

INSTITIUID ÁRD-LEINN BHAILE ÁTHA CLIATH
(Dublin Institute for Advanced Studies)

Annual Report of the work of the
Institute and its Constituent
Schools presented by the Council
to the Minister for Education in
respect of the Financial Year
1949-1950.

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Annual Report of the work of the Institute and
its Constituent Schools presented by the Council
for the Financial Year 1949-1950.

In accordance with the provisions of Section 29 of the Institute for Advanced Studies Act, 1940 (No. 13 of 1940), the Council of the Institute has the honour to present to the Minister for Education for submission to the Government a report of the work and activities of the Institute and its Constituent Schools for the financial year ending 31st March, 1950.

The general purpose which it is hoped to accomplish is clearly stated in the Act establishing the Institute, namely, the Institute for Advanced Studies Act, 1940 (No. 13 of 1940) and in the Establishment Orders establishing the three Constituent Schools, namely, the Institute for Advanced Studies (School of Celtic Studies) Establishment Order, 1940, the Institute for Advanced Studies (School of Theoretical Physics) Establishment Order, 1940, and the Institute for Advanced Studies (School of Cosmic Physics) Establishment Order, 1947, and need not be referred to here. It is deemed desirable, however, to include in the report for the purposes of record certain particulars about the constitution of the Council of the Institute and of the membership of the Governing Boards of the three Constituent Schools on the 31st March, 1950.

The report is presented under the following principal heads:-

- I - Constitution of the Council of the Institute and of the Governing Boards of the three Constituent Schools on the 31st March, 1950.
- II - Report of the Governing Board of the School of Celtic Studies.
- III - Report of the Governing Board of the School of Theoretical Physics.
- IV - Report of the Governing Board of the School of Cosmic Physics.

I - Constitution of the Council of the Institute and of the Governing Boards
of the three Constituent Schools on the 31st March 1950.

1. THE COUNCIL OF THE INSTITUTE.

Chairman:

Right Reverend Monsignor Patrick Browne, M.A. D.Sc.

Ex-Officio Members:

Dr. Michael Tierney, M.A., D.Litt.,
President, University College, Dublin;

Dr. Ernest H. Alton, M.A., Litt.D.,
Provost, Trinity College, Dublin;

Professor John J. Nolan, M.A., D.Sc.,
President, Royal Irish Academy.

Members Appointed by the Governing Boards of the Constituent Schools:

Right Reverend Monsignor Patrick Boylan, D.D., M.A., D.Litt.;

Professor Michael A. O'Brien, M.A., Ph.D.;

Professor Felix E. W. Hackett, M.A., M.Sc., Ph.D.;

Professor Albert J. McConnell, M.A., M.Sc., Sc.D., F.T.C.D.;

Professor Leo W. Pollak, Ph.D., M.R.I.A.

2. THE GOVERNING BOARD OF THE SCHOOL OF CELTIC STUDIES.

Chairman:

Right Reverend Monsignor Patrick Boylan, D.D., M.A., D.Litt.

Senior Professors:

Michael A. O'Brien, M.A., Ph.D.;

Daniel A. Binchy, M.A., Ph.D., B.L.;

Myles Dillon, M.A., Ph.D.

Appointed Members:

Miss Eleanor Knott, M.A., D.Litt., M.R.I.A.;

Miss Áine de Paor, M.A., Ph.D.;

Reverend John Ryan, S.J., M.A., D.Litt.;
Reverend Francis Shaw, S.J., M.A.;
Liam Ó Buachalla, M.Comm., H.Dip. in Ed.;
Liam Ó Domhnaill;
Éamonn Mac Giolla Iasachta, M.A., D.Litt., M.R.I.A.;
Ernest Gordon Quin, M.A., F.T.C.D.

3. THE GOVERNING BOARD OF THE SCHOOL OF THEORETICAL PHYSICS.

Chairman:

Arthur W. Conway, M.A., D.Sc., Sc.D., LL.D., F.R.S.

Senior Professors:

Erwin Schrodinger, M.A., Ph.D., D.Sc.;
John L. Synge, M.A., Sc.D., M.R.I.A., F.R.S.C., F.R.S.

Appointed Members:

Edmund T. Whittaker, Sc.D., LL.D., F.R.S.;
William H. McCrea, M.A., Ph.D.;
Felix E. W. Hackett, M.A., M.Sc., Ph.D.;
Albert J. McConnell, M.A., M.Sc., Sc.D., F.T.C.D.;
Alfred O'Rahilly, M.A., D.Sc., D.Phil., D.Litt.;
George R. Keating, M.Sc.;
Thomas S. Wheeler, Ph.D., D.Sc., F.R.C.Sc.I.

4. THE GOVERNING BOARD OF THE SCHOOL OF COSMIC PHYSICS.

Chairman:

John J. Nolan, M.A., D.Sc.

