Pr. 4996

INSTITIÚID ÁRD-LÉINN 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 1957-58.

Pr. 4996

INSTITIÚID ÁRD-LÉINN BHAILE ÁTHA CLIATH
(Dublin Institute for Advanced Studies)

Annual Report of the work of the Institute and its Constituent Schools presented by the Council for the Financial Year 1957-58

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, 1958.

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 1958.

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, 1958.

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 1958.

1. THE COUNCIL OF THE INSTITUTE

Chairman:

Right Reverend Monsignor Patrick Browne, M.A., D.Sc., President, University College, Galway.

Ex-Officio Members:

Dr. Michael Tierney, M.A., D.Litt., President, University College Dublin; Dr. Albert J. McConnell, M.A., M.Sc., Sc.D., Provost, Trinity College, Dublin; Reverend Aubrey Gwynn, S.J., M.A., B.Litt. (Oxon.), 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 John L. Synge, M.A., Sc.D., F.R.S.C., F.R.S.; Professor Ernest T. S. Walton, M.A., M.Sc., Ph.D., F.T.C.D.; Professor Cormac Ó Ceallaigh, M.Sc.

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 Áine de Paor, M.A., Ph.D.; Reverend John Ryan, S.J., M.A., D.Litt.; Reverend Francis Shaw, S.J., M.A.; Séamonn Mac Giolla Iasachta, M.A., D.Litt.; Ernest Gordon Quin, M.A., F.T.C.D.; Reverend Donnchadh Ó Floinn, M.A.

3. THE GOVERNING BOARD OF THE SCHOOL OF THEORETICAL PHYSICS

Chairman:

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

Senior Professors:

John L. Synge, M.A., Sc.D., F.R.S.C., F.R.S.; Cornelius Lanczos, Ph.D.

Appointed Members:

Albert J. McConnell, M.A., M.Sc., Sc.D.; George R. Keating, M.Sc.; Thomas S. Wheeler, Ph.D., D.Sc., F.R.C.Sc.I.; Reverend James R. McConnell, D.Sc.; Máirtín Ó Tnúthail, D.Sc.; Patrick Quinlan, B.E., M.Sc., Ph.D.

4. THE GOVERNING BOARD OF THE SCHOOL OF COSMIC PHYSICS

Chairman:

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

Senior Professors:

Leo W. Pollak, Ph.D.; Hermann A. Brück, D.Phil., Ph.D.; Cormac Ó Ceallaigh, M.Sc.

Appointed Members:

John J. Dowling, M.A., F.Inst.Phys.; Eric M. Lindsay, M.A., M.Sc., Ph.D.; Reverend Patrick J. I. McLaughlin, D.Sc.; Thomas Edwin Nevin, D.Sc.; Patrick J. Nolan, Ph.D., D.Sc,; John H. J. Poole, M.A., B.A.I., Sc.D.; Mariano Doporto, D.Phys.Sc.; John J. McHenry, M.A., (Cantab.), D.Sc., F.Inst.P.; Cilian Ó Brolcháin, M.Sc., Ph.D.

II - Report of the Governing Board of the School of Celtic Studies adopted at its meeting on 26th November 1958.

1. STAFF, SCHOLARS AND EXTERN RESEARCH WORKERS.

Senior Professors:

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

Professors:

James P. Carney; Miss Cecile O'Rahilly.

Assistant Professor:

Rev. Cuthbert McGrath, O.F.M.

Assistant (Part-time):

Mrs. Nessa Doran.

Technical and Clerical Staff:

Miss Maura Devoy; Miss Máire Breathnach.

Scholars:

Louis Paul Nemo (Roparz Hemon); Terence McCaughey (to 30 September 1957); Calvert Watkins (from 1 October 1957); James Stewart (from 1 November 1957).

Extern Research Workers commissioned by the School:

Dr. R. I. Best; Mr. Seán Mac Airt; Mr. Liam Price; Mrs. Mary Ellen Carney; Rev. Seán Ó Catháin, S.J.; Rev. Canice Mooney, O.F.M.; Rev. Anselm Faulkner, O.F.M.; Rev. Pádraig Ó Súillesbháin, O.F.M.; Rev. Bartholomew Egan, O.F.M.; Professor Heinrich Wagner, Dr. R. B. Breatnach; Mr. Seán de Búrca; Professor Nils Holmer; Mr. J. L. Campbell; Rev. Aubrey Gwynn, S.J.; Rev. Professor D. Meehan; Dr. L. Bieler; Professor Séamus Ó Néill; Mr. Derek Thomson; Signor Mario Esposito; Professor J. Vendryes.

2. GENERAL LINES OF RESEARCH WORK.

As usual, the main work of the School during the year lay in Irish studies, early and modern. In the latter field, the material collected for the Linguistic Atlas was sent to press. Field work in the linguistic survey was continued under the direction of Professor Dillon. It is proposed to publish a volume consisting

of texts (orthographic and phonetic) of Munster Speech. These texts will be selected from tape recordings made in Irish-speaking districts throughout Munster.

Work continued in other branches of Celtic Studies. The first fasciculus of Professor Vendryes's Dictionnaire Etymologique de l'Irlandais was sent to press. In Breton, a Historical Grammar of Breton by Roparz Hemon was completed and submitted for consideration, and progress was made on compilation of a Historical Dictionary of Breton. One volume on Scottish Gaelic was published, a second was in the press and material for a third volume has been submitted for examination. Proofs of all contributions to Celtica, Vol.IV were given further revision and material for Vol.V was submitted to the Director.

In the Hiberno-Latin Texts Series, the second volume, The Writings of St. Columbanus (Sancti Columbani Opera), edited by Rev. G. S. M. Walker was published. Proofs of the third volume, Adamnán's De Locis Sanctis were revised. The material for Vol.IV, Itinerarium Symonis Semeonis, edited by Mario Esposito was sent to press. Work continued on the preparation of Vol.V, a collection of the Hiberno-Latin Penitentials. Volume XVII in the Mediaeval and Modern Irish Series, Merugud Uilix Maic Leirtis, edited by Robert T. Meyer was published and several other volumes were in preparation. In the Mediaeval and Modern Welsh Series, Vol.II was submitted and was still under revision at the end of the period under review. Several volumes are in preparation for this Series also. Work progressed on preliminary matter for Seanmónta Chuige Uladh and Lucerna Fidelium already in proof for the Series of Franciscan Texts, one volume Beatha San Froinsias, edited by Pádraig Ó Súilleabháin, O.F.M. was published, one volume was ready for press and two others were in preparation.

At the end of the period under review eight volumes had been published, nineteen volumes edited or written by members of the staff

or by extern research workers were in the press and approximately thirty-seven others were in preparation.

A record of work in progress by individual members of the academic staff, scholars and research workers follows.

Senior Professors:

Michael O'Brien: Continued work on the indexes of Vol.I (in the press) of Corpus Genealogiarum Hibernicarum and on the texts of Vols.II and III. Completed revision of proofs of Vol.III of the Book of Leinster which was published during the period under review. Continued revision of MS. text of Vols.IV and V of the same Ms. Work progressed on a new edition of the Old Irish Bethu Brigte. Revised proofs of Celtica, Vol.IV.

Daniel A. Binchy: Continued to transcribe legal Mss. for the Corpus Iuris Hibernici. Worked on a fresh translation of two Old Irish penitential texts, which are to be included as an Appendix to a volume on the Hiberno-Latin Penitentials in the Series Scriptores Latini Hiberniae. Compiled notes and vocabulary to Scéla Cano meic Gartnáin for the Mediaeval and Modern Irish Series. Read through several archaic law-texts with Mr. Calvert Watkins of Harvard University. Prepared Ériu, Vol.XVIII for press and wrote three articles for it.

Myles Dillon: Continued work on the Book of Rights which is now in galley proof. Revised Vol.II of the Mediaeval and Modern Welsh Series for press. Much time was given to a grammar of Modern Irish for the Teach Yourself Series. Some field work was done for the Linguistic Survey.

Professors:

James P. Carney: Continued work on a number of literary problems and on an edition of recently discovered Old Irish Poems. Portion of the poems are in the press and will appear in Ériu. Started to prepare O'Reilly genealogies for publication.

