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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 1963-64

Pr.8220

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

Summary of Annual Report
of the work of the Constituent Schools
for the year 1963-64

School of Celtic Studies

Research progressed mainly in the field of Old, Middle and Modern Irish. Work on Scottish Gaelic, Welsh and Breton, either in or under the auspices of the School, progressed. Lectures were delivered in America, Norway and Ireland by members of the Staff who also attended the Celtic Congress held at Cardiff. While at Cardiff an honorary degree of D.Litt. was conferred on Professor Binchy who also read a paper at the Congress. Work progressed in the Place-names Archive under the supervision of Mr. Liam Price. Two seminars were held during the year, one by Professor Binchy on an archaic Irish text and the second by Professor Carney on early Irish poetry. Both were very well attended. Three books were published by the Institute including Vol.VI of Celtica. Two further volumes of Dictionnaire historique de Breton by Roparz Hemon were published. Material for other works was prepared for the printer.

School of Theoretical Physics

Professor Lanczos worked on Fourier series, the Klein-Gordon equation, and the propagation properties of microscopically highly curved Riemannian spaces with positive-definite metric. He also worked with Dr. Ortiz and Mr. Carragher on the averages of functions and other problems. Professor Synge studied the statistical mixing-problem for a classical oscillator, and (with Dr. Florides and Mr. Yukawa) extended a method for the calculation of gravitational fields in general relativity. Professor Takahashi's work in quantum field theory included a proposed ν-limit, the Hamiltonian formalism for many-particle systems, and (with Mr. Judge) the theory of motion relative to the centre of mass. Professor Ó Raifeartaigh (with Dr. Gruber) investigated harmonic oscillator commutation relations and the theory of Lie groups and their application to elementary particle physics. Other researches and studies are described in the Report.

Seminars were held weekly as usual, and there were three Mathematical Symposia (attendances 42, 58 and 49). Professor Lanczos lectured in Dublin, Galway and the U.S.A. Professor Synge gave a course of lectures on general relativity at the Summer School at Les Houches, France. Professor Takahashi, on leave of absence, lectured in Japan, the U.S.A. and Canada. Professor Ó Raifeartaigh gave a course of lectures on local Lie groups at the Madras Institute for Mathematical Sciences.

Three books were in the press; 27 papers were published, including one review article, and 13 were in the press.

School of Cosmic Physics

Astronomical Section:

The death of Professor M. A. Ellison on 12 September 1963 is recorded with deep regret.

Operation of the Lyot Heliograph at the Cape continued during the year and records were obtained on 285 days. Dr. Reid was responsible for the analysis of the films, the results of which were distributed to the World Data Centres and other institutions. The direct recording Askania H-Magnetograph also performed continuously throughout the year. No solar flare effects were recorded, but there were 11 magnetic storms.

Preparation was made at Dunsink for the International Years of the Quiet Sun (I.Q.S.Y.), the two-year period of which commenced on 1 January 1964. Miss McKenna commenced daily observations and forwarded information on flare and prominence activity to the World Data Centres, together with data obtained from S.I.D.A. receivers. Dunsink Observatory is acting as World Data Centre-C for Solar Activity, and there is an interchange of data with World Data Centres A and B at Boulder, U.S.A. and Ondrejov in Czechoslovakia respectively.

Professor Ellison attended the meeting of the Boyden Council in London, 15-17 July 1963. Members of the staff also attended meetings of the Royal Astronomical Society in Edinburgh and London, and Miss McKenna attended the I.A.U. Symposium at Rottach-Egern on Tegernsee (near Munich).

Seven papers were published during the year. The Irish Astronomical Journal completed its first year under the auspices of the observatories of Armagh and Dunsink.

Cosmic Ray Section:

The principal results of the I.C.E.F. Collaboration (an international collaboration on extreme high energy physics) have been published in a special volume of the Supplemento al Nuovo Cimento, 1963.

The European K^- Collaboration continued successfully throughout the year and the work led to the discovery of the first double hyperfragment. Four meetings of the Collaboration (attended by members of the School) took place during the year at: CERN (Geneva), London, Brussels and Warsaw.

As in previous years Professor Ó Ceallaigh was a member of the British Emulsion Committee at N.I.R.N.S., Harwell, and the Emulsion Experiments Committee, CERN, Geneva and attended all meetings. He also attended the International Conference on Cosmic Rays at Jaipur, India, 2-14 December 1963.

Four papers by members of the staff were published during the year as well as three papers published jointly by Collaborating Groups.

Geophysical Section:

The experiments in the Atmospheric Sciences field were wound-up due to Professor Pollak's retirement on reaching the age limit and Dr. Metnieks's resignation to take up an academic post outside the country. Further investigation of the small gravity anomalies was carried out. The tectonic structure of central Ireland was studied in collaboration with Dr. Lees, Leeds University. Measurements of rock magnetism were undertaken in collaboration with Professor Poole and Dr. McAulay of Trinity College.

Results of the Atmospheric Sciences investigations were published.

Professor Pollak and Dr. Metnieks attended the Third International Conference on Atmospheric and Space Electricity at Montreux and the Fifth International Symposium on Condensation Nuclei at Clermont-Ferrand and Toulouse.

Professor Murphy attended the Irish Sea Colloquium at Liverpool.

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 1963-64

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, 1964.

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 the membership of the Governing Boards of the three Constituent Schools on the 31st March 1964.

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, 1964.

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 1964.

1. THE COUNCIL OF THE INSTITUTE

Chairman:

Professor Edward J. Conway, M.D., D.Sc., F.R.S., F.R.C.P.I.

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; Professor Joseph Doyle, B.A., D.Sc., President, Royal Irish Academy.

Members appointed by the Governing Boards of Constituent Schools:

Right Reverend Monsignor Patrick Boylan, D.D., M.A., D.Litt.; Professor Daniel A. Binchy, M.A., Ph.D., B.L.; 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 John H. J. Poole, M.A., B.A.I., Sc.D.; Professor Cormac O Ceallaigh, M.Sc., Ph.D.

2. THE GOVERNING BOARD OF THE SCHOOL OF CELTIC STUDIES

Chairman:

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

Senior Professors:

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

Appointed Members:

Tomás de Bhaldraithe, M.A., Ph.D., D.Litt., M.R.I.A.; Éamonn Mac Giolla Iasachta, M.A., D.Litt.; Reverend John Ryan, S.J., M.A., D.Litt.; Reverend Francis Shaw, S.J., M.A.; Ernest Gordon Quin, M.A., F.T.C.D.

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:

David R. Bates, D.Sc., F.R.S.; John Stephen Roy Chisholm, M.A., Ph.D.; George R. Keating, M.Sc.; Albert J. McConnell, M.A., M.Sc., Sc.D.; Reverend James R. McConnell, D.Sc.; Máirtín O Tnúthail, D.Sc.; Patrick Quinlan, B.E., M.Sc., Ph.D.

4. THE GOVERNING BOARD OF THE SCHOOL OF COSMIC PHYSICS

Chairman:

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

Senior Professors:

Cormac Ó Ceallaigh, M.Sc., Ph.D.; Thomas Murphy, M.Sc.

Appointed Members:

Cyril P. G. Delaney, M.A., Ph.D.; Mariano Doporto, D.Phys.Sc.; Eric M. Lindsay, M.A., M.Sc., Ph.D.; John J. McHenry, M.A. (Cantab.), D.Sc.; Reverend Patrick J. I. McLaughlin, D.Sc.; Thomas Edwin Nevin, D.Sc.; Patrick J. Nolan, Ph.D., D.Sc.; Cilian Ó Brolcháin, M.Sc.; Ernest T. S. Walton, M.A., M.Sc., Ph.D., F.T.C.D.

5. ADMINISTRATIVE STAFF

Registrar:

Patricia O'Neill.

Senior Clerk:

Maura Devoy, B.A.

Clerks:

Mary A. O'Rourke, B.A.; Janet Dowling, D.P.A.; Desmond Pender.