Senior Professors:

Leo W. Pollak, Ph.D., M.R.I.A.;
Hermann A. Brück, D.Phil., Ph.D., M.R.I.A.;
Lajos Jánosy, Ph.D., M.R.I.A.

Appointed Members:

John J. Dowling, M.A., F.Inst.Phys.;

Eric M. Lindsay, M.A., M.Sc., Ph.D.;

Rev. Patrick J. I. McLaughlin, D.Sc.;

Austen H. Nagle, A.R.C.Sc., B.Sc., D.I.C.;

Thomas Edwin Nevin, D.Sc.;

Patrick J. Nolan, Ph.D., D.Sc.;

John H. J. Poole, M.A., B.A.I., Sc.D.;

Ernest T. S. Walton, M.A., M.Sc., Ph.D., F.T.C.D.

II - Report of the Governing Board of the School of Celtic Studies.

1. ACADEMIC STAFF, SCHOLARS AND EXTERN RESEARCH WORKERS.

Senior Professors:

Michael A. O'Brien, Director of the School;
Daniel A. Binchy;
Myles Dillon.

Assistant Professors:

Brian Ó Cuív;
James P. Carney;
Rev. Canice Mooney, O.F.M.;
Miss Cecile O'Rahilly;
David Greene.

Assistant:

Miss Sheila Falconer.

Scholars:

Louis Paul Némo (Roparz Hémon);
Rev. Cuthbert McGrath, O.F.M.;
Heinrich Wagner.

Extern Research Workers commissioned by the School:

Dr. T. F. O'Rahilly;
Dr. R. I. Best;
Dr. Osborn Bergin;
Dr. D. A. Binchy (prior to his appointment to the academic staff);
Mr. Seán Mac Airt;
Rev. Canice Mooney, O.F.M. (subsequent to his resignation from the
academic staff);
Mr. Liam Price, D.J.;
Mrs. Mary Ellen Carney;
Rev. Séan Ó Catháin, S.J.;

Rev. Lambert McKenna, S.J.;

Rev. Shán Ó Cuív;

Rev. Anselm Faulkner, O.F.M.;

Rev. Pádraig Ó Súilleabháin, O.F.M.;

Professor J. Vendryès;

Dr. Tomás de Bhaldraithe.

2. GENERAL LINES OF RESEARCH WORK.

The School is engaged in research work on almost all aspects of the Irish language from the oldest texts down to the modern living dialects.

Dr. Wagner has studied the Irish of Teelin (South Donegal) and Tory Island; Dr. de Bhaldraithe was working on the dialect of Connemara and Mr. Ó Cuív on that of Ballymacoda in Co. Cork. The main attention is being given at present to those dialects which are in imminent danger of losing their last speakers.

Plans for a Linguistic Atlas of Irish were drawn up and a commencement was made by Dr. Wagner, under the supervision of Professor Dillon, in Donegal.

The School has taken over the publication of the Mediaeval and Modern Irish Texts Series. Professor Dillon has prepared a new edition of Serglige Con Culainn and Professor Vendryès proposes to edit Airne Fíngin for publication in this series.

Subjects of research by individual members of the academic staff and by scholars were as follows:-

Professor O'Brien - Irish Genealogies, personal and family names;

Professor Binchy - Early Irish Law and legal texts;

Professor Dillon - Old Irish texts, modern Irish dialects;

Mr. Ó Cuív - Párlíament na mBan, Munster dialects, early modern Irish texts;

Rev. Canice Mooney, O.F.M. - Franciscan texts in Irish;

- Miss O'Rahilly - Arthurian romances in Irish;
Mr. Greene - the Copenhagen collection of poems on the Maguires
of Fermanagh;
Miss Falconer - Irish Arthurian romances;
M. Roparz Hémon - Middle and Modern Breton texts;
Rev. Cuthbert McGrath, O.F.M. - Franciscan poetry in Irish,
Plunkett's Gaelic-Latin Dictionary;
Dr. Wagner - Irish dialect survey and Irish Linguistic Atlas.

Work of extern research workers commissioned by the School
included:-

- Dr. T. F. O'Rahilly - editing of Celtica, Vol.I, Part 2;
Dr. R. I. Best and Dr. Osborn Bergin - The Book of Leinster;
Dr. D. A. Binchy and Dr. Osborn Bergin - translation of
Thurneysen's Handbüch, Part 2;
Mr. Seán Mac Airt - The Annals of Inisfallen;
Mr. Liam Price - Place-Names of Co. Wicklow;
Mrs. Carney - an Irish version of the Aphorisms of Hippocrates;
Rev. Seán Ó Catháin, S.J. - Betha Muire, an Irish version of
the Vita Rhythmica of the Blessed Virgin;
Rev. Lambert McKenna, S.J. - The Poem-book of the O'Haras;
Rev. Shán Ó Cuív - a bibliography of the works of Canon Peter
O'Leary;
Rev. Anselm Faulkner, O.F.M. and Rev. Padraig Ó Súilleabháin,
O.F.M. - Irish Franciscan texts and Plunkett's Gaelic-Latin
Dictionary;
Professor J. Vendryès - an etymological dictionary of the Irish
language, and a new edition of Airne Fíngin;
Dr. de Bhaldraithe - the grammar, vocabulary and philology of
the Irish of Connemara.