Miss Cecile O'Rahilly: Continued preparation of an edition of the Stowe Táin and collation with later Mss. Work continued on preparation of Introduction, and Text was ready for printer at the end of the period under review.

Assistant Professor:

Rev. Cuthbert McGrath, O.F.M.; Work progressed on Dán na mBráthar Mionúr which is now nearing completion. Corrected proofs of Brian Mac Giolla Phádraig for Celtica, Vol.IV, sent to printer. Various articles ready for publication in Celtica and Éigse and others in course of preparation. Work continued on an investigation of Plunket's and other dictionaries and a start was made on B. Ó hEodhosa's Teagasg Críosdaidhe. A bardic poem was edited and forwarded to the printers for inclusion in the John Colgan memorial volume.

Assistant (Part-time):

Mrs. Nessa Doran: Work continued on a Catalogue of Irish Mss. in the National Library. Completed a descriptive catalogue of the Phillips Mss. (Vellum) up to and including No.G7 at the end of March 1958.

Scholars:

Roparz Hemon: Work on a Historical Grammar of Breton was completed and the typescript submitted to the Director. Material for the letter A of a Historical Dictionary of Breton was sent to press and proofs were revised and passed for press.

Terence McCaughey: Continued work on Old Irish texts and attended lectures on Old Irish at University College, Dublin.

Calvert Watkins: Mr. Watkins, a member of the Society of Fellows of Harvard University, worked in the School from 1 October 1957. In the Spring he left for a short period to study in the University of Cracow, with the intention of returning in the Summer term 1958. He received tuition from Professors Binchy and Carney as well as from Professor David Greene in Trinity College, Dublin. An article

by him on 'Old-Irish sernaid and related forms' was accepted by the Editors of Ériu.

James Stewart: Carried out some excerpting for the Dictionary of Classical Modern Irish and spent much of his time in private reading.

Extern Research Workers:

Dr. R. I. Best: Completed revision of proofs of Vol.III of the Book of Leinster which was published during the period under review.

Seán Mac Airt: Work continued on the Annals of Ulster.

Liam Price: Vol.V of the Place-Names of Co. Wicklow - The Barony of Rathdown, was published. Work commenced on Vol.VI.

Mrs. Mary Ellen Carney: Continued work on an edition of the Irish translation of the Aphorisms of Hippocrates.

Rev. Seán Ó Catháin, S.J.: Continued work on an edition of Betha Muire.

Rev. Canice Mooney, O.F.M.: Work progressed on Prelims. of Seanmónta Chúige Uladh (in second proofs).

Rev. Anselm Faulkner, O.F.M.: Work on An Sgáthán Spioradálta and An Bheatha Chrábhaidh still in progress.

Rev. Pádraig Ó Súilleabháin, O.F.M.: The correction of page-proofs of Lucerna Fidelium was completed and work on Prelims. was finished. A study on a list of words compiled by James Scurry (19th cent.) has been prepared for Celtica.

Rev. Bartholomew Egan, O.F.M.: Work continued on the preparation of Preface, Notes etc. for two Franciscan grammatical texts (O'Hussey and O'Mulconry).

Heinrich Wagner: The material for the maps for The Linguistic Atlas and Survey of Irish Dialects was given to the printers and

the Introduction to the volume was prepared for press. Completed revise of the second proofs of Gaeilge Theilinn.

R. B. Breatnach: Work continued on the preparation for press of material from the notebooks of Archbishop Sheehan. Some field work was done for the Linguistic Survey with Professor Dillon in Co. Kerry.

Seán de Búrca: Revised proofs of The Irish of Tourmakeady.

Nils Holmer: Revised proofs of The Gaelic of Arran which was published during the period under review.

J. L. Campbell: Continued revision of proofs for Fr. Allan McDonald's Collection of Words from South Uist.

Rev. Denis Meehan: Revised proofs of Adamnán's De Locis Sanctis (Hiberno-Latin Texts Series, Vol.III).

Séamus Ó Néill: Work continued on a revised edition of Seanmóirí an Easpoig Uí Ghallchobhair.

Derek Thomson: Worked on preparation of material for Vol.II in the Mediaeval and Modern Welsh Series.

Mario Esposito: The material for Itinerarium Symonis Semeonis (Hiberno-Latin Texts Series, Vol.IV) sent to press and correction of first proofs commenced.

Joseph Vendryes: Worked on preparation of an etymological dictionary of Irish - Dictionnaire Etymologique de l'Irlandais - and the first fasciculus had been sent to press by the end of the period under review.

3. LECTURES AND CONFERENCES

Professor Dillon read a paper concerning Structural Linguistics at the International Congress of Linguists at Oslo in August 1957. He also delivered a lecture at the University of Louvain in February 1958.

Professor Carney gave a course of lectures in the Institute on the recently discovered Old Irish Poems.

4. STATUTORY PUBLIC LECTURE

The Statutory Public Lecture under the auspices of the School was delivered by Professor James P. Carney in Trinity College, Dublin on Thursday, 20th March 1958. Professor Carney's subject was O'Hussey and Maguire - A Study in the Relationship of Poet and Patron.

5. PUBLICATIONS

		Date of Publication
SANCTI COLUMBANI OPERA. Edited by Rev. G. S. M. Walker. (Scriptores Latini Hiberniae - Vol.II)		
pp.xciv + 247	Price 42/-	10/4/57
THE PLACENAMES OF WESTMEATH. By Rev. Paul Walsh.		
pp.xxxv + 402	Price 25/-	5/9/57
THE PLACENAMES OF CO. WICKLOW. By Lian Price. Vol.V - The Barony of Rathdown.		
pp.iv + 57	Price 2/-	5/10/57
THE BOOK OF LEINSTER - Vol.III. Edited by R. I. Best and M. A. O'Brien.		
pp.xviii + 289	Price 30/-	10/10/57
IRISH SYLLABIC POETRY (1200 - 1600). (Reprinted) Edited by Eleanor Knott.		
pp.vii + 135	Price 5/-	29/11/57
BEATHA SAN FROINSIAS. Edited by Pádraig Ó Súilleabháin, O.F.M. (Vol.IV - Scríbhinní Gaeilge na mBráthar Mionúr).		
pp.xlvi + 142	Price 21/-	30/12/57
THE GAELIC OF ARRAN. By Nils M. Holmer.		
pp.viii + 211	Price 25/-	31/12/57
MERUGUD UILIX MAIC LEIRTIS. Edited by Robert Meyer. (Vol.XVII - Mediaeval and Modern Irish Series).		
pp.xvi + 46	Price 7/6d.	18/2/58

III - Report of the Governing Board of the School of Theoretical Physics adopted at its meeting on 4 June, 1958.

1. STAFF AND SCHOLARS.

Senior Professors:

John L. Synge, Director of the School; Cornelius Lanczos.

Visiting Professors:

Francis D. Murnaghan; Arthur F. Stevenson.

Research Associates:

Stephen O'Brien; Mrs. Sheila Tinney (to September 1957).

Technical Assistant:

Miss Evelyn Wills.

Scholars:

L. Bass (part-time); N. C. Sil (left October 1957); Rev. P. McHugh (left September 1957); W. Israel; L. Ó Raifeartaigh (left September 1957); C. B. Rayner (entered May 1957); Y. Takahashi (entered October 1957); C. B. Mast (entered October 1957); J. Strathdee (entered October 1957).

Student:

L. Ó Raifeartaigh, working with Professor W. Heitler at the University of Zürich, from October 1957.

2. STUDY AND RESEARCH.

Continuing previous researches, Professor Synge (in collaboration with Professor Duff of Toronto) investigated the application of operational methods to the Cauchy problem for anisotropic elastic media, and he also studied the reflexion and refraction (at a plane of discontinuity) of sound waves from a point-disturbance. He worked at Bondi's theory of gravitational waves, and developed a relativistic theory of elasticity which gives speeds of propagation of disturbances formally identical with those of classical elasticity.

Mr. Israel worked chiefly at problems involving discontinuities in spherically symmetric gravitational fields. He wrote a paper which settles the question of the smoothness of the fundamental tensor in (r, t) coordinates, and deals with thick expanding shells of radiation.