II - Report of the Governing Board of the School of Celtic Studies adopted at its meeting on 25th June 1964.

1. STAFF, SCHOLARS AND EXTERN RESEARCH WORKERS

Senior Professors:

Myles Dillon, Director of the School; Daniel A. Binchy (Acting Director January - June 1964).

Professors:

James P. Carney; Miss Cecile O'Rahilly; Proinsias Mac Cana (to 30 September, 1963).

Assistant Professors:

Rev. Cuthbert McGrath, O.F.M. (to 29 February, 1964); Louis Paul Nemo (Roparz Hemon) (from 1 October, 1963); Gearóid Mac Eoin (appointed 1 July, 1963).

Assistant (Part-time):

Mrs. Nessa Doran.

Research Associates:

Heinrich Wagner; Liam Price.

Technical and Clerical Staff:

Miss Máire Breatnach; Máire Bean Uí Chinnsealaigh.

Scholars:

Richard A. Q. Skerrett (to 31 July, 1963); Rolf Baumgarten; Máire Ní Chatháin; Alan J. Bruford (to 30 September, 1963); Miss Meinir Lewis; Kenneth Nicholls (appointed 1 October, 1963).

Extern Research Workers commissioned by the School:

Rev. Anselm Faulkner, O.F.M.; Rev. Bartholomew Egan, O.F.M.; Rev. Canice Mooney, O.F.M. (decd. December, 1963); Dr. R. B. Breatnach; Dr. L. Bieler; Professor Idris Foster; Lil Nic Dhonnchadha; Gordon Mac Lennan; Professor Simon Evans; Professor Séamus Ó Néill; Mrs. Ruth Lehmann; An tAth. Pádraig Ó Fiannachta; Dr. Wolfgang Meid; Caitlín Ní Maol-Chróin; Éamonn Mhac an Fhailigh; Professor J. J. Tierney.

2. RESEARCH

Professor Binchy held public courses on (1) The Institutions of the Insular Celts; (2) Elementary Old Irish, while Visiting Professor at Harvard University until June, 1963. He also held private readings in advanced Old Irish with Professors Watkins and Hull and in Old and Middle Irish historical documents with Professor Kelleher. On May 18, 1963 he delivered a lecture on 'The Beginning of Christianity in Ireland' to the

Graduates Association in the Catholic University of America at Washington D.C. At the Institute he held a weekly Seminar during Hilary Term 1964 on an archaic Irish text. Work on the MSS. for Corpus Iuris Hibernici was continued. Professor Binchy wrote the article on St. Patrick for the forthcoming new edition of the Encyclopedia Britannica and prepared an edition and translation of a hitherto unpublished Irish law-tract for Vol.XX of Ériu. He delivered the Statutory Public Lecture on The Book of Rights and Irish Pseudo-History at Trinity College, Dublin on 18 February, 1964. An honorary degree of D.Litt. was conferred on Dr. Binchy by the University of Wales at the Celtic Congress held at Cardiff in July, 1963. At the Congress he read a paper on The Britannic words for 'King'.

Professor Dillon edited Celtica Vol.VI which was published in May, 1963. He also checked proofs of The Book of Leinster Vol.IV. Articles for publication in a forthcoming edition of Chamber's Encyclopedia were revised. An article on Celt and Hindu was published in India. In November, 1963 Professor Dillon lectured at the University of Oslo under the auspices of the Council of Europe. He also lectured to the Linguistic Society of the University and was elected a member of the Norwegian Academy of Sciences.

Professor Carney worked on the correction of proofs and the writing of the Introduction for his forthcoming edition of the Poems of Blathmac. An edition of the poems of Eochaidh Ó hEoghusa is in progress. Work has begun in co-operation with Professor Greene, on a volume of essays and articles in memory of the late Professor Angus Matheson. An article on early Irish poetry has been accepted by M. H. Gill and Son, Ltd. for publication in a book on early Ireland by a number of scholars. Professor Carney attended the Celtic Congress at Cardiff in July, 1963 and the Arthurian Congress at Aberdeen from 29 July - 5 August, 1963. He held a seminar on early Irish poetry from November, 1963 and delivered a public lecture on Sedulius Scottus to the Yeats Society in February, 1964.

Professor O'Rahilly prepared the Text and Translation of LL-TBC for the Printer. Preparation of the notes and introduction is in progress. She continued excerpting for the Dictionary of Classical Modern Irish and revised the Glossary of Mrs. Lehmann's forthcoming edition of Fled Dúin na nGéd. The following articles have been accepted for publication in

the next volume of Celtica: (a) Note on forms ciarso, ciarsat in LL; (b) Note on Galad; (c) Note on Cuinnscle; (d) Note on a passage in Cath Ruis na Rig. Two articles have been accepted for publication in Ériu: (a) Note on form gurab; (b) Note on preverb co n-. Miss O'Rahilly attended the Celtic Congress at Cardiff in July, 1963 as official representative of the Institute.

Professor Mac Cana continued to work on a study of the early Irish saga-lists and their background and on an edition of the poetry of Llywarch ap Llywelyn (c.1173-1220). The former will shortly be ready for publication. He attended the Celtic Congress at Cardiff in July, 1963.

Rev. Cuthbert McGrath, O.F.M. completed work on Volumes I and II of Dán na mBráthar Mionúr. An edition of Aistí an Dána Dhírigh was prepared for publication in Professor Caerwyn Williams's History of Irish Literature (Irish translation). Twenty-two articles on Irish saints were published in Enciclopedia Agiografica. Proofs of all Franciscan Texts going through the press were checked. Fr. Cuthbert delivered lectures at University College of North Wales, Bangor on Classical Irish and attended lectures on Old, Middle and Modern Welsh. He resigned from his post of Assistant Professor on 29 February, 1964.

Dr. Gearóid S. Mac Eoin worked on a revision of R. A. S. Macalister's edition of the Annals of Tigernach and on various problems in Middle Irish literature. Six articles on aspects of the history of Irish literature for the New Catholic Encyclopedia were prepared. Dr. Mac Eoin also prepared an article 'Gleann Bolcáin agus Gleann na nGealt' for publication in Béal-oideas Vol.XXX and 'The Irish legend of Pictish Origins' for Studia Hibernica Vol.IV.

M. Hemon worked on his Historical Dictionary of Breton. The seventh volume (E-Espediant) was published in July, 1963 and the eighth (Espediet-Flec'h) in March, 1964. Work is progressing on several Middle-Breton texts, and an edition of the fragments from the mystery play, The Destruction of Jerusalem is being prepared.

Mrs. Nessa Doran revised and checked the typescript of Fasciculus I of the Catalogue of Irish MSS. in the National Library. This fasciculus comprises the last of the 14 vellums of the Phillipps MSS. (Nos.1-14).

Mrs. Doran collated the text of Fled Dúin na nGéd with the MS. for Mrs. Ruth Lehmann's forthcoming edition. She attended the Celtic Congress at Cardiff in July, 1963.

Professor Heinrich Wagner worked on the final proofs of Vol.II of the Linguistic Atlas and Survey of Irish Dialects. Printing of Vol.III was commenced in January 1964. The preparation of the first draft of Vol.IV has begun. Professor Wagner read proofs of a long article on the Irish of Tyrone which is to be published in the next issue of Lochlann. An article on Old Irish do-tuit was accepted for the next issue of Ériu.

Mr. Liam Price continued work on the archive of Irish place-names. He attended the Annual Conference of the Council for Name Studies at Bangor, N. Wales in April, 1963 as representative of the Institute.

Mr. Richard Skerrett continued to work on Fiarfaidhi Sansalmuis and prepared for publication in Celtica Vol.VII a comparison of the verbal systems of the two texts printed in Celtica Vol.VI. He worked on a paper on the verbal-noun termination -achan, which is to be submitted for publication.