In addition to the revision of proofs and the preparation of
new material for works already in course of publication at the
beginning of the period under review, 'copy' for the following new
works was sent to the printers:-

Leabhar Í Eadhra, edited by Rev. Lambert McKenna, S.J.;

Irish Franciscan Texts Series:

Beatha San Froinsias, edited by Rev. Padraig Ó Súilleabháin,
O.F.M.;

Celtica, Vol.II, Part 1, edited by M.A. O'Brien.

3. COURSES OF LECTURES.

M. Roparz Hémon continued his course of lectures on Modern Breton. Lectures are delivered twice weekly during the university terms.

In Hilary Term 1950, Professor D. A. Binchy inaugurated a Seminar on Early Irish Law. The first meeting was held on 19th January, 1950 and weekly meetings continued during the university terms.

A Colloquium was held during the period 7th - 15th October, 1949, in which eminent Celtic scholars from abroad participated. Professors Rudolf Hertz and Leo Weisgerber of the University of Bonn lectured on Relations between Celtic and Italic and Celtic-Germanic relations respectively; Professor G. J. Williams of University College, Cardiff, spoke on Welsh Scholarship and Fräulein Dr. A. Heiermeier on Irish River Names. Dr. Ludwig Bieler of University College, Dublin, and Mr. James Carney spoke on Patrician Legends and their reconstruction; and various aspects of Modern Irish dialects and dialect investigation were discussed by Dr. Tomás de Bhaldraithe of University College, Dublin, and Messrs. Brian Ó Cuív, David Greene and Heinrich Wagner. Attendance at the Colloquium lectures averaged 35 and general discussions on the subjects introduced followed the lectures.

4. STATUTORY PUBLIC LECTURES.

Two Statutory Public Lectures dealing with Irish Dialects and the Irish-speaking Districts were delivered by Mr. Brian Ó Cuív in Trinity College, Dublin, on 13th and 20th March 1950. It is proposed to publish these in book form.

5. PUBLICATIONS.

The following works were published during the period under review:-

		Date of Publication
THE PLACE-NAMES OF CO. WICKLOW - III The Barony of Talbotstown Upper. By Liam Price.		
pp. iv + 78.	Price 2s.	13/5/49
EACHTRA UILLIAM. An Irish version of the Romance of William of Palerne. Edited by Cecile O'Rahilly.		
pp. xxiv + 270.	Price 12s. 6d.	20/6/49
OLD IRISH READER. With a supplement to <u>A Grammar of Old Irish.</u> By Rudolf Thurneysen. Translated from the German by D. A. Binchy and Osborn Bergin.		
pp. x + 139.	Price 7s. 6d.	10/10/49

III - Report of the Governing Board of the School of Theoretical Physics.

1. ACADEMIC STAFF AND SCHOLARS.

Senior Professors:

Walter Heitler, Director of the School (resigned 1st October 1949 to take up a post in the University of Zürich);

Erwin Schroedinger;

John L. Synge.

Scholars:

S. T. Ma (left September 1949);

D. Basu;

M. Brdička (left September 1949);

N. Symonds;

E. Corinaldesi (left September 1949);

Rev. E. McMullin (entered September 1949);

W. Thirring (entered September 1949);

G. Field (student without emoluments, left September 1949);

S. N. Gupta (student without emoluments, left September 1949).

Technical Assistant:

Miss Mary Houston.

2. GENERAL LINES OF RESEARCH WORK.

Arising out of his lectures on hydrodynamics, Professor Synge has obtained a new and simple condition satisfied by the vorticity and expansion in the plane motion of a viscous fluid in a fixed container. He has investigated problems connected with the transmission of energy by sonic and electromagnetic waves.

Work continues on a book on the method of the hypercircle in function-space for the approximate solution of boundary-value problems. The geometrical basis of the method has been clarified and arithmetical applications have been made to problems of torsion.

Taking as analogy Hamilton's formulation of geometrical optics, Professor Synge has attempted a relativistic treatment of the two-body problem, classical and quantum mechanical. The motion of the mass centre is successfully separated from relative motion; but, since quantisation is effected in a space of even dimensionality, half-integer eigen values result and consequently the method requires revision.

In collaboration with Mr. G. H. F. Gardner, a new approach is being made to the problem of the relativistic rigid body.

Work concerning the latest development in Quantum Mechanics included some special collision problems (Dr. Basu) and the quantisation of higher order equations, which led Dr. Thirring to an automatic regularisation of the commutator function and to finite self energies. Dr. Thirring also succeeded in applying the new formulation of Quantum Electrodynamics (Schwinger, Feynman and others) to several problems such as pair creation by mesons, Compton scattering, etc. Dr. Symonds first investigated various aspects of gauge invariance, and later joined in Professor Schroedinger's work on the new non-symmetric field theory.

