion was reached that it is metaphysically impossible to construct physically a unilateral surface. This was the main reason for describing this paper as treating of *Quasi*-Moebian surfaces.

The methods of reconciling the accepted definition of "surface" with the geometric existence of unilateral surfaces, or vice versa, were indicated, and the more satisfactory one was adopted.

A simple diagrammatic method of studying the characteristics of the simple Moebian Band as well as of more complex rings of similar nature but with cross-sections in the form of any regular polygon was described and applied to a few examples indicating the results of cutting such rings along their axis.

THE RATIO STUDIORUM AND THE SCIENCES

(Abstract)

STANLEY J. BEZUSZKA, S.J.

The Jesuit Code of Education expressly framed to set forth a clear statement of educational policy, a definite arrangement of classes and a scholarly appraisal of the best pedagogical traditions available was first reduced to a written form between 1550 and 1575. But not until 1599, after twenty-four years of accumulated criticism based on widespread continental experience, and revision in 1591 did the 'Ratio atque Institutio Studiorum Societatis Jesu' receive its final form and official sanction.

Any definitive plan of study that can outlast the shifting educational innovations of over two centuries, and with slight extension serve for another century, must possess a mark of sound educational structure. At least, it represents a codified system of principles which though flexible enough for minor adaptations, still preserves a core of pedagogical tenets recognized as unchangeable. These educational ideals of the Society, emphasized from the authoritative sources of the Order, will serve as the foundation in the attempted transference of lasting educational principles to the modern exigencies of the scientific curricula.

A consideration of the remarkable progress of the Society in the educational field, reduces its success to three major factors. First, there existed a strong, single-minded co-operative spirit among the members of the Society; second, a trained analytic grasp of the varying needs of their period; third, an ability of completeness by which they systematized the entire course in the light of their primary, well defined aim. None of these characteristics are totally absent from the teaching faculties in the Jesuit Colleges and Universities throughout the country. In general, there exists among the Jesuit scientific faculty and administrators, an abiding conviction that the traditions of the Society are preserved. Still it is more obvious that the requirements peculiar to specific localities and modern needs have reduced whatever semblance of methodology we have to broad precepts and personal recommendations. But now such universal and general precepts are insufficient. For we are not confronted with the task of educating scientific men in general, but educating the Youth of a definite period in a country with individual problems and a definite philosophy. Therefore, the primary problem at present is the need of a publicized and definite set of rules for the various teaching schools under our direction. For though the Ratio broadmindedly permits and encourages personal initiative in the class teacher, still too much has been left to the option of teachers who possess either little experience, or resort to methods alike too old as too new. This scientific organizational group with the combined talents and varied experience of its members, can easily draw up a body of rules and methods which would be of immediate value and assistance in our high schools, colleges and graduate departments.

This need for systematizing is not fictitious or manufactured for the occasion. Numerous scientific magazines in the country whose content is familiar to you, run at least two to three articles a month on the subject of class room methods of teaching mathematics and science. These articles are accepted and printed, because there exists among the scientific faculty in the nation, the conviction that these papers are extremely helpful and pointed. Yet we who claim a superiority of teaching, stressing not our subject matter as much as our methods, have been very reluctant to follow the example. Moreover, when we do, the matter lacks the certain directness and concreteness that is consequent upon results of experience taken over a period of class trials and corrections.

Certainly we possess as much pedagogical skill as others. If our methods and standards are fruitful and adaptable, they ought to be circulated. If they are ineffective, lack precision, fail in achieving the force to carry the matter, we are all broadminded and eager enough to submit to suggestions and alterations. Any organization which makes teaching an outstanding part of its profession should periodically issue for reference, a definite code of educational principles, and approved methods for the guidance of its younger members as well as for the assistance of those lay professors who undertake to teach the more specialized branches in its schools. A sound educational policy recommends this for serious consideration.

A NECESSARY AND SUFFICIENT CONDITION FOR EUCLIDEAN SPACE*

(Abstract)

JOHN F. CAULFIELD, S.J.

The vanishing of the Riemann-Christoffel Tensor serves as a necessary and sufficient condition for Euclidean space.

I. Necessity of the condition: The metric of a Euclidean space is given by the sum of the squares of the differentials of the coordinate variables, i.e $ds^2 = (dy^i)^2$, $(i = 1, 2, \ldots, n)$. In that case the Christoffel symbols of both kinds are zero, and as a consequence the Riemann-Christoffel Tensor is zero.