Mr. Rolf Baumgarten continued to work on the Míniugud Version of Lebor Gabála. Material was collected for examination of 'The use of the article in Early Irish'. Galley-proofs of the Book of Leinster Vol.V were checked. Mr. Baumgarten assisted Mr. Price in examining and sorting place-name material and attended seminars given by Professor Binchy and Professor Carney. He represented the Institute at the 8th International Congress of Onomastic Sciences at Amsterdam from August 27-31, 1963, and attended the Celtic Congress at Cardiff in July, 1963.

Máire Ní Chatháin continued to check proofs of Rev. S. Ó Cathâin's edition of Betha Muire and worked on a thesis on the syntax of the verb in Irish, under Professor Kenneth Jackson. She attended the Seminars held by Professor Binchy and Professor Carney. She also attended lectures in Classical and Vedic Sanskrit held by Mr. E. G. Quin at Trinity College. In July 1963 Máire Ní Chatháin attended the Celtic Congress at Cardiff.

Mr. Alan Bruford worked on his thesis on the Irish Romantic Tales and their relationship to oral tradition which he is preparing for submission to Edinburgh University. An intensive study of Eachtra Chonaill Gulban

was undertaken in preparation for an edition in collaboration with [illegible] A. Scanlon.

Miss Meinir Lewis attended courses on Old Irish and Linguistics at University College, Dublin and on Modern Irish at Trinity College, Dublin. An article on Early Welsh Orthography was submitted to the Editor of the Bulletin of the Board of Celtic Studies.

Mr. Kenneth Nicholls completed work on 16th century maps of Counties Longford, Westmeath, Laois and Offaly. The material for similar maps of Counties Galway and Roscommon has been collected.

Rev. Anselm Faulkner, O.F.M. checked the revised proofs of the Text of An Bheatha Dhiadha. The Notes are ready to be submitted to the printer and the Vocabulary and Introduction are in an advanced stage of preparation. The preparation of the Text of An Bheatha Chráibhaidh has been completed and work on the Notes and Vocabulary is at an advanced stage. Work is proceeding on An Spáthán Spioradálta.

Rev. Bartholomew Egan, O.F.M. worked on the proofs of Graiméir Ghaeilge na mBráthar Mionúr and prepared the Indexes and Preliminaries for the printer.

Rev. Canice Mooney, O.F.M. who died during the year, revised proofs of Seanmónta Chúige Uladh and submitted the Preliminary matter and Notes to the printer.

Dr. R. B. Breatnach continued his research and survey work on Déise morphology.

Dr. Ludwig Bieler's edition of The Irish Penitentials (Vol. V of the Hiberno-Latin Texts Series) was published in October 1963.

Mr. Gordon MacLennan worked on the Vocabulary of his book Gaidhlig Uidhist a Deas and checked proofs of the Text.

Professor Idris Foster continued work on his edition of Kulhwch ac Olwen.

Professor Simon Evans checked final proofs of his book A Grammar of Middle Welsh which will be published shortly in the Medieval and Modern Welsh Series.

Lil Nic Dhonnchadha's edition of Aided Muirchertaig Meic Erca - Vol. XIX of the Medieval and Modern Irish Series was published in March 1964.

Professor Séamus Ó Néill continued work on the preparation of his edition of Bishop Gallagher's Sermons.

Mrs. Ruth Lehmann's edition of Fled Dúin na nGéd was seen through the press and proofs checked by Mrs. Nessa Doran.

An tAthair Pádraig Ó Fiannachta checked galley proofs of his edition of Táin Bó Cuailgne and returned these for revise.

Dr. Wolfgang Meid checked galley proofs of his edition of Táin Bó Fraích and returned them for revise. The Introduction and Notes have been submitted for approval before going to press.

Caitlín Ní Maol-Chróin worked on the Vocabulary and Apparatus Criticus of her edition of Caithréim Cellaig. Proofs were checked and returned for revise.

Éamonn Mhac an Fhailigh prepared a phonemic study of The Irish of Erris, Co. Mayo which was sent to the printer in November, 1963.

Professor J. J. Tierney prepared an edition of Dicuil's De mensura orbis terrae which was sent to the printer in January, 1964.

The Dictionary of Classical Modern Irish: Miss O'Rahilly continued to do some excerpting.

Place-Name Research: On 1 April, 1963, Mr. Liam Price represented the Institute at the Annual Conference of the Council for Name Studies at Bangor, N. Wales.

During the year under review the excerpting of the principal seventeenth century sources has been completed for the four counties which are being studied. Many of the place-names found in these documents are now obsolete, but it has been possible in most cases to determine their location. A few names still remain unidentified in each county. Except for these, the cards for these names have been sorted into indexes. Cards have been made from the Calendars of the Fiants of Henry VIII and Edward VI, and work is proceeding on those of Philip and Mary and Elizabeth. Mr. Baumgarten has assisted in the examination and sorting of the cards.

Mr. Kenneth Nicholls kindly lent a transcript which he had made from the microfilm of the Carrigan papers in the National Library of the 1549 survey of the Laois plantation area; this had been copied by Canon Carrigan from the original in the Public Record Office before its destruction. Mr. Nicholls has made cards from this survey and from the

similar survey of Offaly which was copied by Professor Curtis and printed by him in Hermathena in 1930, and has also made cards from White's Extents of Irish Monastic Possessions, and from a list of lands forfeited in 1540. Mr. Nicholls also spent a few days in south Carlow where he verified some names in the Blackstairs Mountains which had been inserted on recent editions of the O.S. maps, and recorded the local pronunciation of these.

The names in the 1549-1550 surveys of Laois and Offaly are now being examined and compared with those in the plantation grants of 1552 listed in the Fiants of Edward VI and in the lists of lands assigned to the different planters which are given in the State Papers of 1557-1558, and with the names which are shown on the maps of the plantation area which were made about 1563. For all the eastern half of the present counties of Offaly and Laois (formerly King's and Queen's) these documents provide a very full list of the place-names existing in the middle of the sixteenth century.

Hiberno-Latin Texts Series: Dr. Bieler prepared a new critical text of Dicuil's De mensura orbis terrae. Dr. Tierney contributed the Introduction, Translation and Commentary. The Index Latinatis was compiled by Dr. Bieler. This volume is now at the press and should appear as Vol.VI in the Series. The draft of Mr. I. P. Sheldon-Williams's edition of Johannes Scottus was examined. It is intended that this edition should be the seventh volume in the Series.

3. STATUTORY PUBLIC LECTURE

A Statutory Public Lecture entitled The Book of Rights and Irish Pseudo-History was delivered by Professor D. A. Binchy at Trinity College, Dublin, on 18 February, 1964.

4. SEMINARS

Professor Binchy held a seminar on an archaic Irish text.

Professor Carney held a seminar from November to April on Early Irish Poetry.

5. EXTERNAL ACTIVITIES

In November 1963 Professor Dillon lectured at the University of Oslo under the auspices of the Council of Europe. He also lectured to the Linguistic Society of the University and was elected a member of the Norwegian Academy of Sciences.

Some members of the Institute attended the Celtic Congress held at Cardiff in July 1963. The honorary degree of D.Litt. was conferred on Professor Binchy by the University of Wales. A paper on The Britannic Words for 'King' was read by Professor Binchy.

Professor Binchy delivered a lecture on The Beginning of Christianity in Ireland to the Graduates Association in the Catholic University of America at Washington D.C. on 18 May, 1963.

Professor Carney delivered a lecture to the Yeats Society at Sligo in February, 1964, on Sedulius Scottus and attended the Arthurian Congress at Aberdeen from 29 July to 5 August, 1963.

Mr. Rolf Baumgarten represented the Institute at the 8th International Congress of Onomastic Sciences at Amsterdam from August 27 to 31, 1963.

6. PUBLICATIONS

a. Books:

Celtica Vol.VI. Edited by Myles Dillon. pp.vi + 296. Price 30/-
Published May 1963.

The Irish Penitentials. Edited by L. Bieler, with an appendix by D. A. Binchy. (Scriptores Latini Hiberniae - Vol.V).
pp.x + 367. Price 42/- Published October 1963.