Professor Schroedinger delivered a course of lectures extending over the whole academic year, giving a new introduction to the geometry of space-time calculated to lead up in the simplest way to the new non-symmetric unified field theory. Among the problems that sprang up in the course of these lectures and were partly solved by Professor Schroedinger and Dr. Symonds, were the question of the pseudo-energy-tensor in the new theory, special singularity-free wave solutions, and the general solution for a weak charge-free field of electromagnetic waves.

Father McFullin was mainly occupied with the integration of the equations governing the vertical distribution of the various particles of cosmic radiation in cascades and extensive air showers. His work included the proportion of recoil particles, the latitude

effect and a comparison between the theoretical and recent experimental results.

3. SEMINAR AND LECTURES.

Professor Schroedinger gave the last of his three lectures on difficulties in the interpretation of Quantum Mechanics, to the Seminar on 4th May 1949. This was followed by a course on Spinor Calculus which Professor Heitler gave in response to a request. To complete the summer term Professor Synge gave two lectures on Particles and Fields in Classical Electromagnetic Theory.

After the summer vacation two courses of lectures were begun and continued throughout the year. Professor Schroedinger addressed the Seminar on Space-Time Structure and on Thursdays Professor Synge dealt with Hydrodynamical Stability and other classical problems.

Following a suggestion by Professor Jánossy, Dr. Thirring began a series of lectures on Quantum Electrodynamics on Friday, 10th March 1950. These were continued during the summer term.

Professors, lecturers and senior students from University College, Dublin, Trinity College, Dublin and St. Patrick's College, Maynooth attended the courses. Although the numbers were small the attendance was regular - about 15 at the Seminar on Wednesday, and 10 to 12 on Thursdays and Fridays.

4. STATUTORY PUBLIC LECTURES.

The Statutory Public Lectures under the auspices of the School were delivered in University College, Dublin, on Monday evenings, 13, 20 and 27 February and 6 March, 1950. The lecturer was Professor Schroedinger and his subject was Science as a Constituent of Humanism - Physics in our time.

5. DISTINGUISHED VISITORS.

Professor L. Infeld of the University of Toronto spent a few days at the Institute in April 1949. He lectured on The Problem of Motion in General Relativity on Friday, 29th April, 1949. The lecture room was full for this lecture and it provoked a discussion which had to be continued on the Saturday morning.

On 16th November 1949 Professor Randall of King's College, London, who had come to Dublin to lecture at the Royal Dublin Society, paid a short visit to the School.

Professor Lemaitre of the University of Louvain, Belgium was invited to visit the School in March 1950. He gave two lectures under the title, The Cosmological Problem on Monday and Tuesday, 20th and 21st March 1950. About 30 people attended, many of them members of university staffs.

6. PROFESSORS' ACTIVITIES.

Professor Schroedinger was elected a Foreign Member of the Royal Society on 12 May, 1949.

A talk by Professor Schroedinger entitled Do Electrons Think? was broadcast by the B.B.C. in February 1950.

Professor Synge lectured at Leeds University in December, 1949.

7. PUBLICATIONS.

(1) Book:

TENSOR CALCULUS. By J. L. Synge and A. Schild.
Mathematical Expositions No. 5, University of
Toronto Press, 1949.

(2) Contributions to Periodicals:

(a) Contributions recorded as in the press in previous reports:-

D. Basu: Relativistic Scattering of Neutrons by Protons
- Proc. R.I.A., 52 A 10, 127, 1949

- J. L. Synge: Upper and Lower Bounds for the Solution of Problems in Elasticity - Proc. VII International Congress of Applied Mechanics, 1949.
- J. L. Synge: The Geometry of Many Dimensions - Math. Gazette, 33, 249, 1949.
- D. Basu: Influence of Radiation Damping on the Neutron-Proton Scattering at Relativistic Energies - Proc. R.I.A., 53 A 3, 31, 1950.
- J. L. Synge: Upper and Lower Bounds for the Solutions of Problems in Elasticity - Proc. R.I.A., 53 A 4, 41, 1950.

