INSTITIÚID ARD-LEINN BHAILE ÁTHA CLIATH
(Dublin Institute for Advanced Studies)

ANNUAL REPORT

APRIL-DECEMBER 1974

10 Burlington Road, Dublin 4.

Prl.4901

INSTITIÚID ARD-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 period April-December 1974

Prl.4901

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

Summary of Annual Report
of the work of the Constituent Schools
for the period April-December 1974

School of Celtic Studies

Mr. Fergus Kelly was appointed an Assistant Professor and Mr. Mícheál Ó Siadhail a Research Assistant. No funds were available for a Visiting Professorship.

The Statutory Public Lecture, entitled 'Makers and Fakers', was delivered in University College, Dublin by Professor David Greene on 13 December 1974.

The full report gives details of the work of research and editing carried out in their various fields by members of the School and by extern workers. Five books (including periodicals) were published, one of them by the Institute. Members of the School contributed eleven papers or shorter items to books or periodicals published elsewhere.

School of Theoretical Physics

The death of Emeritus Professor Cornelius Lanczos was a severe blow to the School.

A summer seminar on Current Problems in Particle Physics was held in collaboration with University College and Trinity College and attracted forty-six visitors from abroad as well as eighteen local physicists.

The School continued its research in the areas of general relativity, statistical mechanics, Lie groups and high energy physics. Two books and twenty-seven papers were published during the year. Members of the School attended ten international conferences and gave twenty-seven lectures in other institutions. Fifteen scientists from abroad visited the School (apart from the visitors attending the summer seminar).

Events which were continued from previous years were the Wednesday seminars, the Christmas and Easter symposia, and various weekly meetings held jointly with the universities. The joint UCD-TCD-Maynooth-DIAS postgraduate course was continued.

The Statutory Public Lecture was given in Trinity College on 22 November 1974 by Professor Mark Kac of the Rockefeller University, New York.

School of Cosmic Physics

Astronomy Section:

Observational data on a large number of variable stars were handled successfully during the year. The cepheid variable material

for one of the three regions of the Magellanic Clouds has reached final form. Contributions to studies of binary X-ray sources and magnetic variable stars have been made and an analysis of a problem in the statistical distribution of multiple systems has been made.

Cosmic Ray Section:

Three main lines of research were pursued during the year namely, the study of the nuclear composition and energy spectra of heavy cosmic ray primary particles, the production of nuclear fragments by fast proton bombardment of a gold target and the application of quaternions to electrodynamics and very high energy nuclear interactions. Using high altitude research balloons, stacks of cosmic ray particle detectors were successfully flown from Sioux Falls, South Dakota, by members of the Section, working in collaboration with Bristol University. In one, the longest flight on record, a 20.9 million cubic feet balloon remained at constant altitude for 122 hours.

The nuclear fragment experiment was the first large-scale experiment using dielectric track detectors for identifying nuclear fragments in high energy nuclear interactions. A successful study of the charge and energy spectra of the nuclear fragments was carried out at energies below that possible with electronic detectors.

The application of quaternions to the theories of electrodynamics and high energy nuclear interactions has been approached by the introduction of regular functions of the quaternion variables. The formulation shows promise and the main difficulties in applying quaternions to these theories may be overcome.

A study of the slope of the Cosmic Ray spectrum at high energies seems to indicate that the inelastic cross section for nuclear interaction is an increasing function of energy.

Geophysics Section:

Difficulties encountered in filling vacant academic posts and the absence of scholars severely curtailed the activities of the Section.

A brief gravity survey was carried out in connection with a minerals prospecting company's project which confirmed our earlier geological interpretation of the presence of the phenomenon of limestone strata decomposition.

Various small scale magnetic surveys in the southern half of the country indicated the probable presence of Tertiary intrusives in areas unsuspected to date. This discovery may be of great significance scientifically and commercially.

A magnetic map of the Irish Continental Margin was produced from data collected by the United States Naval Oceanographic Office.

Teleseismic recordings were taken at various sites in Ireland in connection with the "Lithosphere Seismic Profile of Britain" using redesigned equipment.

Palaeomagnetic work was carried out on rocks of Devonian age in Ireland and resulted in unique pole positions for the Lower and Upper Devonian.

A series of lectures and later field demonstrations were given to geological students from the two Dublin Colleges and University College Cork. The attendance was up to forty-five.