II. Sufficiency of the condition: The vanishing of the Riemann-Christoffel Tensor is a necessary and sufficient condition that equations of the form:

$$dt^i = -\left\{ \begin{matrix} i \\ rs \end{matrix} \right\} t^r dx^s, \qquad (1)$$

be exact differentials and therefore, completely integrable. The equations (1), moreover, satisfy the differential equations of the geodesic lines of the space under consideration. Their complete integration yield, therefore, the geodesic lines of the space. It is possible to show that these geodesic lines are straight lines on the condition that equations (1) are exact differentials, the latter condition being fulfilled when the Riemann-Christoffel Tensor vanishes. To show that the integration of equations (1) yield straight lines under the above condition, it is necessary to verify it in an indirect way. This is done by taking the equations of straight lines in Euclidean space, viz.

$$y^i = a^i s + b^i \qquad (i = 1, 2, \ldots, n).$$

and transforming the Euclidean variables to any other system of coordinates by transformations of the form: $y^i = y^i\ (x^j)$. Thus:

$$y^i(x^j) = a^i s + b^i,$$

and then differentiating these equations with respect to the arc length *s*. In the differentiation the derivatives of x^j with respect to *s* will appear. Call these quantities t^j, and solve for them. Their differentials dt^j can then be found. The latter will contain a second partial deriv-

*The investigation of this problem was suggested as a Thesis subject by Mr. Marcou of the Boston College Mathematics Department and was worked out with his direction and assistance.

ative of x^k with respect to y^i and y^h, which may be replaced by a substitution obtained from the law of transformation of the Christoffel symbols of the second kind. This law contains two terms, one involving Christoffel symbols that are functions of the transformed variables x^j, the other containing Christoffel symbols that are functions of the original variables y^i. But the latter variables are Euclidean and the corresponding Christoffel symbols are zero. Hence the law of transformation will contain but one term and that will contain Christoffel symbols of the transformed variables. When this law is substituted in the differentials dt^j, one obtains precisely equations (1). Therefore, equations (1), when integrated, will yield straight lines as the geodesic lines in every direction in the space, and a Euclidean coordinate system can be introduced. There are several methods of finding such equations of transformation.

JEROME CARDAN'S GENERAL RULE FOR SOLVING EQUATIONS OF THE FORM

$$ax^m = x^n + b$$

(Abstract)

Joseph P. Crowley, S.J.

Jerome Cardan in his ARS MAGNA, chapter 8, proposes the following method or rule for finding a root or roots of any equation of the form $ax^m = x^n + b$, where m and n are any exponents whatever (m not equal to 0 and n not equal to infinity) but n the greater.

The rule states that we are to separate or divide the coefficient "a" into two such parts y and (a-y), so that the absolute value "b" shall be equal to $(a-y).y^{m/(n-m)}$. Then the root $x = y^{1/(n-m)}$.

A GEOMETRIC SOLUTION OF $(x+y)^3 = x^3 + 3x^2y + 3xy^2 + y^3$

(Abstract)

Francis C. Jackmauh, S.J.

The present demand by industry of workmen skilled in the use of mathematics should rouse the zeal and ingenuity of every high-school teacher so that his students study algebra and geometry for its practical value instead of bearing with it as a necessary evil. Towards this end any means of presentation that helps for clearness, as for example, the use of diagram and blocks to explain the geometric solution of the algebraic expression $(x+y)^3 = x^3 + 3x^2y + 3xy^2 + y^3$, should be used to make a deeper impression upon the youthful mind.

A GEOMETRIC CONSTRUCTION: Given one side, the angle opposite, and the radius of the inscribed circle, construct the triangle.

(Abstract)

Mr. Richard McKenney, S.J.

Given: side AB
angle C
radius r

Required: The triangle

Construction: Bisect the supplement of angle C, construct a triangle with the given side and these two angles. Circumscribe a circle about it. Draw a line parallel to AB at distance r above it. Draw a diameter from C, where the diameter cuts bottom of circle take the point as a center, and with the distance from here to A as radius draw an arc cutting points A and B and cutting the parallel line. Where the arc cuts the parallel line, take point as center and with r as radius draw a circle. Draw tangents to this circle from A and B. This forms the required triangle.

Proof: It can be proved that any triangle in the first circle has the required side and angle. Taking three such triangles it can be found that their excenters lie on a circle which passes thru A and B. It can also be shown the excenter of the triangle formed by joining the excenter of the isosceles triangle AEC with the points A and B, lies at the same point as the lower end of the diameter thru C. Since the triangle finally constructed as above contains the side, angle, and because its in-center is on the parallel line, it follows that it is the required triangle.

N.B.—This problem, with a hint as to its solution, appears as problem No. 41 pg. 15 of,
"Methods and Theories for the Solution of Problems of Geometrical Constructions applied to 410 Problems."
Julius Petersen, Trans. by Sophus Haagensen, Stechert & Co. (First Published 1879; Reprint 1927.)

PHYSICS

HIGH SCHOOL PHYSICS

(Abstract)

J. M. Kelley, S.J.

The future of the Jesuit high school physics teacher appears to be rather uncertain, his very existence, of course, depending on the answer to the question "Should physics be taught in the high schools?"

A quotation from a speech of Prof. Cope of the University of Pennsylvania sums up the first argument in favor of high school physics. "Physics is so close to life and so much a part of daily life that we dare not omit it or ignore it in our educational system." If 70% of our high school students do not go on to college work, as the latest figures indicate, then we dare not omit or ignore physics for them, that is, in the high school.