(b) New contributions:-

- J. L. Synge et al.: Contributions to the Theory of Wave Guides - Canad. J. Research, A, 27, 69, 1949.
- N. Hu: Further Investigations on Proton Isobars in the Theory of Radiation Damping - Proc. R.I.A., 52 A 16, 223, 1949.
- J. L. Synge: On the Motion of Three Vortices - Canad. J. Maths., 1, 257, 1949.
- S. T. Ma: Vacuum Polarization in the Positron Theory - Phil. Mag., 40, 1112, 1949.
- E. Corinaldesi and G. Field: Scattering of Pseudoscalar Charged Mesons by Nucleons I - Phil. Mag., 40, 1159, 1949.
- W. Heitler and L. Jánossy: On the Size-Frequency Distribution of Penetrating Showers - Proc. Phys. Soc., A, 62, 669, 1949.
- E. Corinaldesi and G. Field: On the Self-Energy of a Pseudoscalar Meson in Interaction with Nucleons - Nuovo Cim., 6, 520, 1949.
- S. N. Gupta: On the Calculation of Self-Energy of Particles - Phys. Rev., 77, 294, 1950.
- J. L. Synge: Electromagnetism without Metric - Proc. Second Symposium in Applied Mathematics, 21, 1950.
- W. Thirring: Regularization as a Consequence of Higher Order Equations - Phys. Rev., 77, 570, 1950.
- W. Thirring: Der Massendefekt als Folge der relativistischen Feldgleichung für das Zweikörperproblem - Z. Naturforsch., 5a, 85, 1950.
- J. L. Synge: The Gravitational Field of a Particle - Proc. R.I.A., 53 A 6, 83, 1950.
- N. Symonds: Particle Equations in Generalised Co-ordinates - Proc. R.I.A., 53 A 7, 115, 1950.

(3) The following contributions were in the press at the end of the period under review:-

- M. Brdička: A Remark on Proper Lorentz Transformation of Dirac's Equations.
On Gravitational Waves.
- S. N. Gupta: On the Treatment of Longitudinal Photons in Quantum Electrodynamics.
- E. Schroedinger: What is an Elementary Particle?
Irreversibility.
On the Differential Identities of Affinity.
- J. L. Synge: Note on the Kinematics of Plane Viscous Motion.
- W. Thirring: Bericht über die neuen Entdeckungen im Wasserstoffspektrum.
Einfluss der Retardierung auf relativistische Nukleonenstreuung.
On a Fourth-Order Meson Equation.
Quantization of Higher Order Equations.
Pair Creation by Mesons.

IV - Report of the Governing Board of the School of Cosmic Physics.

A. Geophysical Section.

1. ACADEMIC STAFF AND SCHOLARS.

Senior Professor:

Leo W. Pollak, Director of the School.

Assistant Professor:

Thomas Murphy.

Research Associate:

P. J. Nolan.

Senior Technical Assistant:

Thomas J. Morley.

Junior Technical Assistant:

Miss Nuala O'Brien.

Junior Meteorological Observer:

Kevin Bolster (appointed 27th June 1949).

Scholars:

Rev. P. G. Tedde, S.J.;

P. R. Nolan.

2. PREMISES OF THE SECTION.

With the construction of a laboratory and two small store rooms for the Geophysical Section in the building of the caretaker's house the reconstruction of the premises at 5 Merrion Square is now completed.

An Abbot Silver Disk Actinometer for the Meteorological Observatory was supplied by the Smithsonian Institution, Washington, at a nominal cost. This instrument is the internationally recognised

standard for actinometric measurements and is the only one in this country. The portable slave clock necessary for measurements with this instrument was purchased and photo-electrically controlled connection between the pendulum clock and the upper platform of the Meteorological Observatory was constructed.

3. GENERAL LINES OF RESEARCH AND OBSERVATIONAL WORK.

During the year ended 31st March 1950 the Section concentrated on the gravimetric and magnetic surveys of Ireland. Both projects are of considerable interest for the country from a national and an international standpoint. A gravimetric survey of Ireland has never been undertaken, and a magnetic re-survey of Ireland was long overdue. The last, incomplete, magnetic survey was carried out in 1915 with instruments which do not satisfy modern demands for accuracy. Both projects were organised by the School in close collaboration with the Irish Ordnance Survey and are being carried out in co-operation with that office.

These geophysical surveys, which require very expensive instruments and accessories, were made possible by the great support of several foreign and Irish institutions mentioned later.

Gravity Survey of Ireland: The preliminary results of the gravimetric measurements carried out last Spring in Ireland were so interesting that we approached the Geodetic and Geophysical Department of Cambridge University to lend us its gravimeter in order to make a complete survey of Ireland. This survey is the first ever undertaken here. The Cambridge University Department kindly agreed to let us have their £2,500 Askania (Berlin) gravimeter on loan for the period August 18 to October 10, 1949. A comparison between the values of gravity at London and Dublin was attempted when the instrument was flown between these two cities. Thanks to the co-operation of all officials concerned we were permitted, without any customs formalities

to make measurements on the airfield immediately before the aeroplane took off and directly after it touched down on the runway in order to test the behaviour of the instrument after its first air trip. The experiment was successful.

The gravity survey received great support from the Department of Industry and Commerce (Geological Survey) and the Ordnance Survey Office, Phoenix Park, Dublin. The latter arranged for determining the coordinates of over 300 measuring stations and released from his regular duties Mr. O'Neill, Assistant Superintendent of the Levelling Branch, so as to enable him to work full-time with us for a period of three months.