INSTITIÚID ARD-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 period April-December 1974

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 period 1 April to 31 December 1974.

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, (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 December 1974.

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 December 1974.

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 December 1974.

1. THE COUNCIL OF THE INSTITUTE

Chairman:

Professor W. B. Stanford, M.A., Litt.D., S.F.T.C.D.

Ex-Officio Members:

Thomas Murphy, M.D., D.P.H., B.Sc.Pub.H., President, University College, Dublin; Francis S. L. Lyons, M.A., Ph.D., Litt.D., F.B.A., Provost, Trinity College, Dublin; David Greene, M.A., President, Royal Irish Academy.

Members appointed by the Governing Boards of Constituent Schools:

Professor Brian Ó Cuív, M.A., D.Litt.; T. K. Whitaker, D.Econ.Sc.; Professor L. Ó Raifeartaigh, M.Sc., Ph.D.; Professor P. Quinlan, B.E., D.Sc., Ph.D.; Professor C. Ó Ceallaigh, M.Sc., Ph.D.; Professor E. F. Fahy, M.Sc., Ph.D.

2. GOVERNING BOARD OF THE SCHOOL OF CELTIC STUDIES

Chairman:

Vacant.

Senior Professors:

Daniel A. Binchy, M.A., Ph.D., B.L.; David Greene, M.A.; Brian Ó Cuív, M.A., D.Litt.

Appointed Members:

Tomás de Bhaldraithe, M.A., Ph.D., D.Litt.; James H. Delargy, M.A., D.Litt., Litt.D.; Proinsias Mac Cana, M.A., Ph.D.; Edward MacLysaght, M.A., D.Litt.; Ernest Gordon Quin, M.A., F.T.C.D.; Thomas Kenneth M. Whitaker, D.Econ.Sc.

3. GOVERNING BOARD OF THE SCHOOL OF THEORETICAL PHYSICS

Chairman:

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

Senior Professors:

Reverend James R. McConnell, M.A., D.Sc.; Lochlainn Ó Raifeartaigh, M.Sc., Ph.D.; John T. Lewis, B.Sc., Ph.D.

Appointed Members:

Thomas Edwin Nevin, D.Sc.; Patrick Quinlan, B.E., D.Sc., Ph.D.; Seán Seosamh Tóibín, M.Sc., Ph.D.; Thomas David Spearman, M.A., Ph.D. (Cantab.).

4. GOVERNING BOARD OF THE SCHOOL OF COSMIC PHYSICS

Chairman:

Edward Francis Fahy, M.Sc., Ph.D.

Senior Professors:

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

Appointed Members:

Patrick M. A. Bourke, M.Sc.; Peter Kevin Carroll, M.Sc., Ph.D.; Cyril F. G. Delaney, M.A., Ph.D., F.T.C.D.; Reverend Thomas P. G. McGreevy, M.Sc., Ph.D.; Patrick Nolan, Ph.D., D.Sc.; Neil A. Porter, Ph.D.; Ernest T. S. Walton, M.A., M.Sc., Ph.D., D.Sc., F.T.C.D.

5. ADMINISTRATIVE STAFF

Registrar:

Patricia O'Neill.

Senior Clerk:

Maura Devoy.

Accounts Clerk:

Mary A. O'Rourke.

Clerks:

Angela Stubbs; Noreen Madden; Desmond Pender.

II - Annual Report of the Governing Board of the School of Celtic Studies for the period 1 April - 31 December 1974 adopted at its meeting on 7 February 1975.

1. STAFF, SCHOLARS AND EXTERN RESEARCH WORKERS

Senior Professors:

David Greene, Director of the School; Daniel A. Binchy; Brian Ó Cuív.

Professors:

James P. Carney; Breandán Ó Buachalla.

Assistant Professors:

Rev. Pádraig Ó Súilleabháin, O.F.M.; Pádraig de Brún; Fergus Kelly (from 1 October 1974).

Visiting Research Associate:

Robert J. Jeffers (from 1 October 1974).

Junior Assistant:

Fergus Kelly (to 30 September 1974).

Assistants (Part-time);

Mrs. Nessa Doran; Mrs. Anne O'Sullivan.

Research Assistants:

Rolf Baumgarten; Mícheál Ó Siadhail (appointed 1 October 1974).

Research Associates:

Proinsias Mac Cana; Heinrich Wagner; Gearóid Mac Niocaill.