Aided Muirchertaig Meic Erca. Edited by Lil Nic Dhonnchadha.
(Mediaeval and Modern Irish Series - Vol.XIX). pp.xxi + 73.
Price 8/6d. Published March 1964.

Dictionnaire historique de Breton. By Roparz Hemon.
Rann 7: E-Espediant
Rann 8: Espediet-Flec'h
Chatoulin, Etienne, 1963/64.

b. Contributions to Periodicals:

Cuthbert McGrath, O.F.M.: Twenty-two articles on Irish saints.
Enciclopedia Agiografica.

III - Report of the Governing Board of the School of Theoretical Physics adopted at its meeting on 2nd July, 1964.

1. STAFF AND SCHOLARS

Senior Professors:

John L. Synge, appointed Director of the School for three years from 16 May, 1962; Cornelius Lanczos.

Professors:

Yasushi Takahashi; Lochlainn Ó Raifeartaigh (appointed 1 October, 1963).

Assistant Professor:

Lochlainn Ó Raifeartaigh (to 30 September, 1963).

Visiting Professors:

John C. Taylor; John T. Lewis.

Research Associates:

L. Bass; D. Judge; P. S. Florides; R. O'Connell (appointed April, 1963, left February 1964).

Scholars:

E. Ortiz (left September, 1963); A. I. Solomon (left May, 1963); R. O'Connell (left April, 1963); W. Henneberger (left August, 1963); J. Gallivan (left August, 1963); B. Gruber; T. Yukawa (appointed October, 1963); P. Carrapher (appointed November, 1963); H. Yeh (appointed November, 1963); F. Oktem (appointed November, 1963).

Student:

Rev. C. Ryan (left September, 1963).

Technical Assistant:

Miss Evelyn Wills.

2. STUDY AND RESEARCH

Professor Lanczos investigated the connection between Fourier series and Bernoulli polynomials and its consequences for the convergence of the Fourier series. Using the residue method he obtained the Green's function of the Klein-Gordon equation in n dimensions, and demonstrated that it is reducible to two fundamental functions, namely $I_{-\frac{1}{2}}(x)$ in even dimensional, and $J_0(x)$ in odd dimensional, spaces. Professor Lanczos also continued his researches in highly curved but macroscopically almost flat Riemannian spaces, and demonstrated that a microscopically highly curved space of

positive definite signature is able to propagate signals and imitate in macroscopic relations the properties of a Minkowskian space.

Dr. Ortiz worked on averages of functions, and collaborated with Professor Lanczos on some work on the generation of canonical polynomials associated with certain linear operators.

Mr. Carragher worked under the direction of Professor Lanczos in the field of complex variable. He investigated the following problem: Given an analytic region R and a function f prescribed on an arbitrary small arc of the boundary curve, is it possible to evaluate f(z) where z is an interior point of R ? A solution to this problem would greatly strengthen Cauchy's Integral Formula, where f is prescribed on the whole boundary.

Professor Synge revised the text of his book, Relativity: The Special Theory, for a second edition, incorporating the treatment of rigid motions developed by Dr. J. R. Pounder, at one time a Scholar. He completed work on the application of the Hamiltonian method to water waves, with special reference to waves on beaches, ships' waves and waves on currents. He also wrote a paper pointing out that classical statistical mechanics is essentially a field theory and discussing the mixing problem in phase space for a one-dimensional oscillator.

Working in collaboration, Professor Synge, Dr. Florides, and later Mr. Yukawa, studied the problem of finding, by successive approximations, the gravitational fields of single bodies or systems of bodies, at rest or in steady rotation. Previous methods have been simplified and extended to cover systems of several bodies with an axis of symmetry and a common plane of symmetry.

Professor Synge and Dr. Oktem have studied the use of Laplace transforms and smoothing integrations in the solution of wave equation and the Klein-Gordon equation in spaces of any number of dimensions. Dr. Oktem also studied the theory of propagators and commutators in general relativity and the classification of Einstein spaces. He also worked at unified field theory.

Dr. Yeh studied gravitational waves in the linear approximation, separating the radiation into two types, electric type and magnetic type.

Professor Takahashi investigated, with Professors Umezawa and Kamefuchi, the origin of broken symmetries in particle physics, and proposed a theory of ν-limit, in which pathologically inequivalent representations inherent in quantum field theory are used, in order to obtain a mass spectrum and broken symmetries. They also proved by the same method that the BCS theory of superconductivity is rigorous if the volume of the superconductor is infinite.

Since he returned to Dublin, Professor Takahashi continued his research on the Hamiltonian formalism of many-particle systems, and the quantum mechanical theory of motion relative to the centre of mass, with the collaboration of Mr. Judge. They showed that the independent particle model in low energy nuclear physics can be justified in this formalism, and applied this theory to the adiabatic theory of polarons.

Mr. Judge investigated the uncertainty relation for angle variables in quantum mechanics, a problem raised by Dr. Lewis. With Dr. Lewis, Mr. Judge investigated also the commutation relation for angle variables, and the failure of the proof of the uncertainty relation $\Delta\phi \cdot \Delta\ell_z \geq \hbar/2$. In further studies of the angle commutator, Mr. Judge was led to consider fractional powers of the ν- and δ-functions in extended L_p spaces, where ν is the symbolic function (introduced by Professor Takahashi).

Dr. Lewis worked on the quantum mechanics of systems with a classical analogue; on relativistic principles in quantum theory; and, with Professor Ó Raifeartaigh, on the representation of the time reversal operator in representations of simple Lie algebras.

Professor Ó Raifeartaigh and Dr. Gruber investigated and solved a small but interesting problem raised by Wigner in Physical Review. The problem concerned the relation between harmonic oscillator commutation relations and the Heisenberg equations of motion, and continued earlier investigations by Professor Ó Raifeartaigh and Dr. C. Ryan, reported in the Proceedings of the Royal Irish Academy, and by Boulware and Deser in Nuovo Cimento. Professor Ó Raifeartaigh and Dr. Gruber also studied the theory of Lie groups and their representations, with a particular view to their application to elementary particle physics, and they investigated a number of problems in this connection. A solution to one of these, S-theorem and construction

of the invariants of the simple Lie algebras, has been found, and a second problem, the so-called "State-labelling problem" has been solved in principle. While in Zurich and Paris Professor Ó Raifeartaigh worked on the Heitler-Arnous non-local field theory, on which subject a final paper is expected to be prepared shortly. While in Madras he worked with Professor Sudarshan and Mr. Santhanam on the origin of the symmetries of the elementary particles. This work is now in course of publication.

Dr. Henneberger completed his work on hermiticity of Hamiltonians and existence of eigenstates in soluble field theories, and submitted a paper on this work to Nuclear Physics, for publication. He began some computations in connection with an extension of this work, and also did some reading and research on problems connected with the theory of coherence in quantum optics.

Mr. Gallivan worked on variational principles in analytical mechanics and made a detailed study of Professor Lanczos's book on variational principles. He also studied linear spaces with applications in quantum mechanics and quantum field theory.

Dr. Solomon considered the treatment of the elementary particles according to a model based on the symmetry of the group SU_3 . This model leads to simple relations among the particle masses.

Rev. Dr. Ryan continued, as Fellow of the College of Arts and Science at the University of Rochester, his research in high energy theory in collaboration with Professors Marshak, Sudarshan and Okubo. The main problems considered were the possible existence of a baryon lepton symmetry in weak interactions, the nature of the neutrinos involved in weak interactions and the inelastic cross-section in μ^- -p collisions.

Dr. O'Connell continued his investigations into the theory of internal conversion coefficients for all values of the gamma-ray energy. To facilitate numerical evaluation, the exact results were expanded in a power series in αz , to order $(\alpha z)^2$. Even with this expansion the results are still complicated, so it will be necessary to use a computer to obtain numerical results. The dependence on electron polarization is also being studied and the investigation will be repeated for shells other than the K-shell. In collaboration with Dr. C. O. Carroll (Univ. of Notre Dame), he derived an expression for the third order Coulomb wave function,

correct to order $(\alpha z)^3$ for all momenta and energies and used it to calculate the total cross-section, to order $(\alpha z)^4$, for single-photon emission resulting from a positron annihilating with a K-shell electron (single quantum annihilation). Dr. O'Connell began to study unitary symmetry and its relation to weak interactions and electromagnetism towards the end of the period under review.