To ignore physics in our own high schools suggests an opposition to science which, even though it be only a seeming opposition, our enemies gladly seize on to embarrass us.

If we are to have any number of Catholic leaders in the world of physics, opportunities and training and direction must be provided as early as the high school.

The problem of fewer physics students in fewer schools now disturbing the college world is intensified in the high school because of the larger numbers, the majority not going to college. Many writers on the subject show a startling confusion of mind in their attempts to solve the problem. Colleges cannot begin to solve it or preserve a physics appeal to non technical students unless they realize the fate of high school physics is of vital importance to themselves.

OUT-OF-THE-RUT LABORATORY PROJECTS

(Abstract)

John P. Delaney, S.J.

The value of the project method of teaching has been much emphasized in recent years. Teachers in the grammar grades, no less than in the high schools, have been judged largely by their success with these new methods. Probably it should be conceded that student project activities, although open to abuse, offer an aid that is most valuable both in teaching and in learning. They are infinitely more agreeable and in some cases more successful, probably in most cases, than the more conservative methods of "reading, writing and 'rithmetic, under the rule of the hickory stick."

It might be said that the original idea behind laboratory science was precisely this more modern idea of project work on the part of the individual student. But the refinement of routine laboratory courses and the adoption of standard laboratory manuals appears gradually to have robbed the student of opportunities of following up his own interests in the science laboratory and of solving his own peculiar problems by methods of his own device. This whole subject has been admirably covered by B. A. Wooten in a contribution entitled "Project Work in Undergraduate Physics" presented before The American Association of Physics Teachers and published in Science Education for October, 1932. Prof. Wooten's paper is well worth the attention of every physics teacher.

As an adopted practice Wooten assigns his better students of first year physics to individual laboratory projects of their own choosing after only five months of routine laboratory work, on the theory that, five months are sufficient for the student's introduction to laboratory methods and precision measurements. Wooten's method appears justified by the number of his students he mentions as subsequently carrying their original projects even into postgraduate work. Some of these students later became professional physicists.

This latter point, the development of research physicists, is certainly high commendation for Wooten's methods of project work on the part of the undergraduate student. Of course there is a point in the practice, namely the loss of a half year of routine laboratory training, that would hardly merit approval of the more conservative physics teacher. A half year of formal laboratory work, according to the strict routine of the adopted laboratory manual, appears an irreparable loss when it is considered that ordinary time limitations restrict the whole year's work to less than half of the fifty or sixty standard laboratory experiments which every student really ought to perform. This loss will be partially made up in the cases of students going on to second and third year physics where the more advanced laboratory work, as also continued work on the project will probably compensate for the loss of the more elementary first year work.

The present writer is inclined to favor a modification of Wooten's practice, and the modification has yielded gratifying results. Enquiry has been made into the individual interests of better students, and every incentive has been offered for project work along these individual interests. Laboratory work along these interests has been necessarily performed during the regular laboratory periods, and formal reports always have been required on the work of each period. But extra work done out of class, and formally reported, has also been credited for higher grades.

THE NEW ATOM

(Abstract)

ROBERT B. MACDONNELL, S.J.

The paper described recent developments in the study of the atom. Theoretical physics triumphed in the prediction of the positron several years before it was discovered experimentally. The neutron restored to the subatomic universe the simplicity which had been apparently destroyed by the discovery of isotopes. Experiments give direct evidence of mesotrons with both positive and negative charges, and there is some evidence for a neutral mesotron which is sometimes called the neutretto. There have been predictions of a very light neutral particle, the neutrino, but as yet this is not confirmed by experimental data.

PROBLEMS IN ACOUSTICS

(Abstract)

JOHN J. MCCARTHY, S.J.

Satisfactory acoustical conditions in rooms demand that spoken words die out quickly so as not to interfere with those following. The time that it takes a sound to decrease to one millionth of its original intensity is called the reverberation time of the room. Sabine showed that the reverberation time of a room was directly proportional to the volume of the room and inversely proportional to the area of the absorbing material present. Experiment shows that there is an optimum reverberation time ranging from 0.9 to 2 seconds depending on the size of the room and that music requires a longer reverberation time than speech. The reverberation time of a room of fixed volume can be lowered by the use of sound absorbing materials of which there are a large number of commercial products on the market at the present day. The sound absorbing characteristic of the material is indicated by a decimal fraction called the 'absorption coefficient'. An open window with a coefficient of 1.00 is taken as a standard. All materials show some frequency discrimination but it is more pronounced in materials having high absorbing qualities. The low reverberation time necessary in a broadcast studio can be obtained by using a directional microphone which cuts down the effective reverberation received at the microphone and allows the use of absorbing materials with moderate coefficients and negligible frequency discrimination. Variation in reverberation time of a studio with different types of programs or even during the playing of a particular musical selection for the purpose of more realistic reproduction may be obtained by reversible panels absorbent on one side and non-absorbent on the other which may be built into the wall and turned into the room at will.