Technical and Clerical Staff:

Máire Breatnach; Máire Bean Uí Chinnseala.

Scholars:

Katharine Simms; Alan Ward (to 31 December 1974); Liam Breatnach; Michael Smith (to 31 August 1974); Kay Muhr (to 30 September 1974); Malachy McKenna (appointed 1 April 1974); Tadhg Ó Dúshláine (appointed 1 June 1974); Anders Ahlqvist (appointed 1 October 1974); John Armstrong III (appointed 1 October 1974).

Extern Research Workers:

Dr. Cecile O'Rahilly; M. Louis Paul Nemo (Roparz Hemon); Dr. Ludwig Bieler; Mr. Brynley Roberts; Rev. Fergal Mac Raghnaill, O.F.M.; Rev. Martin McNamara, M.S.C.; Tomás Ó Cathasaigh; Mr. Ronald Black.

On October 1 1974 Mr. Fergus Kelly was appointed an Assistant Professor, and Mr. Mícheál Ó Siadhail a Research Assistant. The filling

of the vacant Assistant Professorship deprived the School of the funds which the Department of Education had regarded as providing for a Visiting Professorship; representations on the desirability of maintaining the latter post were unsuccessful. Nor was the recommendation of the Board that Mr. Rolf Baumgarten should be appointed as Bibliographical Officer accepted; however, his temporary post as Research Assistant was extended for a further three years from 1 August 1974. No progress was made in the efforts to obtain a third member of the clerical staff.

There was enough work at the printers to have ensured the publication of half-a-dozen books; in the event, all that appeared was Professor Brian Ó Cuív's The Linguistic Training of the Mediaeval Irish Poet which is, in fact, a reprint from Celtica X. Irish printers appear to take on more work than they can manage; as an example, it may be noted that the copy for Nua-Dhuanaire II was sent out in January 1974 but no proofs had been received by the end of the year. Printers in Britain were also dilatory, but the three-day week and its aftermath are advanced as an excuse. It is hoped that output will return to normal in 1975.

2. RESEARCH AND EDITING

Professor David Greene continued work on Saltair na Rann; Dr. Brian Murdoch spent three days in the School discussing the lay-out of the projected edition of the Adam and Eve section. Work as editor of Ériu continued in association with Professor Mac Cana. The copy for Celtica XI (Dillon Memorial Volume) was edited, in association with Professor Ó Cuív, and sent to press. An article entitled 'The influence of Scandinavian on Irish' was accepted for publication in Proceedings of the VII Viking Congress. See also sections 3, 4, 5, 6.

Professor D. A. Binchy continued to work on proofs of Corpus Iuris Hibernici, inserting cross references and correcting 2000 of the 2335 pages. The Introduction was prepared for press. The following articles were accepted for publication:- (i) 'Fionnachruth' (Éigse); (ii) 'Semantic Impact of the Latin texts on the Old Irish Glossators' (Latin Script and Letters A.D. 400-900 Festschrift Ludwig Bieler).

Professor Brian Ó Cuív worked on (i) linguistic topics relating to Irish grammar and semantics; (ii) metrics of syllabic and accentual verse; (iii) material for publication in A New History of Ireland. He edited two issues of Éigse and prepared for reprint edition the section of the Proceedings of the International Congress of Celtic Studies held in Dublin July 1959 consisting of the papers on 'The Impact of the Scandinavian Invasions on the Celtic-speaking Peoples c.800-1100 A.D.'

The following articles were accepted for publication in Éigse:- (i) 'A Sixteenth-century Political Poem'; (ii) 'A Mark of Gold'. See also sections 4, 5, 6.

Professor James Carney continued to work on Old Irish poetry and genealogies. Two chapters on the history of Irish literature to 1534 were accepted by the Royal Irish Academy for inclusion in A New History of Ireland. An article entitled 'The Invention of the Ogam Alphabet' was accepted for publication in Ériu.

Professor Breandán Ó Buachalla continued his survey of the MS. material dealing with the history of Irish in Ulster and spent several periods in Belfast consulting documents and manuscripts there; he commenced an edition of the poems of Cathal Buí Mac Giolla Ghunna and continued his study of Ní/Cha in Ulster Irish. An article entitled 'Modern Irish Beirt' was accepted for publication in Ériu.