Dr. Bass continued his study of theoretical electrode kinetics. He investigated the absolute rates of basic electrode processes and the associated potential distributions along two lines, as follows:

(a) Microscopic theory: He set up a theory of spontaneous dissolution of liquid and solid metals (in the vicinity of the electrocapillary maximum). The theory yields a quantitative classification of pure metals in terms of stability or instability in aqueous solutions, and permits absolute calculations of exchange currents and dissolution rates. The calculated rates appear to be in good agreement with the rather scanty experimental results available.

(b) Continuum theory: Dr. Bass set up an exact equation for the steady electric field distribution at interfaces (in the presence of currents) and applied it to metal-electrolyte interfaces and to liquid junctions. He found that an asymptotic expansion of the exact solution of a linearised version of that equation yields the conventional theories in the lowest (first and second term) approximations. The range of validity of conventional potential distributions and their accuracy are thus clarified and explicit correction terms are obtained.

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:

Mr. J. Avidan (School of Cosmic Physics):
Some experimental features of high energy interactions.

Dr. L. Bass:
The stability of metals in polar electrolytes.
The electrical structure of interfaces in steady electrolysis.

Professor D. Bohm (Birkbeck College, London):
Space-time and quantum theory: a topological view of the problem.

Dr. L. Brown (Imperial College, London):
Fredholm determinants in potential scattering (Regge poles).

Professor J. S. R. Chisholm (Trinity College, Dublin):
Automating calculations of high order matrix elements in quantum field theory. (2 lectures).

Dr. B. Gruber:
The influence of a three-body force on the binding of three nucleons.

Professor F. E. Hackett:
Aesthetic heuristics in science. Based on articles by Dirac, Proc. Roy.Soc. Edinburgh, 1925 and Scientific American, May 1963.

Professor C. Lanczos:
The problem of atomism in Einstein's world picture.
Undulatory Riemannian spaces (2 lectures).

Professor J. T. Lewis:
States and observables (3 lectures).
Quantum mechanical systems with a classical analogue.

Professor L. Ó Raifeartaigh:
Time reversal, iso-spin and higher symmetry (2 lectures).

Dr. N. Porter (University College, Dublin):
Possible radio emission from extensive air showers.

Professor E. C. G. Sudarshan (University of Syracuse):
Self-consistent particle interactions and the origin of internal symmetries.

Professor J. L. Synge:
Classical statistical mechanics and the one-dimensional oscillator (2 lectures).
The wave equation and the Klein-Gordon equation (discussion).

Professor Y. Takahashi:
Quantization of relativistic free fields (2 lectures).

Professor J. C. Taylor:
Angular momentum of three-particle systems.

4. STATUTORY PUBLIC LECTURE

A Statutory Public Lecture, under the auspices of the School, was delivered in University College, Dublin, on 20 February 1964, by Professor Takahashi. His subject was "Atom, Universe and Whiskey".

5. VISITING PROFESSORS

Dr. J. C. Taylor (University of Cambridge) completed his term as Visiting Professor on 16 April, 1963.

Dr. J. T. Lewis (University of Oxford) was Visiting Professor from 1 April to 31 July, 1963.

6. VISITORS TO THE SCHOOL

Professor D. Bohm (Birkbeck College, London) from 29 to 30 May, 1963.

Dr. L. Brown (Imperial College, London) from 21 to 24 May, 1963.

Professor P. A. M. Dirac (St. John's College, Cambridge) 1 October, 1963.

Dr. F. A. E. Pirani (King's College, London) from 16 to 17 May, 1963.

Professor E. C. G. Sudarshan (University of Syracuse, N.Y.) from 22 to 23 January, 1964.

7. SYMPOSIA

Mathematical Symposia were held on 19-20 April and 19-20 December 1963, and on 23-24 March 1964. The attendances were respectively, 42, 58 and 49; this included Professors, Lecturers, and Graduate Students from the several Irish Universities.

In addition to the short communications (previews) the following lectures were delivered:

April 1963:

Professor H. Halberstam (Trinity College, Dublin): Perfect difference sets.

Mr. T. T. West (Cambridge): The spectra of compact operators.

Professor P. B. Kennedy (University College, Cork): Eighteen seventy-nine and all that.

Dr. R. McCarroll (Queen's University, Belfast): A nova outburst.

Dr. B. H. Murdoch (Trinity College, Dublin): A problem on uniformly distributed sequences.

December 1963:

Dr. J. T. Lewis (Oxford): Uncertainty.

Rev. Dr. R. Ingram, S.J. (University College, Dublin): Semi direct product.

Professor J. L. Synge (D.I.A.S.): The Hamiltonian method for water waves.

Dr. L. J. Crane (Trinity College, Dublin): Heat transfer.

Dr. A. H. Klotz (Liverpool): Mie's electrodynamics and spinors.

March 1964:

Professor J. S. R. Chisholm (Trinity College, Dublin): Integral equations and Padé approximants.

Professor P. B. Kennedy (York): A problem on integral functions of perfectly regular growth.

Dr. Elizabeth Hilton (Exeter): The nature of the singularity in the Schwarzschild space-time.

Professor C. Lanczos (D.I.A.S.): Signal propagation in a Riemannian space with positive-definite metric.

8. EXTERNAL ACTIVITIES

Professor Lanczos gave the Mgr. Browne Commemoration Lecture at University College, Galway, on 18 May, 1963 on "Modern physics in perspective". He participated in the Approximations Conference, at the invitation of the Programme Committee, held in Gatlinburg, Tenn., U.S.A., from 21 to 26 October 1963, and gave two lectures at it, on "A precision approximation of the Gamma function", and "Evaluation of noisy data". In Dublin he lectured to the Pax Romana Society on "Positivistic and rationalistic tendencies in contemporary physics"; in the Ely Residence Hall on "Mathematics and personality"; and at the Inaugural Meeting of the Scientific Society of University College, Dublin, on 4 March 1964 on "The inspired guess in the history of physics".

Professor Synge gave a course of lectures on "An introduction to general relativity" at the Summer School at Les Houches; these lectures will be published. He also gave lectures as follows: at the University of Toronto (28 October 1963) on "Classical statistical mechanics and the one-dimensional oscillator"; to Graduate Engineers, Trinity College (6 February 1964) on "Electrical circuit theory"; to the Edinburgh Mathematical Society at Queen's College, Dundee (20 March 1964) on "The Hamiltonian method and its application to water waves". As President of the Royal Irish Academy he represented the Academy at the Centennial Celebrations of the National Academy of Sciences at Washington, D.C., 17 to 23 October, 1963.

Professor Takahashi spent the second part of his year's leave of absence, begun in September 1962, in Japan, the United States and Canada. He organized a seminar on broken symmetries at Kyoto University on 28-29 May, 1963. He visited the University of Colorado from 17 to 19 June, 1963, the University of Chicago from 20 to 21 June, Brandeis University (Summer School) from 24 June to 6 July, and 20 July to 3 August, and was an Invited Speaker at the seminar on unified field theories of elementary particles at the University of Rochester from 8 to 19 July. In Canada he visited the National Research Council, Ottawa, from 5 to 17 August, 1963. During the above visits he gave lectures as follows: "The Hartree-Fock solution in quantum field theory" (29 May, Kyoto); "The mass-levels and broken symmetry" (18 June, Colorado); "On the parastatistics" (19 June, Colorado); "Broken symmetry and the theory of superconductivity" (20 June, Chicago); "Broken symmetries in terms of inequivalent representations" (19 July, Rochester); "Generalized commutation relations and parastatistics" (23 July, Brandeis); "Parastatistics" (8 August, Ottawa); "Broken symmetries" (9 August, Ottawa); "Relativistic quantization of fields" (12, 14 August, Ottawa).