The gravimetric survey of Central Ireland which started on 5th September was concluded on the 10th October, 1949. Mr. Murphy has made measurements at about 260 new stations in Central Ireland having covered about 4,500 miles. Provisional results of this gravity survey were published in the Geophysical Bulletin No. 1. A full account will be published in Geophysical Memoirs No. 2, Part 3.

It is intended to extend the gravity survey to other parts of Ireland when the Cambridge University Department will be able to spare for a few weeks the only gravimeter in the British Isles.

In March 1950 we were invited by the Department of Geodesy and Geophysics of Cambridge University to collaborate in the gravity survey of Northern Ireland so that a gravity survey of the whole of Ireland could be accomplished. These measurements are scheduled for September 1950.

Magnetic Survey: A magnetic variometer, ordered many months ago, has been delivered by Messrs. Hilger and Watts.

The Carnegie Institution of Washington has kindly sent us on loan what is probably the only available absolute magnetic theodolite (C.I.W. magnetometer No. 13) in the world for the duration of the magnetic survey of Ireland. It arrived in the School on the 8th September 1949. This support of our work by the Director of the

Department of Terrestrial Magnetism of the Carnegie Institution, Dr. Tuve, deserves our deepest gratitude as, apart from the value (approx. £3,000) of such equipment, the time of delivery of a similar instrument if ordered in 1949, would be approximately 2 years and its post war quality doubtful.

We have further to acknowledge that a no less important item for any survey of a country, a 15 cwt. capacity 8-cylinder Ford van, was kindly presented to the School for the field work of the Section by Messrs. Arthur Guinness, Son & Co. Ltd., Dublin.

The magnetic survey of Ireland is being carried out in co-operation with the Ordnance Survey Office, Phoenix Park, Dublin. This co-operation consists in placing at our disposal during the survey, two members of its staff who form the geodetic party, while the School supplies two members for the magnetic team. Mr. Murphy is in charge of the Survey.

The Director General of the British Ordnance Survey Office, Chessington, offered to supply copies of the description of 30 trigonometric points, reference objects and computed azimuths with their required corrections, which we selected for our magnetic measurements. In addition, the same office lent us a $3\frac{1}{2}$ " Tavistock Theodolite complete with optical micrometer readings of both circles direct to one second of arc.

We also received on loan, for the duration of the survey, two marine chronometers - one from the Irish Meteorological Service and one from Irish Shipping Ltd. The British Astronomer Royal, with the approval of the British Admiralty, lent us a valuable navigational chronometer; and the Irish Meteorological Service placed at our disposal a compensated precision aneroid barometer for use by the geodetic party.

A comparison between our magnetometer and the instruments used at Valentia Observatory for its weekly readings was carried out by Mr. Murphy and Mr. Morley during the last week of March 1950.

In several conferences with the Ordnance Survey a detailed plan for the field work, which started in the second half of March 1950, was worked out.

Research Work: The investigation of the long-period fluctuations of the frequency of cyclones over the Atlantic was continued by Professor Pollak. The great clerical and statistical work involved was very much speeded up by the support of the Irish Land Commission which took over the production of approximately 35,000 punch cards. The statistical analysis of these cards which is carried out fully automatically by machines, is proceeding rapidly.

Professor Pollak and Mr. P. R. Nolan concluded the investigation into the possibility of seasonal forecasting of the yield and sugar content of sugar beet in Ireland for one county (Waterford). It was found to be possible, as early as the end of June, to predict from temperature and rainfall (taking into account fertilisation) the yield of sugar beet in October with an average accuracy of $\pm 12\%$. Excluding a year with an abnormal October, which would increase the sugar content shortly before harvesting, the average prediction accuracy is even better.

Preliminary experiments to introduce in the regression equations "effective" meteorological elements which take into account the influence of months other than June promise to give an improved accuracy of prediction.

Dr. Tedde, S.J., under the supervision of Dr. P. J. Nolan, continued his investigation into the relationship between nuclei and meteorological elements in Dublin. He has found e.g. that there exists a linear relationship between the size of nuclei and humidity, the correlation coefficient being 0.75.

Observational routine and the recording instruments have been maintained throughout and the results published monthly in the Meteorological Bulletin for Dublin City and the Meteorological Summary. The latter is reproduced regularly in several Dublin newspapers.

4. COURSES OF LECTURES.

Dr. P. J. Nolan delivered a course of lectures on Atmospheric Electricity in the Michaelmas term of 1949/50. Dr. Nolan dealt with the modern development of the subject and with unsolved problems still under discussion.

Professor Pollak in the Hilary term delivered a course of lectures on Motion of the Atmosphere (with an introduction on atmospheric radiation problems).

A Meteorological and Geophysical Seminar was held monthly, except in July, August and September, in the lecture room of the School at 7.30 p.m. The following lectures were delivered:

Dr. P. J. Nolan: Size and charge-distribution of atmospheric nuclei.