Rev. Pádraig Ó Súilleabháin, O.F.M. continued to index etymological and lexicographical notes, notes on grammar and syntax, dialects etc. and excerpted some works for the Dictionary of Early Modern Irish. He continued to work on the Vocabulary of Cuthbert McGrath's edition of Dán na mBráthar Mionúr II and read proofs of the text of Feargal Mac Raghnaill's edition of Ó hEodhusa's Teagasg Críosdaidhe. An article entitled 'Seanmóin ar an meisce' was accepted for publication in Éigse.

Pádraig de Brún resumed his work on a catalogue of Irish manuscripts in Cambridge (with M. Herbert) and on part IV of Nua-Dhuanaire. The following articles were accepted for publication in the Journal of the Kerry Archaeological and Historical Society, No.8:- (i) A census of the parishes of Prior and Killemlagh, December 1834; (ii) Scéal ó Chill Mhaoile (probable title). See also section 6.

Mr. Fergus Kelly completed an edition of the 7th century poem Tiughraind Bhécáin which was accepted for publication in Ériu, and worked on a forthcoming edition of Bechbretha. Work on a linguistic introduction to Dr. Bieler's edition of the Lives of Patrick progressed. See also section 5.

Mícheál Ó Siadhail, in collaboration with Dr. Arndt Wigger, completed the preparation of Córas Fuaimeanna na Gaeilge which was sent to press in December 1974. Work on the vocabulary of Inis Meán progressed.

Mrs. Nessa Doran catalogued MSS. G130-132, 135-40 for Fasc.IV of A Catalogue of Irish MSS. in the National Library of Ireland. Leave of absence was granted in July-August 1974 to assist Professor Carney in the preparation of his contribution to A New History of Ireland.

Mrs. Anne O'Sullivan completed the correction of the final proofs of Professor Binchy's edition of Corpus Iuris Hibernici. Transcription of the remaining part of the Book of Leinster is almost complete.

Mr. Rolf Baumgarten continued to collect and arrange entries for the Bibliography of Irish Linguistics and Literature. A list of the papers by Professor D. A. Binchy and their publishers and a bibliography of the publications of Professor James Carney were completed. He prepared for publication in Celtica XII the O'Donnell lecture entitled 'The Irish settlements in Wales' which was delivered by the late Professor Dillon at Oxford in 1971.

Professor Proinsias Mac Cana, General Editor of the Mediaeval and Modern Welsh Series, read revised proofs of Brynley F. Roberts's edition of Cyfranc Llud a Llefelys. The typescript of E. I. Rowlands edition of Poems of the Cywyddwyr was read and some amendments suggested to the author.

Dr. Gearóid Mac Niocaill corrected galley proofs of The Annals of Ulster, Vol.I and continued work on the text and translation of Volume II (1155- [probably] 1399). Preparation of a new edition of Chronicon Scotorum is progressing - text and translation completed, revision of notes progressing and work on the index commenced.

Miss Katharine Simms continued work on her Ph.D. thesis 'Gaelic Lordships in Ulster in the later Middle Ages'. She assisted Professor Ó Cuív in compiling a catalogue of manuscript sources for bardic poetry. See also sections 5 and 6.

Dr. Alan Ward completed his doctoral thesis 'The Grammatical Structure of Munster Irish' which he presented to Trinity College, Dublin and was awarded the degree of Ph.D. The thesis is now being revised with a view to publication in book form. Preliminary work was done on a proposed edition of Irish non-rhyming alliterative poems. See also section 6.

Mr. Liam Breathnach presented his thesis 'The Suffixed Pronouns and other related forms in Early Irish' to N.U.I. and was awarded the M.A. degree. He began work on an edition of 'Tochmarc Luaine ocus Aided Athairne'.

Mr. Michael Smith continued his investigation of the syntax and semantics of the Old Irish definite article.

Miss Kay Muhr continued to work on an edition of 'Airecc Menman Uraird meic Coisse' and on a Ph.D. thesis - 'The development of style in traditional Gaelic narrative, with special reference to "runs"' which is to be presented at the University of Edinburgh. An article entitled 'Eachtra an Cheatharnaigh Chaoilriabhaidh' was accepted for publication in Scottish Studies.