In October, 1963, Professor Ó Raifeartaigh spent three weeks at the University of Zurich, working with Professor Heitler, and at the Institut Henri Poincaré (Paris), working with Professor Arnous. From 4 December, 1963 to 10 February, 1964 he was a Visiting Member at the Madras Institute for Mathematical Sciences, where he gave a course of 24 lectures on local Lie groups and their representations, and attended a symposium on elementary particle physics. Professor Ó Raifeartaigh also gave a seminar at Liverpool University on 19 March, 1964, on "The construction of the invariants of the simple Lie groups".

Dr. Bass attended a seminar of the University of Liverpool in October 1963, and a colloquium at King's College, Newcastle-upon-Tyne (University of Durham) in November, 1963. At both these meetings he reported on his work on the microscopic theory in theoretical electrode kinetics.

Dr. Ortiz lectured at Trinity College, Dublin, on 30 November 1963, on "Averages of functions", and at Sir John Cass College (University of London) on "The solution of certain types of degenerate differential equations", on 13 and 27 May, 1963.

9. PUBLICATIONS

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

a. Books:

Published: none.

In the press:

Relativity: the Special Theory. By J. L. Synge. 2nd edn., North-Holland Publishing Co.

Albert Einstein and the Cosmic World Order. By C. Lanczos. Wiley & Sons.

The Fourier Series and its Applications, Vol.I. By C. Lanczos. Oliver & Boyd.

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

None published.

c. Contributions to periodicals and other publications:

(i) Published:

J. L. Synge:

* The Hamiltonian method and its application to water waves. Proc. R.I.A. 63 A (1963), 1-34.

* Review: Les Théories Relativistes de la Gravitation. Éditions du Centre National de la Recherche Scientifique, Paris, 1962. Contemporary Phys. 4 (1963), 468-71

Group motions in space-time and Doppler effects. Nature 198 (1963), 679.

C. Lanczos:

* Undulatory Riemannian spaces. J. Mathl. Phys. 4 (1963), 951-59.

* Intégration globale. Ann. Fac. Sci. Univ. Clermont, Math. 2, No.8: Actes Colloq. Math. Tricent. Mort B. Pascale, II (1962), 97-107.

* Modern physics in perspective. Studies 52 (1963), 283-93.

Y. Takahashi:

Broken symmetries in terms of inequivalent representations. Proc. Seminar on Unified Theories of Elementary Particles. Univ. Rochester, July 1963. URPA-11 (1963), 390-410.

Y. Takahashi & H. Umezawa:

* Relativistic quantization of fields. Nuclear Phys. 51 (1964), 193-211.

On the Hartree-Fock solution in field theory. Physica 30 (1964), 49-58.

H. Umezawa, Y. Takahashi & S. Kamefuchi:

The mass levels and the broken symmetry in terms of inequivalent representations. Ann. Phys. 26 (1964), 336-63.

L. Ó Raifeartaigh & G. Rasche:

Probability-conserving transformations and superselection rules in quantum theory. Ann. Phys. 25 (1963), 155-73.

B. Gruber & L. Ó Raifeartaigh:

Uniqueness of the harmonic oscillator commutation relation. Proc. R.I.A. 63 A (1964), 69-73.

B. Gruber:

The influence of a three-body-force on the binding of three nucleons. Phys. Lett. 5 (1963), 278-9.

R. F. O'Connell:

* K-shell internal conversion coefficients at threshold. Nuclear Phys. 45 (1963), 142-55.

C. O. Carroll & R. F. O'Connell:

Third-order Coulomb wave function and single quantum annihilation. Phys. Rev. 132 (1963), 2540-44.

W. Henneberger:

Hermiticity of Hamiltonians and existence of eigenstates in soluble field theories. Nuclear Phys. 49 (1963), 321-7.

D. J. Judge:

On the uncertainty relation for L_z and ϕ Phys. Lett. 5 (1963), 189.

D. J. Judge:

On the uncertainty relation for angle variables. Nuovo Cim. 21 (1964), 332-40.

D. J. Judge & J. T. Lewis:

On the commutator $[L_z, \phi]$. Phys. Lett. 5 (1963), 190.

C. Ryan & E. C. G. Sudarshan:

Representations of parafermi rings. Nuclear Phys. 47 (1963), 207-11.

R. E. Marshak, C. Ryan, T. K. Radha & K. Raman:

New baryon-lepton symmetry principle for leptonic weak interactions. Phys. Rev. Lett. 11 (1963), 396-9.

E. Ortiz:

On a new study of Spanish American science towards the end of the colonial period. Archives Internat. d'Hist. d. Sciences 15 (1962), 353-9.

L. Bass:

Exchange currents at liquid electrodes. Nature 200 (1963), 667-8.

Spontaneous dissolution of metals in polar electrolytes. Nature 198 (1963), 982-3.

Heat balance of the Earth. Nature 198 (1963), 980.

Irreversible interactions between metals and electrolytes. Proc. Roy. Soc. A 277 (1964), 125-36.

A. Schild:

* Gravitational theories of the Whitehead type. Proc. Internat. School of Physics "Enrico Fermi" Course 20, 69-115, London, Academic Press, 1962.

(ii) In the Press:

J. L. Synge:

Introduction to general relativity. Summer School at Les Houches, 1963.

Classical statistical mechanics and the one-dimensional oscillator. Proc. R.I.A.

P. S. Florides & J. L. Synge:

Stationary gravitational fields due to single bodies. Proc. Roy. Soc. A.

C. Lanczos:

* Methodes locales et globales pour l'intégration des problèmes de trajectoires. Comptes Rendus du Colloque sur l'Analyse Numérique, Mons, 1961.

Signal propagation in a positive-definite Riemannian space. Phys. Rev.

A precision approximation of the Gamma function. J. Soc. Industrial Appl. Math.

Evaluation of noisy data. J. Soc. Industrial Appl. Math.

The inspired guess in the history of physics. Studies.

L. Ó Raifeartaigh:

Review: Man and Science. By. W. Heitler. Oliver & Boyd, London & Edinburgh, 1963. Studies.

E. C. G. Sudarshan, T. S. Santhanam & L. Ó Raifeartaigh:

The Smuchkeirch principle and the origin of unitary symmetry. Phys. Rev.

R. E. Marshak, C. Ryan, T. K. Radha & K. Raman:

Universal theory of semi-weak interactions. Nuovo Cim.

C. Ryan & S. Okubo:

On the equivalence of the Majorana and two component theories of the neutrino. Nuovo Cim.

C. Ryan:

Inelastic μ^- + p scattering with the production of a single neutral pion. Internal Report for Particle Physics Lab., Univ. of Rochester.

IV - Report of the Governing Board of the School of Cosmic Physics adopted at its meeting on 25th November, 1964.

A. Astronomical Section.

1. STAFF AND SCHOLARS

Senior Professor:

M. A. Ellison (deceased 12 September, 1963).

Chief Assistant:

J. H. Reid.

Assistant:

Miss S. M. P. McKenna.

Scholars:

F. N. Byrne (left 30 January, 1964); I. Elliott (appointed 1 January, 1964).

Clerical and Technical Staff:

Miss M. Callanan; Mr. P. Murphy.

It is with deep regret that we record the death, on September 12, 1963, of Professor M. A. Ellison, who was Senior Professor since 1958.

Dr. F. N. Byrne relinquished his Scholarship at the end of January, 1964.

Mr. Ian Elliott rejoined the staff as a Scholar from 1 January, 1964, having spent a year and a half working at Sacramento Peak Observatory, at Sunspot, in New Mexico.

2. LYOT HELIOGRAPH AT THE CAPE

Following Professor Ellison's death, responsibility for the analysis of the films has been transferred to Dr. Reid. Its functions remain unchanged; these are to provide a cinematographic patrol of activity occurring in the Sun's hydrogen atmosphere and material for basic researches on solar flares and their terrestrial effects.