Dr. Rayner (holding a D.S.I.R. Fellowship) made a careful study of rigid motions in general relativity, and found that the differential equations are of parabolic type. As a result of this work he was led to investigate the geometry of a space endowed with a singular contravariant semi-definite fundamental tensor.

Mr. Ó Raifeartaigh completed his work on a generalization of the Einstein universe; a paper on this is in press. In collaboration with Professor Synge, he wrote a paper showing that if empty space-time is flat on some spacelike 3-space, it is flat everywhere. As a Student in Zürich, he worked on the following two problems under Professor Heitler:- 1) The calculation of meson-production by two nucleons at very high energies. This problem had already been treated (using the Weizsacker-Williams method) by Heitler and Peng (Proc. Roy. Irish Acad. 1943) and Heitler (ibid. 1945), and the present treatment differed from the previous in two ways. First, a cut-off energy was to be introduced as suggested in the work of Heitler and Arnous (Nuovo Cimento 1953) and secondly the meson-scattering data used were to be experimental and not theoretical data. This work is now completed but is unlikely to be published, particularly in view of the absence of experimental results with which the results could be compared. 2) In conjunction with Drs. Terreaux, Pandit, and Sredniawa, he undertook the calculation of the proton-neutron mass difference using perturbation theory and paying attention only to the terms of order e^2f^2 in the perturbation expansion [e = electromagnetic coupling constant (charge) and f = meson coupling constant].

Dr. Mast worked at problems of clock retardation, chiefly in connection with the retardation experienced by a clock carried by an artificial satellite; he sought to present in more general and understandable form results obtained by other workers.

Professor Lanczos obtained further clarification in the general theory of the quadratic action principle of general relativity, particularly concerning the role of the free vectorial function which appears in that theory as the result of a canonical transformation, and its physical interpretation as the electric current vector.

Another line of research was originated by the lecture series given at Oregon State College. The step by step integration procedure of W. E. Milne is based on Simpson's quadrature formula. Another approach is possible by applying the method of undetermined coefficients to the Taylor expansion. A formula is thus obtained which gives optimum results from the standpoint of reducing the accumulation of rounding errors to a minimum. Moreover, this formula satisfies the condition of stability under all circumstances.

Another programme of research belongs to the realm of boundary value problems associated with linear partial differential equations. The customary "well-posed" problem (in the sense of Hadamard) assumes that the data can be prescribed freely and that they are sufficient to yield one and only one solution. In the most general case the data may have to satisfy compatibility conditions and they may not suffice for a unique solution of the problem. A solution of the general problem was obtained on the basis of a fundamental decomposition theorem which holds in the realm of matrices and which can be transferred to arbitrary linear operators. (To be presented at the International Congress of Mathematicians, Edinburgh, August 1958).

Rev. McHugh continued his studies of Debye Potentials, especially their application to wave-guide problems. He also studied McCrea's relativistic formulation of the theory.

Mr. Sil continued his investigations on electron capture phenomena, and submitted the results as a Ph.D. thesis (Electron Capture Phenomena) at Dublin University, with a description of the various interesting physical phenomena in which the problem of electron capture plays an

important role. He calculated the probability of electron capture by protons passing through an atmosphere of hydrogen atoms for both low and high values of the incident proton energies. For high incident proton energies the method of Born approximation was used and the electron capture into arbitrary excited orbits calculated.

Dr. Takahashi investigated the parameter variation in quantum field theory in order to derive relations between physical quantities, without recourse to any approximation. This was done with the collaboration of Mr. Strathdee. Dr. Takahashi also treated the thermal expansion of solids, by using his formulation of expanding quantum systems. He further examined the relation between Ehrenfest's adiabatic hypothesis in the early stage of the quantum mechanics and the quantization procedure in relativistic field theory and showed that the divergence difficulties are removed, if the adiabatic process is consistently taken into account in the treatment of the S-matrix.

Mr. Strathdee also constructed a representation-free formulation of quantum field theory. The primary objective of this work is the isolation of merely kinematical or notational elements in order that the basic dynamical behaviour of quantized fields may be clarified and exhibited in a concise manner.

Dr. Bass studied superconductivity, and lectured on it in the Seminar.

Professor Murnaghan worked on orthogonal and symplectic groups, in particular the simplification of the treatment of the modification rules for the rotation, symplectic and orthogonal groups given in his book, "Theory of Group Representations". He found a simple solution of the problem of analysing the representation $\{m\} \otimes \{\lambda_1, \lambda_2\}$ of the 2-dimensional unimodular unitary group.

Professor A. F. Stevenson investigated the stability of a rotating, electrically conducting, fluid sphere which has a uniform volume distribution of thermal sources. Small perturbations from the equilibrium

state with zero magnetic field are considered. This problem is of interest in connection with theories of the origin of the earth's magnetic field.

3. SEMINARS AND LECTURES.

As in previous years the seminar lectures throughout the year were attended by members of staff and students from Trinity College, Dublin, University College, Dublin, and St. Patrick's College, Maynooth, as well as by members of the School of Cosmic Physics.

The following seminar lectures were given:

Dr. L. Bass:
Superconductivity (2 lectures).

Professor H. Brück (School of Cosmic Physics):
The scale of the universe (2 lectures).

Rev. Dr. R. Ingram (Seismological Observatory, Rathfarnham Castle):
Problems in seismology (3 lectures).

Mr. W. Israel:
Non-statical spherically symmetric gravitational fields (2 lectures).

Professor C. Lanczos:
Matrix algebra.

Professor F. D. Murnaghan:
The orthogonal and symplectic groups (9 lectures).
(The lectures will be published as a Communication of the Institute).

Dr. B. Spain (T.C.D.):
Harmonic spaces.

Professor A. F. Stevenson:
Theories of the origin of the earth's magnetic field (2 lectures).

Professor J. L. Synge:
Waves of action in classical dynamics, Newtonian and relativistic (3 lectures).
A model in general relativity for the instantaneous transformation of a massive particle into radiation.

Dr. Y. Takahashi:
The development of quantum field theory and its difficulties (5 lectures).

Professor E. T. S. Walton (T.C.D.):
Acceleration of particles to high energies.

4. STATUTORY PUBLIC LECTURE.

A Statutory Public Lecture, under the auspices of the School, was delivered in University College, Dublin, on November 12, 1957, by Professor Murnaghan. His subject was "The search for simplicity and accuracy in the use of high-speed electronic computers".

5. VISITING PROFESSORS.

During the period under review, there were two visiting professors at the School, as follows:

Professor F. D. Murnaghan (Instituto Tecnologico de Aeronautica, São José dos Campos, Brazil), from October to December 1957;

Professor A. F. Stevenson (Wayne State University, Detroit), from January to March 1958.

6. VISITING LECTURERS.

Dr. F. A. E. Pirani (King's College, London) visited the School from July 15 to 20, 1957, and gave three lectures in the Seminar under the general title "Theory of gravitational radiation".

Professor W. Kohn (Imperial College of Science and Technology) visited the School from March 5 to 8, and gave two lectures to the Seminar, entitled "Quantum thsory of electrical conductivity".

Professor A. Giao, of Paris, visited the School on March 26-27, and gave two lectures to the Seminar, on "The problem of time in relativistic cosmology".

7. EXTERNAL ACTIVITIES.

At the September Meeting of the British Association for the Advancement of Science, held in Dublin, Professor Lanczos spoke on "The Striving for rigour in Greek science", and Professor Synge spoke on "How stands the theory of gravitation to-day?" Professor Synge lectured to the Dublin University Experimental Science Association on November 12, on

"How to think about space-time", and he gave a lecture at the Queen's University, Belfast, on November 28, entitled "Is the study of its history a brake on the progress of science?"

Professor Lanczos attended the Symposium in Advanced Numerical Analysis held in August 1957 at Ann Arbor, Michigan, and gave three lectures there entitled "Linear systems in self-adjoint form", Fundamental decomposition theorem for linear operators", and "Unconventional boundary value problems". He also attended the Conference for Matrix Computations, at Detroit, and lectured there on "Iterative solution of large scale linear systems".