Mr. Malachy McKenna transcribed tapes of the Breton dialect of Guémené-sur-Scorff (Vannetais) recorded from April to October 1973 and checked the transcriptions with Professor Hemon. The systematization and analysis of the information on the phonology of the vowel was

completed. During a short field-trip to Brittany in August 1974 he collected a full paradigm of irregular verb inflection. Work on an edition of a Breton MS. contained in the Institute Library was completed; the text and translation have been checked by M. Hemon; the edition may be accepted for publication in the next issue of ZCP. Preparation of a paper entitled 'Stress in Bas-Vannetais' to be read at the Congress of Celtic Studies in Cornwall progressed.

Tadhg Ó Dúshláine worked on a critical study of European literary themes and motifs in 17th century devotional literature and on the preparation of an edition of Keating's Eochair Sgiath an Aifrinn. See also section 6.

Dr. Anders Ahlqvist commenced an investigation of the grammatical text Auraicept na nÉces particularly quotations from Latin grammarians and other traces of non-native elements in the text. He prepared the final draft of an article entitled 'A Note on Old Irish ro' which has been accepted for publication in Ériu XXVI. See also section 6.

Mr. John Armstrong worked on:- (i) the collection of materials for the final version of his Ph.D. thesis 'Syntax of the VN in 17th century Irish prose'; (ii) a study of the language and metrics of Bardic poetry, including Irish grammatical tracts and their closer derivatives; (iii) the texts published by L. MacKenna in BST, with a view to correcting certain MS. misreadings, improvement and extension of the editor's commentary, and the search for parallel passages in hitherto unpublished tracts. The following articles were accepted for publication:- (i) 'Phonological Irregularity in Compound Verbs in the Wurzburg glosses' (Ériu); (ii) 'Remark on Initial Mutation in Modern Irish' (Linguistic Inquiry VI, 2).

Dr. Cecile O'Rahilly completed the preparatory work on the Text and Translation of TBC Recension I and this material was sent to the Printer in September 1974. Preparation of the Notes and Introduction is now complete and work has commenced on the Indexes. The following articles have been accepted for publication in Éigse:- (i) 'Ferda sin! Ferda écin!'; (ii) 'On some passages in the O'Curry MS. TBC'. See also section 6.

M. Louis Paul Nemo (Roparz Hemon) continued to work on:- (i) Historical Dictionary of Breton; (ii) Doctrin an Christenion (Middle Breton text). Final proofs of A Historical Morphology and Syntax of Breton were checked and passed for press. See also section 6.

Dr. Robert J. Jeffers, who was granted leave of absence from the Department of Linguistics, Ohio State University, pursued general studies in Celtic linguistics and philology at the Institute. He investigated the Indo-European origins of the Celtic verbal noun in conjunction with a larger research project concerning the history of non-finite verbals in the Indo-European languages.

Dr. Ludwig Bieler, General Editor of Scriptores Latini Hiberniae, completed the preparation of his edition of the Patrician Texts in the Book of Armagh. Professor D. A. Binchy and Mr. Fergus Kelly have contributed to this edition. It was suggested that Mr. Kelly should add a chapter on the language of the Irish texts in the so called Additamenta. Work on this chapter is now in progress and when completed the volume will be ready for press. Preparation of a critical edition by Dr. Gerard MacGinity, O.S.B., with introduction, English translation, commentary and indexes, of the Irish Augustine's De mirabilibus Sacrae Scripturae is in progress.

Mr. Brynley Roberts read revised proofs of the Introduction, Text, Notes, Appendix and Indexes of Cyfranc Llud a Llevelys which is to be published as Volume VII in the Mediaeval and Modern Welsh Series.

Rev. Feargal Mac Raghnaill, O.F.M. checked revised proofs of the Text of Ó hEódhusa's Teagasg Críosduidhe. Work on the insertion of textual line numbers on the Introduction and Notes progressed.

Rev. Martin McNamara, M.S.C. read revised page proofs of The Apocrypha in the Irish Church.

Tomás Ó Cathasaigh checked proofs of The Heroic Biography of Cormac Mac Airt and these were returned to the printer for revise.

Mr. Ronald Black continued his work on the cataloguing of the Gaelic manuscripts in the National Library of Scotland and submitted descriptions of 12 manuscripts to the Institute.

3. STATUTORY PUBLIC LECTURE

A statutory lecture entitled 'Makers and Fakers' was delivered by Professor David Greene at University College, Dublin on 13 December 1974.

4. SEMINARS

Professor David Greene held a weekly seminar on Saltair na Rann during the Michaelmas term 1974.

Professor Brian Ó Cuív held a weekly seminar on 'Irish metrics and phonology' during the Michaelmas term 1974.