Mr. Murphy: The pre-history of the earth's magnetic field.

Dr. H. I. S. Thirlaway, Department of Geodesy and Geophysics, Cambridge University: Preliminary results of a regional gravity survey of Ireland.

Professor Pollak: Tests of significance in periodography.

Dr. Nevin: The spectrum of the night sky.

Rev. Fr. R. Ingram, S.J.: On the seismological laboratory at Pasadena and some modern problems in seismics.

Mr. P. M. A. Bourke, Assistant Director of the Irish Meteorological Service: Practical Meteorology in the Service of Aeronautics.

Mr. B. C. Browne, Director of the Department of Geodesy and Geophysics, Cambridge University: Geophysical investigation of the ocean floor.

Colonel J. E. Nolan, Deputy Assistant Director, Irish Ordnance Survey: The development of the Aeronautical chart.

Dr. A. Beer, Cambridge University: Seismic-meteorological investigation of the Burton-on-Trent explosion.

The Askaniá Gravimeter and the C.I.W. Magnetometer used in the survey of Ireland were demonstrated by Professor Murphy to the members of the Seminar.

The Seminar was attended regularly by 35 to 40 persons.

5. PUBLICATIONS.

(1) Geophysical Memoirs of the Dublin Institute for Advanced Studies.

No. 1 - Eight Place Supplement to Harmonic Analysis and
Synthesis Schedules. By L. W. Pollak.

Part 1 - Register; Part 2 - Index. Price 7/6 each.
Published 1949.

In preparation

No. 2 - Part 1: Measurements of Gravity in Ireland.
By A. H. Cook.

Part 2: Gravimeter Observations at Dublin,
Sligo, Galway and Cork.
By H. I. S. Thirlaway.

(2) Geophysical Bulletin of the Dublin Institute for Advanced Studies.

No. 1 - Provisional Results of the Gravity Survey of
Central Ireland. By Thomas Murphy. Published 1950.

(3) Meteorological Bulletin of Dublin City. Issued monthly.

(4) Other Publications.

(a) All Term Guide for harmonic Analysis and synthesis.
By L. W. Pollak.
Geophysical Publications, Irish Meteorological
Service, Dublin. Vol. II. Published S.O. 1949.

(b) Vertical Magnetic Intensity Map of Ireland.
By Thomas Murphy in collaboration with the
Geological Survey of Ireland. Published S.O. 1949.

B. Cosmic Ray Section.

1. ACADEMIC STAFF.

Senior Professor:

Lajos Jánosy.

Assistant Professor:

C. B. A. McCusker.

Research Associate:

T. E. Nevin.

Scholars:

D. M. Ritson;

D. Millar (without emoluments; on a scholarship from St. Andrew's
University);

H. Messel (without emoluments; on a Canadian Government
scholarship).

2. LABORATORY AND WORKSHOP EQUIPMENT.

During the year the facilities available in the workshop and laboratory were improved by the construction and purchase of new apparatus and equipment. The workshop was continuously occupied on the construction of the apparatus required for the experimental investigations in progress. During the early part of the year design studies for a 15 KW magnet were completed. Later the machining and construction of the cast iron yoke and pole pieces was completed. The winding of the magnet coils during the later part of the year was prevented by difficulties in connection with the supply of the perspex casings to enclose the coils to allow water cooling. The cables for the current supply for the magnet were laid to both cosmic ray huts.

3. GENERAL LINES OF RESEARCH WORK.

Experimental Work: Experimental work on the nature of the penetrating particles in air showers commenced during the year 1948-49 was concluded and the results embodied in two papers, one by Mr. McCusker on Penetrating Particles in Air Showers, the other by Mr. Millar on The Nature of the Penetrating Particles in Extensive Air Showers. These papers were submitted for publication subsequent to the period under review.

At the conclusion of the above work Mr. Millar began an investigation of the transition effect of air showers in various absorbing materials.

In the latter part of the year 1949-50, Dr. Nevin and Mr. McCusker began preparing a cloud chamber on loan from University College, Dublin, for an investigation to check the Bhabha-Chakrabarty theory of shower production as applied to the electrons which constitute the soft component of air showers. During the year Dr. Nevin developed an arrangement for detecting and investigating the possible presence of delayed particles in extensive air showers. The experiment was still in progress at the conclusion of the period under review.

An apparatus for recording meson decays was constructed by Dr. Ritson and used to study the angular distribution of slow mesons. The experiments were still in progress at the end of March 1950.

Theoretical Work: In collaboration, Professor Heitler and Professor Jánossy developed a theory of the absorption of nucleons and the production of penetrating showers. Two papers have appeared on the subject and a third was in preparation at the end of the year.

Professor Jánossy worked on various extensions and refinements of the cascade theory of shower production. These included a new formulation of the fundamental diffusion equation and a study of the lateral spread of air showers.

In collaboration with Professor Pollak a new method for practical Fourier analysis was developed.