NUCLEAR FISSION
AND
THE FATE OF THE TRANSURANIC ELEMENTS

(Abstract)

John S. O'Conor, S.J.

After a review of the history of the discovery of nuclear fission the particular aspect of this topic stressed was the practically complete abandonment by nuclear physicists of the notion that elements of atomic number higher than 92 were formed by the bomdardment of heavy nuclei by neutrons, followed by absorption of the neutron and subsequent emission of an electron.

That such a process is possible and in fact does occur despite the acceptance of fission theory seems to be confirmed by the existence of the 23 minute U^{239}. This short lived radioactive isotope of Uranium produced by resonance capture of 25 volt neutrons has been chemically established as true Uranium by precipitation as uranyl sodium acetate.

Its beta activity should result in $_{93}$Eka-Re, a transuranic element which would be expected also to be unstable. However no alpha or beta emission has ever been found from it. Thus the one remaining transuranic element has as yet not been directly observed but its existence is still logically inferred.

Cf. Turner, Physical Review 57-P. 154 L.

A PROBLEM IN POTENTIAL

(Abstract)

Merrill F. Greene, S.J.

Some properties of regions under the influence of space, surface, and double layer distributions of static charges of electricity were applied to a given potential function (theoretical), in order to determine what distributions were responsible for it, their respective strengths, and the values of the electric intensity in the regions where the function obtained.

A PSYCHO-GALVANOMETER

(Abstract)

John F. Fitzgerald, S.J.

Described in this paper is an instrument for obtaining indications and qualitative measurements of the psycho-physical reactions attendant upon psychic disturbances. The Tarachometer, as this device contructed at Weston College has been named, utilizes the varying

body resistance of the Subject under test to provide an indication of internal disturbance. It consists of a Wheatstone Bridge, high gain d.c. voltage amplifier and an output stage coupling the voltage amplifier to the indicating meter—a low resistance Milliammeter. The Subject, forming the X or variable resistance arm of the input stage, is connected by means of a metal strip strapped to each palm. The voltage amplifier consists of a '57 tube connected as the plate load of a similar pentode. An additional tube ('59) is used to convert the voltage fluctuations to current changes. Preliminary tests have been satisfactory—providing adequate indications of disturbances resulting from lies, laughs and the performance of problems of mental arithmetic. Further tests, to be conducted by the Department of Empirical Psychology, are now awaited.

THE OSSIPEE EARTHQUAKES OF 1940

(Abstract)

C. Nelson Blais, S.J.

This paper gave an account of the work done at the Weston College observatory in the study of New England seismic disturbances. On December twentieth and twenty-fourth, 1940, two quakes shook New England and immediately after each shock a preliminary determination of the epicenter showed that they had originated in the Ossipee Mountains of New Hampshire. U. S. Coast and Geodetic Survey questionnaire cards were mailed to responsible citizens living in the vicinity of the epicenter. A group of seismologists from Weston and Harvard conducted an investigation of the affected areas. With the data that had been gathered in the field and in response to the Survey cards—over 600 items in all—an isoseismal map of New England was plotted and the center of the quake was placed in the town of Tamworth, N. H. When the various member stations of the North Eastern Seismological Association had sent their reports to the central station at Weston, the quake center was accurately placed in the western section of Tamworth. Four interesting papers on the quakes have been written by Weston and Harvard seismologists and will soon appear in the Bulletin of the Geological Society of America.

JESUITS IN AVIATION

(Abstract)

James J. Dolan, S.J.

This paper treated of the work of early Jesuit scientists in the field of aviation. Although it is not well known the original works of such famous men as Athanasius Kircher, Gaspar Schott, and Lauro give considerable space to the consideration of man's attempts at flying.

While the conquest of the regions above the earth has been realized only in recent times, our early scientists foresaw and explained the principles which govern the airship and the balloon. Had these men only had the necessary money and material there is no doubt but what aviation would be two centuries older than it is.

THE PRINCIPLE OF INDETERMINISM

(Abstract)

J. P. Kelly, S.J.

From the analytical study of the Physical aspect of this problem, it would seem that the Principle of Indeterminism attacks one of the foundation stones of Classical Physics. In the past, it was held that an exact knowledge of phenomena was, in principle, possible. Even though in the actual process of experimentation errors did occur, the scientist believed that in principle, these could be corrected, either by more accurate observation or through a greater precision of physical instruments.

The Heisenberg Principle denies that such exact knowledge is, in principle, possible. For, in the sub-atomic order, the very instruments of observation and measure cause a disturbance of the conditions of the phenomenon to be known. The margin of error is relatively so large that exact knowledge is placed beyond our reach.

The Indeterminacy Principle does not really affect any fundamental principles or notions in Scholastic Philosophy. Though the scientist may use the terms: Free Will, Causality, he defines these terms quite differently from the philosopher.