Professor Lanczos was on leave of absence for 6 months (October 1 - March 31) at the Department of Mathematics, Oregon State College, Corvallis, Oregon, U.S.A. There he gave a course of lectures (October 15 - March 15) on "The Green's function and its applications". He also gave the following lectures in Corvallis: Dec. 10, "The role of theory in contemporary physics"; Jan. 15, "Science and engineering"; Jan. 22, "The problem of curve fitting"; Feb. 25, "The quadratic action principle of general relativity"; March 6, "Data analysis".

Elsewhere in the U.S.A. he gave the following lectures: At the University of Oregon, Eugene, Oregon: Dec. 3, "Linear systems in self-adjoint form". At the Lockheed Airplane Company, Palo Alto, Calif.: Feb. 4, "Step by step integration of trajectory problems". At Stanford University, Calif.: Feb. 5, "Diagnostic analysis of large scale linear systems"; and Feb. 6, "Linear systems in self-adjoint form". At Portland State College, Oregon: March 20, "Numerical integration of trajectory problems". At Washington State College, Pullman, Washington: March 24, "The role of theory in contemporary physics"; March 25, "Step by step integration of ordinary differential equations"; March 26, "Extended boundary value problems"; and March 27, "Gaussian quadrature". At G.E.C., Schenectady, New York: March 31, "Error analysis of large scale linear systems", with adjoining general discussion of problems in applied mathematics.

Mr. Sil, Rev. McHugh, Mr. Israel, and Mr. Ó Raifeartaigh attended the Colloquium held at University College, Cork, from July 10 to 12, 1957. Mr. Israel spoke on "Determination of electromagnetic fields from normal components", and Mr. Ó Raifeartaigh on "The conservation equations in relativity", to the Applied Mathematics Group, on July 11.

Dr. C. B. Rayner attended the British Mathematical Colloquium, held at Nottingham University from September 11 to 13.

Professor Murnaghan lectured at the University of St. Andrews, on November 21. His subject was "Approximation to differential functions by polynomials for the use of electronic computers". On November 29 he lectured on the same subject to the Dublin University Mathematical Society. On November 29 he also spoke at a meeting sponsored by the Irish Branch of the International Mathematical Union on "The teaching of mathematics in secondary schools, with special emphasis on algebra and trigonometry". He gave these two lectures again on December 8 and 9 at University College, Cork.

3. PUBLICATIONS.

Items marked with an asterisk were recorded as in press in previous reports.

a. Books:

(i) Published:

* The Hypercircle in mathematical physics. By J. L. Synge. University Press, Cambridge, 1957.

* The Relativistic Gas. By J. L. Synge. North-Holland Publishing Co., Amsterdam, 1957.

* What is Life? and Other scientific essays. By E. Schrödinger. Doubleday Anchor Books, New York, 1956.

(ii) In the press:

* Variation principles of mechanics. By C. Lanczos. Article for the Handbook of Engineering Mechanics. McGraw-Hill, New York.

* Tensor Calculus. By C. Lanczos. Article for the Handbook of Physics. McGraw-Hill, New York.

* Classical Dynamics. By J. L. Synge. Article for Vol. 3 of Encyclopedia of Physics. Springer, Berlin.

b. Communications of the Dublin Institute for Advanced Studies - Series A, Physics:

In preparation:

No. 13. The orthogonal and symplectic groups. By F. D. Murnaghan.

c. Contributions to periodicals:

(i) Published:

* F. A. E. Pirani:
On the physical significance of the Riemann tensor. Acta. Phys. Polon., 15, 389, 1956.

* J. L. Synge and W. F. Cahill:
The torsion of a hollow square. Quart. Appl. Math., 15, 217, 1957.

* J. L. Synge:
Elastic waves in anisotropic media. J. Math. Phys., 35, 323, 1957.

A definition of an invariant density in a gravitational field. Proc. R. I. A., 58 A, 29, 1957.

A model in general relativity for the instantaneous transformation of a massive particle into radiation. Proc. R.I.A., 59 A, 1, 1957.

How stands the theory of gravitation today? Advm. Sci., 14, 207, 1957.

L. Ó Raifeartaigh:
Fermi coordinates. Proc. R.I.A., 59 A, 15, 1958.

C. Lanczos:
Electricity and general relativity. Rev. Mod. Phys., 29,337, 1957.

Y. Takahashi and H. Umezawa:
A general treatment of expanding systems. I. Formulation. Nuovo Cim. 6, 1324, 1957.

A general treatment of expanding systems. II. Application to Multiple Meson Processes. Nuovo Cim., 6, 1382, 1957.

(ii) In the press, 31 March 1958:

* J. L. Synge:
Stationary principles for forced vibrations in elasticity and electromagnetism. Proc. Symposium Appl. Math. (Amer. Math. Soc.).

Whittaker's contribution to the theory of relativity. Proc. Edinburgh Math. Soc.

An introduction to space-time. The New Scientist.

L. Ó Raifeartaigh:
A static generalization of the Einstein universe. Proc. Roy. Soc., A.

C. Lanczos:
Linear systems in self-adjoint form. Amer. Math. Monthly.

Iterative solution of large-scale linear systems. S I A M.

IV - Report of the Governing Board of the School of Cosmic Physics adopted at its meeting on 19th December, 1958.

A. Astronomical Section.

1. STAFF AND SCHOLARS.

Senior Professor:

H. A. Brück (resigned 30 September, 1957).

Chief Assistant:

M. J. Smyth.

Research Associate:

Máire T. Brück (resigned 30 November, 1957)

Technical and Clerical Staff:

Mrs. M. Connolly; Mr. P. Murphy.

Scholar:

Miss S. M. P. McKenna.

2. EQUIPMENT.

After the completion of the photographic programme a photoelectric head was constructed and fitted to the solar spectrograph for the purpose of measurements in fixed spectral regions.

A Robot 35mm camera was installed in the spectrohelioscope to enable sequences of photographs to be taken of the H_α emission in solar flares.

A D.C. amplifier was constructed for use in conjunction with the Cambridge Recorder in photoelectric measurements of bright stars with the 28-inch reflector.

A V.H.F. receiver was installed in the Clock Room for more reliable recording of radio time-signals. Mr. H. Young presented to the Observatory two clocks made by his brother, the late R. E. Young, F.B.H.I., a well-known Dublin horologist.

3. RESEARCH WORK.

Solar Spectroscopy:- With the concave-grating spectrograph, Dr. Smyth obtained third-order plates down to 306Å, to complete Dr. Thompson's programme on the ultra-violet spectrum of the sun. Dr. M. T. Brück completed the direct-intensity tracings of the region, and the results have been sent to Professor Minnaert at Utrecht for incorporation in his Table of Equivalent Widths of Fraunhofer Lines.

Dr. Smyth designed a photoelectric head for the spectrograph, in order to attempt to detect H- and K-line absorption due to approaching streams of particles emitted from solar flares, in continuation of earlier work at Cambridge and Edinburgh.

Solar Patrol:- Regular spectrohelioscope observations were made by Dr. M. T. Brück and Miss McKenna. Disk drawings were made on 81 days and spectrohelioscope observations on 65 days.

Monthly lists of solar flares and SEA's (Sudden Enhancements of Atmospherics) were circulated to I.G.Y. World Data Centres and to interested observatories. Daily I.G.Y. Warning Messages have been received via the Irish Meteorological Service.

Results for the co-operation series of observations of 12 Lacertae, mentioned in last year's report, are in the press.

28-inch Reflector:- In a spell of exceptionally fine weather, Dr. Smyth was able to obtain photoelectric measurements of the nucleus of Comet Arend-Roland on 14 nights during May and early June. An unusually complete light-curve was obtained. The diaphragm used was changed nightly so as always to correspond to one minute of arc at unit geocentric distance, so that a fixed area of the comet's nucleus was measured. An attempt is being made to corelate departures from a smooth light-curve with solar activity. Extensive re-examination of the comparison stars was undertaken during the following winter.

Successful photographs of Comets Arend-Roland and Mrkos were taken with the Contax camera and 300mm telephoto lens, attached to the 28-inch telescope.