Work on cascade theory requires a considerable amount of numerical computation. Numerical work was made possible by the use of two pairs of automatic calculating machines and was carried out by Mr. Messel and Mrs. L. Jánossy. As a result of this work, there now exist extensive tables of the first and second moments of cascade showers and of all auxiliary functions needed in further computations. These tables have been circulated to interested cosmic ray workers and are reproduced in part in the second edition of Professor Jánossy's book Cosmic Rays.

4. CONFERENCES.

Professor Jánossy attended on invitation through UNESCO the twin conferences in Basle and Como, October 1949 and read papers.

Professor Jánossy accompanied by Mr. McCusker and Dr. Ritson attended and read papers at the International Conference on Nuclear Physics held at Edinburgh in November 1949 on the invitation of Professor Max Born.

5. PUBLICATIONS.

(1) Book:

COSMIC RAYS. By L. Jánosy.
2nd edn. The Clarendon Press, Oxford. 19

(2) Hectographed Publications:

TABLES OF CASCADE FUNCTIONS. By Léonie Jánosy and H. Messel.
Issued December 1949.

(3) Contributions to Periodicals:

L. Jánosy and J. McConnell: Scattering by a Nuclear Potential.
Proc. R.I.A., 52 A 15, 203, 1949.
L. Jánosy: Note on the Fluctuation Problem of Cascades.
Proc. Phys. Soc., A, 63, 241, 1950.

C. Astronomical Section, Dunsink Observatory.

1. ACADEMIC STAFF.

Senior Professor:

H. A. Brück.

Chief Assistant:

H. E. Butler.

Assistant (Part-time):

F. J. O'Connor.

2. BUILDINGS AND INSTRUMENTS.

The reconstruction and re-equipment of Dunsink Observatory was almost completed at the end of the year under review. Included in the constructional work carried out, was the necessary installation of a new water supply from a bore hole sunk north-east of the main building.

The chief instruments of the Observatory, the solar telescope and spectroscope, were successfully set up in the course of the year. The mirrors of a 16-inch coelostat were mounted on the steel platform which had been erected earlier above the roof of the former Meridian House. These mirrors reflect sunlight into a stationary vertical 15-inch telescope which allows images of the Sun, 15 inches in diameter, to be thrown on to the slit of a large concave grating spectrograph. This spectrograph, 30 feet in length, is erected on concrete piers in the Meridian Room. Preliminary tests were made of the whole instrumental set-up which is to be used for a detailed analysis of solar radiation.

New photometers for precision measurement of stellar brightness both of the photo-electric and of the Fabry photographic type were constructed so as to be used in conjunction with the 12-inch refractor and the 15-inch reflector.

The construction of the 36-inch Schmidt-Baker Telescope to be operated jointly by the Armagh, Dunsink and Harvard Observatories, was almost completed by the Perkin-Elmer Corporation during the year under review.

3. OBSERVATIONAL AND OTHER WORK.

Both telescopes of the Observatory were used extensively for photometric observations of variable and other stars. Occultations of stars by the Moon were observed regularly, and routine observations of sunspots were made during the greater part of the year. Comets and other phenomena were observed occasionally.

A paper on absorption line intensities in the infra-red region of stellar spectra was submitted by Dr. Butler to the Royal Irish Academy. The spectrum of the peculiar variable star Beta Lyrae in the case of which two components revolve around each other inside an expanding shell of gas, was the subject of further study. Some other work was done to test the existence of fluctuations of intensity of

the visible solar radiation on the basis of indirect measurements of the solar constant.

4. LECTURES.

The Statutory Public Lecture on Recent Astronomical Telescopes and Problems they may solve was delivered by Professor Brück in the Physics Theatre, Trinity College, Dublin, on 30th March 1950.

Professor Brück gave two courses of lectures on The Theory of Stellar Atmospheres and on The Internal Constitution of the Stars in the Michaelmas and Hilary terms. Dr. Butler gave an introductory course on Observational Astrophysics in the Michaelmas term.

A series of Astronomical Discussions was inaugurated on 15th December 1949 by Professor R. O. Redman, Director of the Cambridge University Observatory, who delivered a lecture on Recent Developments of Photo-electric Photometry in Astronomy.

On 20th March 1950, Professor Fr. Becker, Director of the Bonn University Observatory and President of the Astronomische Gesellschaft, gave a lecture on Recent Astronomical Research in Germany.

The above lectures were delivered in the lecture-room of the School at 5 Merrion Square. Other lectures on various astronomical problems were given in Cambridge and other places by Professor Brück and Dr. Butler.

5. VISITORS.

An average of a hundred and fifty people visited Dunsink on the first Saturday of each month when the Observatory is open to the general public. Following numerous requests parties of members of various societies and other groups were shown over the Observatory outside those times as well.

D. Mac GRIANNA
CLÁRATHÓIR

PÁDRAIG De BRÚN
CATHAOIRLEACH

21 Márta 1951