NEWS ITEMS

GEORGETOWN UNIVERSITY

A Brief Report of the results obtained by the Georgetown College Observatory section of the National Geographic-National Bureau of Standards Eclipse Expedition—Patos, Brazil—1940.

PAUL A. MCNALLY, S.J.

Owing to the international situation, the Navy Department cancelled the Naval Observatory expedition about a month before the expedition was to have left for Brazil. The Superintendent of the Naval Observatory, Captain Hellwig, then requested Father McNally to include in his program the most important feature of the Naval Observatory program—A determination of the times of contacts. Georgetown was extremely fortunate in having this request made—since the floating clouds during the eclipse period, especially at the time of totality, made impossible the carrying out of most of the rest of the program of the expedition.

In general the method followed in this investigation, is to secure a series of photographs of the partial phases of the eclipse, both before and after totality. A schedule of lengths of chords is then computed, using the best available positions of the moon—with this schedule the measured values of the chords from the photographs are compared. The residules constitute the corrections to the positions of the moon.

The best previous determination by this method was made by Mr. J. Willis, of the Naval Observatory, from partial phase pictures secured during the 1937 eclipse, Canton Island. At that time 48 crescent pictures were used.—One picture being taken on each plate. Had there been no clouds at Patos 260 pictures would have been taken—but even with the clouds interfering more than 100 partial phase pictures were secured.

Particulars worthy of note.

Instrument and attachments.

All the photographs were taken with the Georgetown College Observatory 3.5 inch Ross lens—63 inch focal length. This camera and another of 21 inch focal length are mounted along with a 5 inch visual telescope equatorially.

The shutter of the camera was electrically connected with the chronograph, for the recording of the times of the exposures. A sidereal chronometer furnishing the time record.

To reduce the intense sun-light, and avoid scattering, a thinly silvered optical flat of high quality, was used in front of the objective. Experiment before eclipse day showed that with this combination, using an exposure of about one tenth second, a series of sixty exposures could be put on an 8x10 plate without any fogging, or scattering of light.

For the orientation of the exposures a white screen, marked with a series of sixty dots was placed in the focal plane of the 21 inch camera to assist in the manual setting of the instrument, between exposures. A red filter in front of the 21 inch lens of this camera cut down the light of the sun—so that moving the image from dot to dot was very simple. A metronome, beating seconds, was used at the instrument as an aid in spacing the exposures.

Emulsion and development.

The emulsion selected for this work was the Eastman Microfile—an extremely fine-grained emulsion. The Eastman Company very kindly put the emulsion on glass for this experiment.

Eastman D.K. 15 was used in developing the plates. The recommended time for this developer is about three minutes at 65F. But since measurable points as dark as possible were the main features to be considered on these plates, a developing time of five minutes was used.

Results

All the plates were measured on the Georgetown measuring engine. The very remarkable feature of this part of the work was the sharpness of the crescent points. Father Phillips has reported on this subject in an earlier issue of the science bulletin.

Corrections to the predicted times of contacts.

I	contact	—$0^s.22$
II	contact	—0 .30
III	contact	—0 .30
IV	contact	—0 .37

The probable error was of the order of ± $0^s.30$

WESTON COLLEGE

SEISMOLOGICAL OBSERVATORY

Two members of the Department, Fathers James J. Devlin and Laurence C. Langguth, have departed for Tertianship at St. Robert's Hall, Pomfret, Connecticut. Two others, Messrs. Clarence N. Blais and John F. McEwen, have taken over their duties.

During the summer the Humble Oil and Refining Co., of Houston, Texas, donated six more amplifiers, galvanometers, geophones, etc., to complement the equipment they had given us before. The Department purchased a new Ford chassis and Mr. Vincent P. Marran of Holyoke, Mass., donated a specially built body to house the seismic equipment. Mr. John Hanby, an engineer in the employ of Mr. Marran, designed the body to fit the needs of the twelve trace reflection unit.

Mr. C. Phelan, owner of Station WESX, Salem, Mass., presented a Hallicrafter All-Wave receiver to the Department, and is likewise having his station engineer design certain communication sets to be used with our seismic truck.

A seismic survey of the Triassic formation of the Connecticut River Valley was planned for the month of July in the current year. Due to the "Emergency" certain equipment as channel wire, etc., could not be obtained. The present plans call for the commencement of the survey in October. The survey will begin about 8 miles west of Springfield, and as we work eastward the city officials of Springfield have offered full cooperation under the direction of Prof. Howard C. Meyerhoff, head of the Dept. of Geology at Smith College. This year's work is more in the form of a preliminary survey to ascertain whether it will be worthwhile to conduct a series of profiles down the Valley in the State of Connecticut. The project is financed by the Geological Soc. of America.

Several papers by members of the Department are to appear soon in the Bulletin of the Seismological Society of America. These papers are published in conjunction with the Division of Geological Sciences of Harvard University.