Artificial Satellites:- Many photographs of the bright objects $1957\alpha_1$ and 1957β have been taken with miniature cameras. For accurate timing, a mounting was constructed which displaces the camera once per second, the impulses being provided by an electromagnet actuated by the Shortt Clock. Measurements from these photographs, and many observations contributed by the public during the early days, were circulated to world data centres, from which regular predictions have been received. Observations from Dunsink are among the most numerous submitted during the first months. Some of Mr. P. Murphy's photographs were reproduced in Nature, and Dr. Smyth summarized requirements for amateurs' satellite photography in an article in Spaceflight.

ADH TELESCOPE AND BOYDEN OBSERVATORY.

Dr. Smyth attended a meeting of the Administrative Council of the Boyden Observatory, at the Observatoire Royal de Belgique, Uccle. A proposed formal Agreement for the running of the entire Observatory by the six nations was discussed in detail. This Agreement was submitted to the Finance Solicitor, who gave his approval in principle after discussion with Dr. Smyth.

The running of Boyden Observatory has been greatly facilitated by the appointment of a resident Director (Dr. H. Haffner) from August for two years. Lack of staff has made it impossible to send an observer from Dunsink to South Africa or to make progress with the many existing ADH plates of open star clusters.

CONFERENCES AND VISITS.

Professor Brück attended by invitation a conference in Rome on the subject of Stellar Populations, at the Pontifical Academy of Science, of which he is a member.

Dr. Smyth attended an informal conference at the Royal Greenwich Observatory.

6. VISITORS.

The Observatory has been open as usual to the public on the first Saturday of each month from September to April. About 120 members of the British Association for the Advancement of Science visited the Observatory in September. The 12-inch refractor has continued to be available to members of the Dublin Centre of the Irish Astronomical Society.

7. PERSONAL.

In September Professor Brück left Dunsink to take up his appointment as Astronomer Royal for Scotland and Regius Professor of Astronomy in the University of Edinburgh..

Miss S. M. P. McKenna, a graduate of University College, Dublin, joined the Observatory as Scholar in August.

B. Cosmic Ray Section.

1. STAFF AND SCHOLARS.

Senior Professor:

C. O'Ceallaigh.

Professor:

C. B. A. McCusker.

Assistant Professor:

R. H. M. Johnston (appointed for 3 years from 1st October 1957).

Technical and Clerical Staff:

Mr. J. Daly, Miss C. Inight, Miss E. Smith, Miss N. Leahy, Miss. N. Ryan, Miss H. Clark, Miss D. Kelly.

Scholars:

R. J. Reid (entered 1 January 1956); G. Alexander (entered 1 January 1956, appointment ended 31 March 1958); M. J. O'Connell (entered 1 October 1956); D. E. Page (entered 4 September 1957).

During his visit to California Professor O'Ceallaigh was able to obtain an exposure of four small stacks to mono-energetic electrons from the linear accelerator at Stanford University at energies of 100, 200, and 300 MeV. Best thanks are due to Professor W. K. F. Panofsky and his collaborators for arranging the special experimental conditions necessary, and to Dr. G. Goldhaber and Mr. H. Schwarz for providing facilities for processing the stacks. Unfortunately, owing to a failure of the device for printing grids on the backs of the emulsions, it was found impossible to follow the electron tracks through the stacks and measurements had to be confined to the 0.5 cms. of track available in the first strip in each stack. The investigation which was subsidiary to that on the spectrum of the β-decay of K^+-mesons, was designed to determine experimentally the correction for Bremsstrahlung loss to the estimate of the energy of fast electrons obtained by the technique of multiple scattering. Further exposures are planned.

Time Variations Experiment: The air shower array, include two penetrating set detectors and now incorporate two Wilson Cloud Chambers to give improved accuracy in determining the directions of incidence of the showers. It has been in continuous operation throughout the year. In the last annual report, proposals and plans for the setting up of a similar station in Jamaica were outlined. This station commenced full time operation in August 1957 under sponsorship from the Office of Scientific Research of the Air Research and Development Command, United Stated Air Force Contract No. AF 61(514)-1164.

Dublin Station: Three separate types of shower have been found to produce time variations. Of these, the first two were with respect to solar time, and were almost exactly in antiphase. The rate appeared to be strongly correlated with semi-diurnal oscillations of the higher levels of the earth's atmosphere. Evidence for the existence of both types continues to accumulate, and the effects may now be taken as established. Analysed with respect to sidereal time, neither of these types of shower shows any departure from isotropy. It has been noted

however, for brief periods, that the effect appears to fade, and the possibility of this being related to a physical cause, as opposed to statistical fluctuations, is being considered.

The rate of a third type of event, corresponding to a primary of higher energy has continued to exhibit a variation with sidereal time, and the scope of the experiment has been greatly enhanced by the use of two cloud-chambers to measure shower directions while retaining telescopes of wide angle to ensure a high rate of accumulation of events. The variation in the sidereal rate of these showers may now be regarded as being established. It is now found that there exist further anisotropies when the density of events in different declination strips is compared with those to be expected if no variation with declination existed. In addition, Professor McCusker has shown that contrary to accepted notions, isotropy would not result in a symmetrical distribution of events North and South of the line of declination defined by the small circle traced out by the zenith at a given latitude.

As an addition to the present array, apparatus has been added to investigate the claims made for a simple type of shower detector having good resolution (Ref. Shen K.Y. and Singer S.F., Phys. Rev. 106, 555, 1957), but results show that the directional properties of this array are not superior to those of more conventional arrangements.

Personel of Station:

April - June 1957	Professor C. B. A. McCusker, R. J. Reid.
July - October 1957	Professor C. B. A. McCusker, Miss E. Smith.
October - March 1958	Professor C. B. A. McCusker, Miss E. Smith, D. E. Page.

Jamaica Station: The station at Jamaica was set up in the hope of confirming, at a different latitude, the existence of the effects detected at the Dublin Station. The location is particularly favourable for the study of the variations with solar time, as there, semi-diurnal variations are very consistent and of large amplitude. For the study of sidereal variations, it has advantages in that a different portion of the sky is seen (including the centre of our own galaxy).

In addition, as the bands of declination swept out by the two stations have some overlap, the comparison of results in this region provides a valuable check on the reproducability of the observations.

For the solar variations, enough material has not yet been amassed to yield significant results. However, one type of shower at least is exhibiting a pattern identical with that obtained in Dublin.

For the sidereal variation, longer exposure will be required before statistical tests gain significance. Two Wilson cloud chambers designed by Mr. J. Daly and constructed in Dublin were brought out to Jamaica by Professor McCusker and installed in an air conditioned hut, which with the control and trigger circuits had been made ready in Jamaica. Both cloud chambers were put into operation on 1 March 1958.

Further extensions to the Jamaican station in terms of additional shower detectors are envisaged.

Personel of Jamaican Station:

April 1957	Professor McCusker
July 1957 - March 1958	R. J. Reid.

3. CONFERENCES.

Rochester Conference 1957: Professor O'Ceallaigh attended by invitation the 7th Annual Rochester Conference on High-Energy Nuclear Physics at Rochester New York, from April 15 - 19, 1957. He reported the work on the secondary decay products of K^+ mesons on behalf of various collaborating Groups including the Dublin Institute for Advanced Studies. He subsequently visited by invitation the following Institutions: Naval Research Laboratory, Washington D.C., University of St. Louis Mo., University of California, Berkeley, California, Stanford University, Palo Alto, California, Brookhaven National Laboratory, Upton, New York. At the first three places he gave invited talks on some aspects of the work in progress in the Cosmic Ray Section of the School.

A. Wataghin, G. Alexander and R. H. W. Johnston.
A Search for the Existence of Asymmetries in Positive K-Meson Decay.
Padova-Venice Conf. Rep. VII, 3, 1957. Nuovo Cimento 7, 128, 1958.

S. McKenna, S.Natali, N.O'Connell, J.Tietge and N. Varshneya.
Decay Spectrum of the τ'-Meson.
Padova-Venice Conf. Rep. VI, 54, 1957. In publication Nuovo Cimento.

European K^- -Collaboration Report.