During 1963, heliograph records were obtained on 285 days with a total coverage of 1700 hours, as compared with 276 days and 1567 hours in 1962. The number of observing hours during 1963 was the highest since

the heliograph came into operation, and the mean daily observing time was 5 hours 58 minutes, which is also the highest for the five years.

The following table summarises the operation of the instrument and the number of flares recorded in each of the past five years:

Number of days of observation	Total observing time	1-	1	2	3	3+	Total	Number of flares per hour
1959: 258 (71% of possible)	1403^h05^m (5h 26m per day)	475	307	61	6	0	849	0.605
1960: 284 (71% of possible)	1554^h55^m (5h 29m per day)	339	249	22	4	2	676	0.435
1961: 296 (81% of possible)	1651^h34^m (5h 29m per day)	170	112	10	0	2	294	0.178
1962: 276 (76% of possible)	1567^h20^m (5h 41m per day)	63	67	7	0	0	137	0.087
1963: 285 (78% of possible)	1700^h20^m (5h 58m per day)	75	58	7	1	0	141	0.083

Although more flares were observed in 1963 than in 1962, the number of flares per hour of observation decreased.

The resurgence of flare activity in September and October accounted for 48 of the total number of flares observed, and this included the Class 3 flare on September 26.

Throughout the year the films have been developed at the Cape and despatched weekly to Dunsink for analysis and distribution of results to the World Data Centres and other institutions.

The frame-by-frame projector used for analysis (which was a modified ex-American-Army one purchased in 1957) is showing signs of its age: during the year a number of components were replaced and it was fitted with a remote control system.

The third paper on the Cape Heliograph Results (6) was published in Dunsink Observatory Publications, Vol.I, No.4.

Our grateful thanks are due to Her Majesty's Astronomer at the Cape, Professor R. H. Stoy, and to his staff who, as always, have continued to operate the heliograph with great efficiency. Their efforts have provided

a large amount of material for basic researches on solar phenomena.

3. SOLAR FLARE EFFECTS

The radio receivers, which record the integrated level of atmospherics on frequencies of 24 and 30 Kc/s, were in operation throughout the year, except for short periods when each set was overhauled in preparation for IQSY. Only 4 sudden enhancements of atmospherics (S.E.As) indicative of D-layer ionization by solar flares, were recorded.

The direct recording Askania H-magnetograph also performed continuously throughout the year. No solar flare effects (crochets) were recorded, but there were 11 magnetic storms.

4. SOLAR OBSERVATIONS

During 1963 the floor of the solar tower was completely replaced by Mr. Murphy in preparation for the International Years of the Quiet Sun (I.Q.S.Y.) which commenced on January 1, 1964. Since that date Miss McKenna has been making daily observations (weather permitting) and forwarding information on flares and prominence activity to the World Data Centres, together with data obtained from S.E.A. receivers.

Mr. Elliott is engaged in the analysis of data on the inhomogenetics in the spectra of the solar Balmer lines, which he obtained during his stay at Sacramento Peak Observatory.

5. THE INTERNATIONAL YEARS OF THE QUIET SUN 1964-65

This two-year period of international co-operation commenced on January 1, 1964. In addition to the observations mentioned above, Dunsink Observatory is acting as World Data Centre-C for Solar Activity - Sudden Ionospheric Disturbances.

Reports are being received from stations throughout the world, and there is also an interchange of data with World Data Centres A and B at Boulder, U.S.A. and Ondrejov in Czechoslovakia respectively.

6. THE 28" TELESCOPE

During 1963 this telescope was overhauled and modified by Dr. Byrne. He aluminised the secondary mirror and the flat and realigned the optical system of the telescope. The drive of the telescope was overhauled and the correcting pulses from the sidereal clock are now obtained by an electronic method. The D.C. amplifier was also modified to give increased gain and very much improved stability. To increase the accuracy of the observations, he designed an electronic timer, and this also lessens the burden of observing.

It was intended to use the telescope in an international programme (co-ordinated by Dr. K. Gyldenkerne of Brorfelde Observatory in Denmark) of observations of the eclipse of Zeta Aurigae.

Unfortunately the weather at Dunsink was such that only one observation was possible during the eclipse period.

7. NEW ALUMINISING PLANT

The present plant will only take mirrors up to 18" in diameter. During the year we purchased a new rotary pump and in the next financial year we hope to obtain a chamber, capable of taking the 28" mirror. The diffusion pump and control equipment have been purchased in earlier years.

8. CONFERENCES AND VISITS

Miss McKenna attended the I.A.U. Symposium on "Solar and Stellar Magnetic Fields" which was held at Rottach-Egern on Tegernsee (near Munich) from 3-10 September, 1963.

Professor Ellison attended the meeting of the Boyden Council held in London from 15 to 17 July, 1963.

Dr. Reid and Dr. Byrne attended the Summer Meeting of the Royal Astronomical Society in Edinburgh from 17 to 21 September 1963. They were present at the official opening ceremonies of the new building and the twin telescopes at the Royal Observatory, Edinburgh.

Dr. Reid attended the February 1964 meeting of the Royal Astronomical Society in London.

9. PUBLICATIONS

During the year the following papers were published:-

(1) M. A. Ellison:

Solar flares and associated phenomena. Planetary and Space Science 11, 597, 1963.

(2) J. H. Reid:

Classification of solar flares. Irish Astronomical Journal 6, 45, 1963.

(3) J. H. Reid:

The prediction of solar activity. New Scientist 18, 540, 1963.

(4) M. A. Ellison and J. H. Reid:

Solar flares. Proceedings of the IGY Symposium, Los Angeles. August, 1963.

(5) P. N. Byrne, M.A. Ellison and J. H. Reid:

A literature survey on solar flares and advice on instrumentation for their detection during flight. (Report prepared under contract for the British Ministry of Aviation.) It is hoped to publish this in a modified form in one of the normal Journals.

(6) J. H. Reid:

A study of regions where important solar flares occur. Dunsink Observatory Publications 1, No.4, 1963.

(7) M. A. Ellison:

Galaxies, Universes and Cosmologies. Irish Astronomical Journal 6, 167, 1964.

The Irish Astronomical Journal has completed its first year under the auspices of the Observatories of Armagh and Dunsink, with Dr. E. J. Opik of Armagh and Dr. J. H. Reid of Dunsink as joint editors.

B. Cosmic Ray Section.

1. STAFF AND SCHOLARS

Senior Professor:

C. Ó Ceallaigh.

Professor:

K. Imaeda (appointed 1 July, 1963).

Assistant Professor:

Vacant.

Assistant:

Miss M. Kazuno.

Technical and Clerical Staff:

Miss C. Inight; Mr. J. Daly; Miss N. Leahy; Miss M. McGovern; Miss M. Longmore; Miss E. Cullen; Miss E. McGee (appointed 16 March, 1964).

Scholars:

A. Thompson; J. Avidan; T. P. Shah; D. O'Sullivan.

2. RESEARCH WORK

I.C.E.F. Collaboration: Mr. J. Avidan, Professor K. Imaeda and Miss M. Kazuno, assisted by Miss M. Longmore.

The principal results of this work have been published in a special volume of the Supplemento al Nuovo Cimento, Vol.I, 4, 1963, and theoretical analysis of the mechanism of jet-production has been continued by Professor Imaeda and Miss M. Kazuno and compared with experimental numbers obtained from the collaboration material.

A thesis embodying the work of Mr. J. Avidan on the existence of anisotropy and asymmetry of emission in the C.M. system is to be submitted to the University of Dublin. Arising out of the work two statistical problems have been investigated by J. Avidan and C. Ó Ceallaigh, assisted by Miss C. Inight and Miss M. Longmore, the titles of which are listed under PUBLICATIONS. The question of the publication of Mr. Avidan's results is under consideration.

European K^- Collaboration: Messrs. D. O'Sullivan, T. P. Shah and A. Thompson, assisted by Misses N. Leahy, M. McGovern, E. Cullen and E. McGee.