BIOLOGY DEPARTMENT

During the past few years the Biology Department has acquired ample equipment for a thorough undergraduate course.

In addition to these routine courses, experiments have been carried on in several other fields. One experimenter conducted crosses with the fruit fly in which he not only reviewed the fundamental types of inheritance but also investigated numerous complicated multiple factor crosses.

Interest of others in the raising of tropical fish has resulted in the acquiring of a number of tanks which contain about twenty varieties of fish. Up to the present, work in this branch has included an accurate observation of their various habits, both feeding and breeding; the best methods of caring for them and the difficult problem of raising cultures of Daphnia, Brine Shrimp, and Enchytrae with which to feed them.

Nature work in the numerous woods and fields about Weston is being done by several members of the department. Samples of pond water and plant life have provided excellent sources of specimens for observation in the laboratory. A large map of the grounds is gradually recording data, derived from check lists of flowers, birds, insects, reptiles, etc., found around the college.

A new addition to the department in the last year was the building of a room in the cellar which now contains cages housing about fifty guinea pigs. During the course of the year the animals were controlled in their breeding so that the inheritance of their coat colors could be studied. Further experiments, concerned with the transplanting of various organs and glands, are planned for the coming year.

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Note: The figures at the end of each entry indicate the year the member was admitted to the Association.

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Bauer, Mark, 1935, *Woodstock College.*
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Busam, Rev. Joseph F., 1921, *Holy Cross College.*
Callahan, Rev. Edward A., 1932, *Holy Trinity Church.*
Carroll, Philip, 1937, *Woodstock College.*
Coniff, Rev. Arthur A., 1923, *Georgetown University.*
Cronin, Rev. Thomas C., 1935, *Woodstock College.*
Deeley, James J., 1937, *Weston College.*
Didusch, Rev. Joseph S., 1922, *Loyola College.*
Dore, Rev. Francis J., 1924, *Boston College.*
Dougherty, John J., 1937, *Woodstock College.*
Dubois, Rev. Edwin C., 1924, *Boston College.*
Ewing, Rev. J. Franklin, 1933, *Ateneo de Manila.*
Fay, John G., 1939, *Woodstock College.*
Flavin, John W., 1941, *Fordham University.*
Freatman, Rev. Harold L., 1924, *Los Angeles, Cal.*
Frisch, Rev. John A., 1925, *Canisius College.*
Gerry, Stanislaus T., 1939, *Weston College.*
Glose, Rev. Joseph C., 1930, *Woodstock College.*
Gookin, Rev. Vincent A., 1923, *Baghdad, Iraq.*
Harley, Rev. James L., 1927, *Fordham University.*
Harrington, Eugene J., *Holy Cross.*
Hennessey, Rev. Gerald J., 1934, *St. George's College, Kingston, Jamaica, B.W.I.*
Keegan, Rev. Joseph G., 1930, *Kohlmann Hall.*
Kirchgessner, Rev. George L., 1925, *Cagayan, oriental Misiamis, P. I.*
Kleff, Louis C., 1939, *Woodstock College.*

Lawlor, George F., 1939, *Weston College.*
Lynch, Rev. Joseph P., 1932, *Canisius High School.*
MacCormack, Rev. Anthony I., 1925, *Weston College.*
McCauley, Rev. David V., 1923, *Georgetown University.*
McCoy, Daniel F., 1939, *Fordham University.*
Murray, Rev. Joseph W., 1934, *Woodstock College.*
O'Brien, Rev. John J., 1934, *Auriesville, N. Y.*
O'Neill, Rev. Philip H., 1941, *Fordham University.*
Pfeiffer, Rev. Harold A., 1931, *Xavier High School.*
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Roy, Gregory R., 1941, *Boston College.*
Schuh, Joseph E., 1939, *St. Joseph's College.*
Shaffrey, Rev. Clarence E., 1923, *St. Joseph's College.*
Smith, Rev. Thomas N., 1936, *La Plata, Md.*
Stoffel, Rev. Joseph I., 1933, *Auriesville, N. Y.*
Walsh, Rev. Michael P., 1935, *Weston College.*
Walter, Rev. William J., 1930, *Fort McClellan, Ala.*
Wilkie, Rev. Francis X., 1934, *Cranwell Preparatory School.*
Zegers, Rev. Richard T., 1934, *Woodstock College.*

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Beatty, Vincent F., 1941, *Loyola College.*
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Blatchford, Rev. John A., 1923, *Winchester Park, Kingston, Jamaica.*
Brady, John J., 1938, *Woodstock College .*
Brophy, Rev. Thomas A., 1932, *Woodstock College.*
Brosnan, Rev. John A., 1923, *Woodstock College.*
Brown, Rev. Thomas J., 1922, *Canisius College.*
Buck, Francis C., 1941, *Boston College.*
Butler, Rev. Thomas B., 1922, *Boston College.*
Carroll, Rev. Anthony G., 1929, *Chaplin U. S. Army.*
Cawley, Joseph A., 1938, *Woodstock College.*
Cheney, Edmund K., 1935, *Weston College.*
Cummings, Rev. William V., 1932, *Georgetown Preparatory School.*
Doino, Rev. Francis D., 1930, *Ateneo de Manila.*
Duke, Joseph A., 1940, *Fordham Preparatory School.*