B.Bhomik, D.Evans, D.Falla, F.Hassan, A.A.Kamal, K.K.Nagpaul, D.J.Prowse (Bristol); M.René (Brussels); R.H.W.Johnston, G. Alexander, C. O'Ceallaigh, D.Keefe (Institute for Advanced Studies and University College, Dublin); E.H.S. Burhop, D.H.Davis, R.C. Kumar, W.B.Lasich, M.A.Shaukat, F.R.Stannard (University College, London); M.Bacchela, A.Bonetti, C.Dilworth, G.Occhialini, L.Scarsi (Milano); M.Grilli, L.Guerriero, L.von Lindern, M.Merlin, A. Salandin (Padova).
Padova-Venice Conf. Rep. II, 1, 1957.

C. B. A. McCusker and F. C. Roesler.
New Experimental Evidence and the Tunnel Theory of Cosmic Ray Jets.
Nuovo Cimento, 5, 1136, May 1957.

C. B. A. McCusker.
The Measurement of Primary Directions in Extensive Air Showers.
In Publication Phys. Rev.

C. B. A. McCusker, D. S. Page and R. J. Reid.
The Directional Properties of an Extensive Air Shower Array.
In Publication Phys. Rev.

C. Geophysical Section.

1. STAFF AND SCHOLARS.

Senior Professor:

Leo W. Pollak.

Professor:

Thomas Murphy.

Senior Technical Assistant:

Thomas J. Morley.

Technical and Clerical Staff:

Miss Nessa Falconer; Miss Margaret Ryan; Mr. Kevin Bolster; Mr. Martin Cotter.

Scholar:

Arvids Leons Metnieks (to 28 February 1958, from 1 March 1958 Research Assistant under U.S. Air Force Contract).

2. INVESTIGATIONS, EXPERIMENTAL AND FIELD WORK.

a. Senior Professor L. W. Pollak and A. L. Metnieks (Scholar):
Photo-electric condensation nucleus counter. - In the period covered by this report photo-electric condensation nucleus counters of high precision have been developed for measuring low and very low concenfrations of nuclei such as are experienced in aeroplane ascents and occur in maritime, arctic and antarctic aerosols, and also in laboratory investigations as e.g. with the resolution of polydisperse aerosols into their components using the dynamic method.

The world-wide use of the photo-electric counter under climatic conditions very different from those under which the instrument was calibrated some fifteen years ago, created new problems. It was necessary to study certain properties of the fog in the fog-tube which affect the measurement of its extinction. An effect observed in Greenland by the U.S. Army Signal Engineering Laboratories which interferes seriously with photo-electric measurements of the extinction at very low concentrations was investigated and eliminated. The results of these researches have either been published or are in course of publication.

Diffusion coefficient of large ions.- The equipment for carrying out the programme as suggested by Pollak and approved by the U.S. Air Force has been completely assembled and used for measuring the diffusion coefficient of large ions. The results of this investigation will be presented at the 2nd Conference on Atmospheric Electricity at Wentworth-by-the-Sea, U.S.A. on May 20, 1958.

Resolution of Polydisperse aerosols. - For the resolution of polydisperse aerosols into their components using the dynamic method a diffusion battery is required which eliminates faults hitherto overlooked. The construction of a precision battery is far advanced employing principles which promise the solution of a problem troubling workers in this field in Ireland, Great Britain (Harwell) and the U.S.A. (Oak Ridge National Laboratory) for several years.

Integrating lightmeter. Professor Pollak has assembled an integrating light meter for our observatory combining a low inertia motor with mechanical counter (starting current 1.5 mA) and the new Si-photo-elements with linear output up to 100000 Lux. At the moment the instrument is being tested and calibrated by Messrs. B. Lange in Berlin. Since the instrument does not require costly DC-Amplifiers its price is about £30 and thus only one fifth of the cost of commercially available light integrators.

b. Professor T. Murphy:

Gravity Survey. The gravity survey of Ireland is continuing. Since the lifetime of the Worden gravity meter is limited, all available funds have been allocated for this work even at the expense of other investigations. Professor Murphy spent several months on field work and the following counties were completed at the intended density of one station per 9 sq. kilometres: Carlow, Dublin, Kilkenny, Limerick, Tipperary, Waterford and Wicklow. A regional survey of Cork and Kerry was also carried out. In all, 1994 new stations were set up. As heretofore, the Ordnance Survey have supplied all the maps. The computations are not complete but provisional values are available for a large part of the area surveyed.

Geological maps of Ireland. The one inch geological maps are being redrawn by Miss Ryan on the scale of two miles to one inch and ten of the thirteen new maps have been completed. The Geological Survey have given on loan all the necessary manuscript maps and technical assistance has been given by the drawing staff of the Ordnance Survey.

Radioactivity. Samples of air taken each day are filtered and the filtrate examined for β ray activity. A radioactive standard supplied gratis from the Atomic Energy Research Establishment at Harwell is used for standardisation.

Bowen period. Rainfall figures for Ireland are being analysed in a search for the Bowen meteor periodicities.

Visitors. Messrs. Miller and Flitty from the Messman-Rinehart Oil Company, Wichita, Kansas visited the School to inspect the geophysical data both published and unpublished and had discussions with Professor Murphy regarding their significance.

c. Mr. A. L. Metnieks (Scholar).

Sea-salt nuclei. An Bord Iascaigh Mhara (Chairman: Mr. S. O. Meallain) on 6 April 1957 kindly permitted that Mr. Metnieks makes observations of salt nuclei aboard the fishing boat "Ard Mor" when operating west of Galway.

The necessary equipment for these measurements in a small vessel of 35 tons (56 feet long) was constructed and assembled in the workshop of the Section. Professor Pollak established Metnieks in Galway on the 3rd and 4th June 1957.

Mr. Metnieks measured for three weeks salt nuclei at sea on the Atlantic west of Galway and on the Aran Islands. The results of his investigation promise to be of great value in assessing the role of the oceans as source of cloud-forming nuclei.

Mr. Metnieks' extensive researches on salt nuclei in Ireland will be submitted to Trinity College, Dublin as thesis for the Ph.D. degree.

3. PUBLICATIONS.

L. W. Pollak and A. L. Metnieks:
Photo-electric condensation nucleus counters of high precision for measuring low and very low concentrations of nuclei.
Geofisica Pura e Applicata, Milano; Vol. 37 (1957/II), pp. 174-182.

L. W. Pollak and A. L. Metnieks:
The fog in the photo-electric nucleus counter.
Ibidem: Vol. 38 (1957/III), pp. 181-203.

L. W. Pollak and A. L. Metnieks:
The influence of scintillation on the measurement of extinction with the photo-electric nucleus counter at very low concentrations.
Ibidem: Vol. 38 (1957/III), pp. 204-207.

L. W. Pollak and A. L. Metnieks:
The diffusion coefficient of large ions.
(Accepted for presentation at and publication in the Proceedings of the 2nd Conference on Atmospheric Electricity at Wentworth-by-the-Sea, U.S.A.)

T. C. O'Connor:
Further measurements of global radiation using black and white atmometers. Ibidem: Vol. 38 (1957/III), pp. 154-156).

4. U.S. AIR FORCE CONTRACT

a. Extracts from letters (signed by A. C. Trakowski, Lt. Colonel, USAF, Chief, Physical Sciences, Technical Operations Division) of Air Research and Development Command USAF (European Office, Brussels) addressed to Professor Pollak:

(i) 28 March 1957: "Many thanks for your fine proposals and the set of reprints of your papers which accompanied your letter of 7 March..... Your proposal for 'Research on Polydisperse Aerosols using Photo-electric Nuclei Counter', looks very good, and I have forwarded it to our geophysics laboratories in the United States for evaluation with my recommendation..... The work you propose is unique in possibilities..."

(ii) 22 April 1957: "It is my pleasure to tell you that we have received the completed evaluation of the proposal you sent to us on 7 March 1957 for research on polydisperse aerosols. Dr. Junge tells me that he has the highest regard for your very careful and ingenious research, and feels that your proposal will nicely complement his established program in aerosol physics. He has, therefore, indicated his approval for the support of your work.
It is our intent to begin a contract negotiation with you as soon as the necessary funds can be made available. We do not expect that obligation to support your proposal can be made before sometime in the autumn of this year. Since you have indicated a starting date for your research of March 1958, we trust there will be plenty of time to conclude all details without difficulty".

b. On 18 November 1957 Lt. Col. A. C. Trakowski accompanied by his Contract Officer visited Professor Pollak in connection with special research requested by the U.S. Air Force.