The collaboration has continued successfully throughout the year and the

work led to the discovery of the first double hyperfragment (see PUBLICATIONS). Other work in progress concerns the general characteristics of hyperfragment production at increasing K^- momentum and small angle scattering of K^- mesons at very low energy. Four meetings of the Collaboration took place during the year for the purpose of collecting the results obtained from the individual laboratories and for the discussion of proposals for future experiments. The meetings were at the following centres and were attended by representatives of the Institute named in brackets: CERN, September 1963 (A. Thompson); Westfield College, London, November 1963 (A. Thompson, C. Ó Ceallaigh); Brussels, February 1963 (A. Thompson, C. Ó Ceallaigh); Warsaw, June 1963 (C. Ó Ceallaigh). In connection with the exposures, Mr. D. O'Sullivan worked at CERN Proton Synchrotron during the three months January-March 1964.

3. CONFERENCES

The following International Conferences were attended by members of the Cosmic Ray Section:

International Conference on Cosmic Rays, Jaipur, India, December 2-14, 1963. (Professor Ó Ceallaigh).

Siena International Conference on Elementary Particles, Siena. (A. Thompson).

4. COMMITTEES

British Emulsion Committee at N.I.R.N.S., Harwell: Professor Ó Ceallaigh attended the two meetings of the Committee which were held during the year.

Emulsion Experiments Committee, CERN, Geneva: Professor Ó Ceallaigh remained a member of the Committee and attended all meetings save one.

5. PERSONAL

Professor K. Imaeda was appointed on the 1st July, 1963, for a period of two years, to the position of Professor in the School.

Miss E. McGee was appointed to a post as Scanner on the 16th March, 1964.

6. PUBLICATIONS

K. Imaeda:

An Investigation of Jets Based on Meson-Nucleon Collision. Interpretation of Nucleon-Nucleon Collision.
Nuovo Cimento, 28, 908, 1963.

J. Avidan, K. Imaeda and M. Kazuno (with others) - I.C.E.F. Collaboration:

High Energy Nuclear Interactions from the International Co-operative Emulsion Flights.
Nuovo Cimento, Supp.1, 1039, 1963.

K. Imaeda and M. Kazuno:

Description of Characteristics of High-Energy Nuclear Interactions and Isobar Decay Products.
Nuovo Cimento, Supp.1, 1197, 1963.

C. Ó Ceallaigh:

Tables for Reduction of Estimates of Ionization by Blob-Counting in Nuclear Emulsion.
Comm. Dublin Inst. Adv. Studies, Series B, No.1, 1963.

R. H. W. Johnston:

A Special Purpose Computer for the Analysis of Measurements of Multiple Scattering in Photographic Emulsion.
Electronic Engineering, Vol.35, No.424, June 1963.

D. O'Sullivan, T. P. Shah, A. Thompson (with others):

Observation of a Double Hyperfragment.
Phys. Rev. Letters, 11, 29, 1963.

D. O'Sullivan, T. P. Shah, A. Thompson (with others):

The Identification of a Double Hyperfragment.
Nuclear Physics, 49, 12, 1963.

In the press:

C. Ó Ceallaigh:

The Frequency Function of the Gaps Defined by Points Placed at Random on the Circumference of a Circle.

In preparation:

C. Ó Ceallaigh:

A Statistical Problem arising in the Study of High-Energy Interactions.

J. Avidan:

Investigation of the Distribution in Azimuth of Secondary Particles from Extreme High-Energy Interactions.

C. Geophysical Section.

1. STAFF AND SCHOLARS

Senior Professor:

Leo W. Pollak (to 23 September, 1963); Thomas Murphy (from 1 January, 1964).

Professor:

Thomas Murphy (to 31 December, 1963).

Research Assistant:

Arvids L. Metnieks (to 31 October, 1963).

Research Associate:

Rev. G. McGreevy.

Senior Technical Assistant:

Thomas J. Morley.

Technical and Clerical Staff:

Miss Brenda Kennedy; Miss Ann Nolan; Mr. Kevin Bolster; Mr. Martin Cotter.

2. EXPERIMENTAL AND FIELD WORK

a. Atmospheric Sciences (L. W. Pollak and A. L. Metnieks):

No new investigation was undertaken; the work was confined to winding up research already under way.

b. Gravity (T. Murphy):

Work on the small Bouguer anomalies with a view to their elucidation was continued by two methods. The first was a complete survey at station intervals of approximately one mile in the predominantly Carboniferous Limestone area of East Galway and Roscommon. It was found that in this region the phenomenon is almost completely absent and confirms the present thinking (1962-63 Report) that simple subaerial solutioning of the limestone is not the cause.

The second method consisted in following up any evidence for the presence of small anomalies in the east central plain and their possible connection with geological structure. This proved fruitful and a direct relationship between one area of low anomaly and the occurence of an

unusual siliceous deposit in Co. Meath has been encountered. Further detailed work has been postponed, since it is expected that, in the coming months, the deposit will be examined with a view to exploitation. Furthermore, the relationship between the occurence of the anomalies and the tectonic structure is becoming clearer and Dr. A. L. Lees, a geologist from Reading University, is collaborating on the interpretation.

The work in Roscommon has not brought forward evidence for the continuation of the Southern Uplands Fault of Scotland. Several deep-sited structures have been outlined and these will be of help in the structural analysis.

c. Magnetism:

The partly constructed "Spinner" magnetometer has been transferred to the Physics Department of Trinity College, completed and made operative by Professor J. H. Poole and Dr. I. R. McAulay. Tests are being carried out on the rock samples collected for the density measurements (cut to cylinders one inch long by one inch diameter).

3. PUBLICATIONS

L. W. Pollak and A. L. Metnieks:

A small portable photo-electric condensation nucleus counter. Geofisica Pura e Applicata, Milano, Vol.55 (1963/II), pp.137-150.

In the press

T. J. Morley:

The Climate of Dublin City, Part II, Temperature at Trinity College, Dublin 1904-63, Geophysical Bulletin, No.23 of the School of Cosmic Physics.

4. CONFERENCES

Professor Pollak and Dr. Metnieks attended the Third International Conference on Atmospheric and Space Electricity (Montreux, 6-10 May 1963) and the Fifth International Symposium on Condensation Nuclei (Clermont - Ferrand and Toulouse, 13-18 May 1963).

Professor Pollak acted as Chairman at the meeting on 15 May and reported at the morning session of this day on the small portable photo-electric condensation nucleus counter.

Professor Murphy attended the Irish Sea Colloquium (Liverpool, 16-18 December 1963), presented a paper and acted as Chairman at one of the Sessions.

5. STATUTORY PUBLIC LECTURE

The Statutory Public Lecture was delivered by Dr. P. L. Willmore of the Royal Observatory, Edinburgh, entitled "New Methods in Seismology", at Trinity College, Dublin, on 18 March, 1964.

6. PERSONALIA

Dr. L. W. Pollak, on reaching the age limit, retired on 23 September, 1963 from the post of Senior Professor, a position he held since the establishment of the School in April 1947. He has accepted an offer to act as Co-Director and Research Professor at the Atmospheric Sciences Research Center of the State University of New York.

On 4 July, 1963, the degree of Sc.D. (honoris causa) was conferred by Dublin University on Professor Dr.phil. L. W. Pollak.

Dr. A. L. Metnieks left the School on 31 October 1963 to take up a research position in the Physics Department of the University at Parma, Italy.

Rev. G. McCreevy continued as a research associate of the School throughout the year.

Mr. H. Flüger of the Danish Atomic Energy Commission spent a short period from 29 July to 5 August 1963 comparing two recently constructed photo-electric nucleus counters with our Standard Counter.

7. MISCELLANEOUS

The Section exhibited geophysical instruments with illustrations and demonstrated their uses at the Royal Dublin Society's Scientific Exhibition, 22-25 October, 1963.

EDWARD J. CONWAY
CHAIRMAN

8th December 1964