Fiekers, Rev. Bernard A., 1933, *Holy Cross.*
Gisel, Rev. Eugene, 1925, *Ateneo de Manila.*
Guay, Rev. Leo J., 1935, *St. Robert's Hall.*
Haggerty, Gerard A., 1934, *Woodstock College.*
Hauber, Rev. Edward S., 1929, *Fordham University.*
Hilsdorf, George J., 1940, *Canisius College.*
Hohman, Rev. Arthur J., 1922, *St. Peter's College.*
Hufnagel, Rev. Alvin A., 1933, *Brooklyn Preparatory School. 1150 Carroll St.*
Hutchinson, Rev. Gerald F., 1933, *Weston College.*
Kelleher, Rev. William L., 1932, *St. Andrew Bobola House.*
Landrey, Rev. Gerard M., 1930, *Cranwell Preparatory School.*
Martus, Rev. Joseph A., 1934, *St. Robert's Hall.*
McCawley, Edward G., 1934, *Woodstock College.*
McGuinn, Rev. Albert F., 1932, *Boston College.*
Molloy, Rev. Joseph J., 1929, *St. Joseph's College.*
Moynihan, Rev. Joseph C., 1930, *45 Cooper St., Boston, Mass.*
Muenzen, Rev. Joseph B., 1923, *Fordham University.*
O'Byrne, Rev. Francis M., 1934, *St. Andrew-on-Hudson.*
Pallace, Rev. James J., 1934, *Auriesville, N. Y.*
Power, Rev. Francis W., 1924, *Fordham University.*
Quevado, Rev. Anthony J., 1933, *Auriesville, N. Y.*
Schmitt, Rev. Richard B., 1923, *Loyola College.*
Sullivan, Rev. Joseph J., 1923, *Holy Cross College.*
Thiry, James H., 1935, *Woodstock College.*

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Caulfield, John F., 1939, *Weston College.*
Cohalan, Joseph F., 1934, *Woodstock College.*
Connolly, Rev. James K., 1933, *Holy Cross College.*
Crowley, Joseph P., 1939, *Weston College.*
Depperman, Rev. Charles E., 1923, *Manila Observatory.*
Dineen, Edward H., 1938, *Woodstock College.*
Donohoe, Francis J., 1938, *Weston College.*
Donohue, Rev. Joseph J., 1934, *Jamaica, B.W.I.*