Both the scientific and the financial points of the contract intended for two years were discussed and the visitors were shown the equipment already assembled for the research. The subject of the contract was chosen by Lt. Colonel Trakowski in the most general terms in order to give as much freedom as possible in selecting the special problems for investigation. In order to permit finishing investigations then in progress Professor Pollak suggested as a commencing date for the

contract 1st March 1958. The annual expenditure of the contract amounts to $4500.- in the first year. Mr. Metnieks has been taken over as from the above date as Research Assistant with an annual salary of $2520.-.

The Contract AF 61(052)-26 arrived on the 28th November 1957 and was passed by the Council of the Institute at their meeting on the 9th December 1957. The signed and sealed contract was returned to Brussels on the same date. The completed contract signed on behalf of the U.S.A. government was received in Dublin on 16th December 1957 and is filed in the Administrative Office in 64/65 Merrion Square.

5. METEOROLOGICAL AND GEOPHYSICAL SEMINAR.

25th April 1957: Mr. R. J. Murgatroyd, Meteorological Research Flight, Royal Aircraft Establishment, Farnborough: Some recent meteorological research in aircraft.

Note: In the discussion Professor Pollak showed slides of the photo-electric nucleus counter for measuring very low concentrations of nuclei which employs for measuring the extinction an electrical compensation method and he discussed measurements of concentrations of less than 220 nuclei per cm^3 during their decay in a gasometer.

23rd & 24th May 1957: Dr. B. J. Mason, Department of Meteorology, Imperial College of Science and Technology, London: (i) Mechanisms of rain formation, (ii) The artificial production of rain.

20th June 1957: Mr. A. Bourke, Assistant Director, Irish Meteorological Service: Technical assistance in meteorology: a year in Chile.

28th November 1957: Dr. E. E. Schneider, Physics Department, King's College, University of Durham; Nuclear magnetic resonance and the measurement of the earth's field.

12th December 1957: Professor L. W. Pollak and Mr. A. L. Metnieks, School of Cosmic Physics, Dublin: Recent work on the fog formation and measurement of extinction in the photo-electric nucleus counter.

23rd January 1958: Dr. T. W. Wormell, Cavendish Laboratory, Cambridge: The lightning discharge as a meteorological phenomenon.

24th January 1958: Dr. T. W. Wormell, Cavendish Laboratory, Cambridge: The lightning discharge as radio transmitter.

6th March 1958: Dr. W. J. Megaw, Health Physics Division, AERE, Harwell: Condensation nuclei produced by ionising radiation.

27th March 1958: Professor A. Giao, Paris: Basis of a dynamical classification of climates.

28th March 1958: Professor A. Giao, Paris: Thermodynamic expressions of wind and their applications.

6. STATUTORY PUBLIC LECTURE.

The Statutory Public Lecture was given on 12 March, 1958 under the title "The Gravitational Field at the Earth's surface and why gravity is measured" by Professor Murphy in the Physical Laboratory of Trinity College Dublin.

7. APPLICATIONS FOR SCHOLARSHIPS.

Applications for scholarships in the Meteorological Section have been received from the following:

(i) Mr. Richard Nelis, a graduate from Queen's University Belfast, at present holding a Short Service Commission in the Royal Navy and teaching at the R.N. Electrical School at Fareham, Hants.

(ii) Dr. Elmar Herpertz, Meteorological Observatory, Aachen (West Germany).

(iii) Dr. Fr. E. Volz, Meteorological and Geophysical Institute of the University in Mainz (West Germany).

(iv) Mr. S. Twomey, Radiophysics Division, Sydney, Australia.

Although ample research work for two additional scholars in my Section could be provided all applications had to be rejected since provision for only one Scholar is made at present. A second Scholarship which was initially granted to the Section was lost during the re-trenchment taking place in recent years.

8. INTEREST IN OUR NUCLEUS COUNTERS AND NUCLEI INVESTIGATIONS.

(i) The photo-electric nucleus counter is now used from the Arctic to the Antarctic, from the West indies and the United States through Europe to Australia. Thirteen countries are now using the Irish instrument for regular observations at more than 25 stations.

(ii) A photo-electric condensation nucleus counter of high precision made according to our specification and advice in the workshop of the American Shell Co. for the British Caribbean Meteorological Service in Trinidad, was sent to our laboratory for testing and standardisation. The instrument has been adjusted and extensively compared with our standard. The Director of this Caribbean Service,

Mr. W. A. Grinsted, stayed in the Section from 20 to 23 August in order to familiarise himself with the working and treatment of the instrument. He is an expert in instruments and took part with Mr. Stagg and Mr. Sheppard in the 2nd International Polar Year Arctic expedition in the 1930s. Mr. Grinsted intends to use several of the photo-electric counters in his Service, stretching over 2,000 miles in tropical latitudes. During his stay in the School a set of measurements was carried out and it was shown, for instance, that there is an agreement of better than 1% between the diffusion coefficients measured with three photo-electric nucleus counters of different design.

(iii) Dr. F. H. Bowen, Director of the Physics Department, University College of the West Indies, Mona, St. Andrews, Jamaica, visited our laboratory on the 29th August 1957 in order to discuss a research programme on condensation nuclei to be carried out in Jamaica. Two photo-electric nucleus counters have been built in his Department according to our specification and a third instrument has been ordered by him of the series manufactured by Messrs. Joyce. Professor Bowen was made acquainted with our work and supplied with all necessary information and literature. The counters will be used both in collaboration with the British Caribbean Meteorological Service, Trinidad for routine work and for teaching and research on concentration and size of condensation nuclei.

(iv) Dr. H. Weickmann, Chairman, Committee on Cloud Physics, American Geophysical Union, accompanied by Mr. L. P. Panak, of the Evans Signal Laboratory of the U.S. Army Signal Engineering Laboratories, Belmar, New Jersey, visited me and the Section for a discussion from 1st to 3rd September 1957. Our equipment and method of work was demonstrated in detail. During the demonstration Dr. Weickmann mentioned a problem which cropped up in his work on condensation nuclei at the U.S. Army base on the Greenland ice and which must be clarified if measurements of such low concentrations as occur in the Arctic are to be of value. We could show from our laboratory records that we had just started to investigate the same phenomenon which we observed when testing our counters for airtightness. On the request of the visitors we carried out a fair number of experiments on this problem which occupied

the whole day of the 2nd September and the morning of the 3rd.

Both visitors offered Professor Pollak a contract from the U.S. Army to continue this investigation but Pollak asked to be excused since he had already accepted a contract from the U.S. Air Force starting on 1st March 1958.

Professor Pollak however promised to investigate their problem before our U.S. Air Force contract starts, together with another one in connection with its cloud physics project in which the U.S.Army Meteorological Section is very much interested, and which could roughly be described as isolating the active nuclei in cloud formation. The visitors emphasised that they would like to have one year's observations in Ireland if the laboratory experiments were positive. The expenses of running the experiment including an assistant would be borne by the U.S. Army.

The results of our investigations of the first problem, carried out subsequently, together with its solution are given in the publication "The influence of scintillation on the measurement of extinction with the photo-electric nucleus counter at very low concentrations".

Our condensation nuclei laboratory, its instrumentation and set-up were very favourably viewed by the visitors and Pollak was asked to let the American laboratory have working drawings of a number of constructions and the set-up together with a general photograph of the arrangement in our laboratory for copying in their meteorological branch of the Physical Sciences Division.

Professor Pollak has been invited to visit the U.S. Army Signal Engineering Laboratory, Fort Monmouth, New Jersey and to deliver a lecture there on the occasion of his attendance at the 2nd Conference on Atmospheric Electricity to be held in Wentworth-by-the-Sea in May 1958. The lecture is scheduled for 3rd June 1958.

(v) Mr. R.J.Murgatroyd of the Meteorological Research Flight, Royal Aircraft Establishment, Farnborough, and Mr. W. Macklin of the Commonwealth Scientific and Industrial Research Organisation, Sydney, Australia, visited the Section on 5th September 1957 for a discussion on mutual problems, for which Mr. Murgatroyd asked in his letter of 16th August 1957.

The Meteorological Research Flight is interested in the same problem as Dr. Weickmann namely the number of active condensation nuclei under conditions as they occur in natural clouds.

We demonstrated our set-up for this investigation and pointed out to the visitors that neither the Rich counter of the General Electric Company nor any photo-electric nucleus counter is suitable for this purpose. The only instrument - so far as we know - suitable for this investigation is the stereo-photographic nucleus counter constructed in our Section in combination with the new set-up. Mr. Murgatroyd asked for working drawings of the stereo-photographic counter incorporating certain improvements now under construction in order to have an instrument of this type made in his workshop for their flights.

The visitors were shown over the laboratory and acquainted with all our instruments in their present state of development, particularly those for very small concentrations of nuclei which Mr. Murgatroyd considered suitable for measurements in the stratosphere.

(vi) As can be seen from G. J. Day's Meteorological Office, Air Ministry, Research Committee Publication M.R.P. 1069, S.C. 111/242, 2nd September 1957 the Meteorological Office, London has built and adopted our instrument constructions including the photographic recording counter for their nucleus concentration measurements in the vertical by aeroplane. The advantages of our photo-electric instrument are discussed and the help given by us is acknowledged in that publication.

QUOTATIONS FROM LETTERS received by Professor Pollak from

(i) Dr. R. Pürth, Birbeck College, University of London. - 2nd April 1957: "I went to the Physical Society Exhibition and saw Messrs. Joyce & Co. Ltd.'s stand. Your instrument was exhibited, but not demonstrated. I had no opportunity to see its inside, but from outside it looks well finished." (See also: The Physical Society, London, Handbook of Scientific Instruments and Apparatus, 1957 Exhibition, p.132).

(ii) Dr. S. Ohta, Chief, Section of Surface Observation, Tokyo. - 2nd April 1957: "Following your kind instructions, I have made a fog-tube counter of 6 cm diameter and I am now collecting some experience with the counter. I am now constructing smaller tube counters of 2.5 cm diameter following your advice, one of which will be used at our Antarctic Observatory...."

2nd June 1957: "As far as my tests go, the Pollak counter, made in our laboratory, showed a surprisingly good consistency or certainty for continuous measurements of nuclei".

(iii) Air Ministry, Meteorological Office, London; Kew Observatory, Richmond, Surrey. - 9th April 1957: "You may be interested to learn that we have just commenced recording with an automatically operated photo-electric counter. Basic lly it is your standard counter, with an internal diameter of 2.5 cm, but its operation is controlled by etc. The counter is mounted vertically.

Work with the counter you were good enough to calibrate for us is still in progress at Farnborough and is now amplified by...."

I understand from a Principal Officer of the Meteorological Office, London that the automat mentioned above is considered as a prototype for several other instruments which will be distributed over Great Britain.

(iv) Radiophysics Division, C.S.I.R.O., University Grounds, Sydney, N.S.W., Australia. - 25 June 1957: "We have constructed a number of photoelectric condensation nucleus counters about twelve months ago... it looked as if there are some interesting features to the vertical distribution of condensation nuclei in the atmosphere. We have found fairly high concentrations at high levels which apparently are small nuclei effective at relatively large expansions (still well below the ion limit, however)."

(v) United Kingdom Atomic Energy Authority, Health Physics Division, Atomic Energy Research Establishment, Harwell. - 25th July 1957: "We have now got three counters in operation made to your design. You may be interested to hear that we have found a connection between the generation of nuclei by irradiation of air and the SO_2 content of the air".

(vi) United Kingdom Atomic Energy Authority, Health Physics Division, Harwell. - 25th April 1957: "There will of course be no charge for the (radioactive) source. We are very glad to be able to repay some of your past kindness."

10. INVITATIONS.

(i) Professor Pollak has been invited by letter dated 11 October 1957 to become a Member of the 'Centre International de Recherches sur la Météorologie de la Méditerranée'. Quotation from the letter: "We hope that you will be able to accept this invitation for we are sure that your advice and collaboration would be of very great value for the successful development of the Centre".

(ii) Professor Pollak has been invited by the President (Dr. Ignacio Borsarelli di Rifreddo) of the Centro per lo Svilluppo della difesa anti-grandine della Provincia di Asti presso la Camera di Commercio Industria ed Agricultura (Prot. No. 35/BS/Fe dated 10 Marzo 1958) to participate in the 'Colloque sur la physique des nuages et relatives applications a l'agriculture" from 27 to 28 April 1958. Travelling expenses and subsistence allowance allowance during the Conference to be provided by the Chamber of Commerce of Asti.

11. ROYAL METEOROLOGICAL SOCIETY, LONDON.

The 1958 two-day Summer Meeting will be held in Dublin from 25th to 27th June. Professor L. W. Pollak was elected Chairman of the local organising Committee in its meeting of 22nd. February 1958.

The scientific sessions will take place in Trinity College Dublin.

The first day is devoted to "Atmospheric Aerosols". Speakers: Professor L. W. Pollak (School of Cosmic Physics), "The photo-electric nucleus counter and its applications"; Professor P. J. Nolan (U.C.D.), "The calibration of the photo-electric nucleus counter"; Mr. G. J. Day (Kew Observatory), "On the airborne use of the photo-electric counter" and Mr. W. G. Durbin (Royal Aircraft Establishment, Farnborough), "On Meteorological Research Flight work".

On the second day members of the Irish Meteorological Service will speak on "Meteorological service for trans-Atlantic flights" (Mr. J. W. O'Byrne) and "Some aspects of aviation route weather over the North Atlantic" (Mr. P. K. Rohan).

During the whole meeting the laboratory of the Section will be accessible to the participants and the instruments and methods developed in Dublin will be demonstrated.

The Provost of Trinity College Dublin and the President of University College have kindly agreed to give evening receptions in honour of the participants, and Messrs. A. Guinness have invited the participants to

lunch prior to showing them over their establishment. Refreshments during the morning sessions will be provided by the Dublin Institute for Advanced Studies.

12. MISCELLANEOUS.

(i) The Minister for Education, Mr. J. Lynch, visited the School on 18th December 1957. During the visit which lasted an hour and a half, the Minister was shown over the premises in 5 Merrion Square and acquainted with the work carried out here. Professor Pollak seized the occasion to raise the question of pensions for the two mechanics of the School when showing the Minister how these mechanics are contributing to our work. In the letter of 18th December to the Minister, Professor Pollak confirmed his statement that each of these two mechanics would earn in Great Britain or in America a multiple of his salary here and that their patriotism which keeps them from emigrating deserves consideration from the authorities. In the acknowledgment of this communication (dated 21st December 1957) Runai an Aire writes: The Minister "has noted the matter which you have raised with him with regard to the mechanics at the School of Cosmic Physics and will have this question examined".

(ii) The first photo-electric counter manufactured by Messrs. Joyce & Co., Gateshead-on-Tyne has arrived in the School for standardisation. Mr. Barrett of Messrs. Joyce remained in the Section for discussions from 28th February to 3rd March 1958. The counter was standardised and returned to the makers.

(iii) Much time was spent in preparing the cooperation of the Section with Dr. H. W. Georgii, University of Frankfurt a.M. which the U.S. Air Force Cambridge (Mass.) Research Center has requested (See Annual Report for 1956/57). It was difficult to find a suitable location on the west coast of Ireland for the joint investigation because Georgii's mixing cloud chamber for investigating ice nuclei is constructed for three-phase current and a change to DC-current was considered by Georgii as inopportune.

Only through the kindness of the Western Union Telegraph Company, who have a three-phase generator at their cable station on Valentia Island, was the project made possible at all. The Company have placed a room in the cable station at our disposal and granted all facilities free of charge. The chief mechanic Mr. Weine of the Meteorological Institute of Frankfurt University will instal the chamber at the end of July 1958 and our combined work will start after our return from the Third International Symposium on Condensation Nuclei at the Cavendish Laboratory, Cambridge and continue throughout August. A great advantage of the selected site is that in the neighbourhood is situated Valentia Observatory of the Irish Meteorological Service where regular observations of the concentration of condensation nuclei with a photo-electric nucleus counter are made and all meteorological elements are continuously recorded so that the equipment to be transported can be considerably reduced.