Doucette, Rev. Bernard F., 1925, *Manila Observatory.*
Duross, Rev. Thomas A., 1932, *Xavier High School.*
Dooley, Rev. Joseph C., 1934, *Jamaica, B.W.I.*
Dutram, Rev. Francis B., 1935, *Jamaica, B.W.I.*
Eiardi, Rev. Anthony J., 1935, *Weston College.*
George, Rev. Severin E., 1934, *Xavier High School.*
Gough, Raymond V., 1938, *Woodstock College.*
Greene, Merrill F., 1939, *Weston College.*
Hennessey, Rev. James J., 1933, *Woodstock College.*
Jackmauh, Francis C., 1939, *Weston College.*
Judah, Rev. Sidney J., 1934, *Jamaica, B.W.I.*
Kelley, Rev. Joseph M., 1922, *Loyola High School.*
Love, Rev. Thomas J., 1923, *St. Joseph's College.*
MacDonnell, Robert F., 1937, *Weston College.*
McCarthy, John J., 1938, *Weston College.*
McCauley, Charles E., 1934, *Woodstock College.*
McCormick, Rev. James T., 1923, *Holy Cross College.*
McDevitt, Rev. Edward L., 1933, *Canisius High School.*
McGrath, Rev. Philip H., 1932, *St. Peter's College.*
McNally, Rev. Paul A., 1923, *Georgetown University.*
Merrick, Rev. Joseph P., 1923, *Baghdad, Iraq.*
Morgan, Rev. Carol H., 1933, *Boston College.*
Mulchay, John J., 1938, *Weston College.*
Murray, Rev. Joseph L., 1928, *Boston College High School.*
Murray, John P., 1939, *Weston College.*
Nash, Edward H., 1940, *Loyola High School.*
Neuner, Charles M., 1938, *Woodstock College.*
Nuttall, Rev. Edmund J., 1925, *Manila Observatory.*
O'Brien, Rev. Kevin J., 1933, *Auriesville, N. Y.*
O'Callahan, Rev. Joseph T., 1929, *Pensacola, Fla.*
O'Donnell, Rev. George A., 1923, *Boston College.*
Phillips, Rev. Edward C., 1922, *Georgetown University.*
Persich, Joseph A., 1940, *Brooklyn Preparatory School.*
Quigley, Rev. Thomas H., 1925, *Holy Cross College.*
Repetti, Rev. William C., 1923, *Manila Observatory.*
Rocks, Rev. Thomas J., 1937, *Ateneo de Manila.*
Rooney, Rev. Albert T., 1933, *St. Peter's High School.*
Roth, Joseph S., 1941, *Xavier High School.*
Schweder, Rev. William H., 1933, *Auriesville, N. Y.*
Smith, Rev. John P., 1923, *St. Joseph's High School.*
Smith, Rev. Thomas J., 1925, *Weston College.*
Sheehan, Rev. William D., 1928, *Baghdad, Iraq.*
Sohon, Rev. Frederick W., 1924, *Georgetown University.*
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Brock, Rev. Henry M., 1922, *Holy Trinity Church, Shawmut Ave., Boston.*
Burns, Rev. William F., 1935, *St. Robert's Hall.*
Caulfield, John F., 1939, *Weston College.*
Cohalan, Joseph F., 1934, *Woodstock College.*
Connolly, Rev. James K., 1933, *Holy Cross College.*
Crowley, Joseph P., 1939, *Weston College.*
Daley, Rev. Joseph J., 1930, *Manresa Institute, Keyser Island.*
Delaney, Rev. John P., 1923, *Loyola College, Evergreen, Baltimore, Md.*
Depperman, Rev. Charles E., 1923, *Manila Observatory.*
Devlin, Rev. James J., 1934, *St. Robert's Hall, Pomfret, Conn.*
Doherty, Rev. Joseph G., 1930, *Loyola University, New Orleans.*
Dutram, Rev. Francis B., 1931, *Boston College.*
Fitzgerald, Rev. John F., 1935, *Weston College.*
Frohnhoefer, Rev. Frederick R., 1926, *Xavier High School.*
Gallico, Jacobus E., *Loyola College, Evergreen, Baltimore, Md.*
George, Rev. Severin E., 1934, *Xavier High School.*
Grady, Donald F., 1939, *Weston College.*
Greene, Merrill F., 1939, *Weston College.*
Guichetau, Rev. Armand J., 1932, *Ateneo de Manila.*
Hearn, Rev. Joseph R., 1925, *St. Ignatius Church, Baltimore.*
Hennessey, Rev. James J., 1933, *Woodstock College.*
Heyden, Rev. Francis J., 1931, *St. Mary's Church, Boston, Mass.*
Jaskievicz, Walter C., 1940, *Boston College.*
Kelley, Rev. Joseph M., 1922, *Loyola High School.*
Kelly, Rev. Joseph P., 1931, *Weston College.*
Kirsch, Simon C., 1937, *Woodstock College.*
Kolkmeyer, Rev. Emeran J., 1922, *Brooklyn Preparatory School.*
Langguth, Rev. Laurence C., 1935, *St. Robert's Hall, Pomfret.*
Linehan, Rev. Daniel, 1931, *Weston College.*
Love, Rev. Thomas J., 1923, *St. Joseph's College.*
Lynch, Rev. J. Joseph, 1922, *Fordham University.*
MacDonnell, Robert B., 1937, *Weston College.*
McAree, Rev. Joseph F., 1923, *Brooklyn Preparatory School.*
McCarthy, John J., 1938, *Weston College.*

McDevitt, Rev. Edward L., 1933, *Canisius High School.*
McGrath, Rev. P. H., 1932, *St. Peter's College.*
McKone, Rev. Peter J., 1931, *Boston College.*
McNally, Rev. Herbert P., 1922, *Norfolk, Va.*
Merrick, Rev. Joseph P., 1923, *Baghdad, Iraq.*
Miller, Rev. Walter J., 1931, *St. Mary's Church, Boston, Mass.*
Morgan, Rev. Carol H., 1933, *Boston College.*
Murray, Rev. Joseph L., 1928, *Boston College High School.*
Murray, John P., 1939, *Weston College.*
Nuttall, Rev. Edmund J., 1925, *Manila Observatory.*
O'Brien, Rev. Kevin J., 1933, *Auriesville, N. Y.*
O'Callahan, Rev. Joseph T., 1929, *Pensacola, Fla.*
O'Connor, Rev. Eric, 1936.
O'Conor, Rev. John S., 1923, *Woodstock College.*
Phalen, Rev. Robert P., 1935, *Weston College.*
Phillips, Rev. Edward C., 1922, *Georgetown University.*
Quigley, Rev. Thomas H., 1925, *Holy Cross College.*
Reardon, Rev. Timothy, 1935, *Georgetown University.*
Ring, Rev. James W., 1935, *Weston College.*
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N. B. The Editor appreciates the fact that this list may be incomplete, especially with regard to new members. If all such errors are reported in time, the corrections will be made in the next issue.

—Editor.