5. EXTERNAL ACTIVITIES

Professor David Greene attended the conference of the European Linguistic Society in Jyväskylä, Finland, 30-31 May, 1974.

Professor Brian Ó Cuív delivered a lecture entitled 'Eachtra Mhuireadhaigh Í Dhálaigh - Fact or Fiction?' to Cumann Gaelach Choláiste na Tríonóide at Trinity College, Dublin, on 14 May 1974.

Mr. Fergus Kelly lectured to the Botanical Society of Ireland on 'Trees in the Brehon Laws' at Trinity College, Dublin, on 19 October 1974.

Mr. Rolf Baumgarten delivered a lecture entitled 'Early Irish names and native etymology' to the Irish Department, University College, Cork, on 5 April 1974.

Miss Katharine Simms read a paper on 'The Medieval Kingdom of Loch Erne' to a conference of the Group for the Study of Irish Historic Settlement at Enniskillen, on 4 May 1974, and on 10 October 1974 she lectured to the Irish Military History Society at a meeting in Carroll's Building, Grand Parade, Dublin, on 'Warfare in Medieval Gaelic Lordships'.

6. PUBLICATIONS

(a) Books published by the Institute:

The Linguistic Training of the Mediaeval Irish Poet. By Brian Ó Cuív. Statutory Lecture 1969. Reprinted from Celtica X. 27 pp. Price 30p. Published May 1974.

(b) Books published outside the Institute:

David Greene:

Ériu XXV. Published by the Royal Irish Academy and edited by David Greene and Proinsias Mac Cana.

Brian Ó Cuív:

Éigse XV, Part iii. Published by the National University of Ireland and edited by Brian Ó Cuív.

The Irish Bardic Duanaire or 'Poem-book'. Published by the Malton Press, Dublin 1974.

Roparz Hemon:

Historical Dictionary of Breton: Rann XXII. (Lovean - Merenn) Published by Etienne, Paris. pp.2101-2200.

(c) Contributions to periodicals and other publications:

David Greene:

Distinctive plural forms in Old and Middle Irish. Ériu XXV, 190-199.

Brian Ó Cuív:

Some Reflexive Constructions in Irish. Éigse XV, 203-214.

Reviews. ibid. 254-60.

Katharine Simms:

The Archbishops of Armagh and the O'Neills. Irish Historical Studies XIX, 38-55.

Anders Ahlqvist:

Notes on 'Case' and Word-Boundaries. Ériu XXV, 191-9.

Pádraig de Brún:

A census of the parish of Ferriter, January 1835. Journal of Kerry Archaeological and Historical Society 7 (1974), 37-70.

John Windele and Father John Casey: Windele's visit to Inis Tuaisceart in 1838. ibid. 71-106.

Ardfert in 1827. ibid. 148-9.

Alan Ward:

Infhilleadh na nAinmfhocal i nGaeilge na Mumhan - dearcadh stairiúil. Ériu XXV, 200-252.

Cecile O'Rahilly:

Cess Naíden. Éigse XV, 252.

Tadhg Ó Dushláine:

An Nua-Fhilíocht. Irisleabhar Mhá Nuad (1974), 25-34.

Litríocht as Ithir an Dúchais. Léachtaí Cholm Cille V (1974), 54-68.

III - Annual Report of the Governing Board of the School of Theoretical Physics for the period 1 April - 31 December 1974 adopted at its meeting on 13 February 1975.

1. STAFF AND SCHOLARS

Emeritus Professors:

Cornelius Lanczos, died 24 June 1974; John L. Synge.

Senior Professors:

Rev. James R. McConnell; Lochlainn S. Ó Raifeartaigh, Director from 10 January 1972 to 31 December 1974; John T. Lewis.

Visiting Professor:

G. A. C. Graham for the academic year 1974-75.

Assistant Professors:

R. Acharya (to 30 September 1974); W. G. Sullivan (from 1 October 1974).

Research Associates:

D. Judge, Rev. D. McCrea, S. Dineen (UCD); P. S. Florides, B. K. P. Scaife (TCD); P. D. McCormack (UCC); A. I. Solomon (Open University); D. H. Tchrakian (Maynooth); J. M. Golden (Kevin St. College of Technology & Foras Forbartha) - all to 30 September 1975; T. Garavaglia (Kevin St. College of Technology) from 23 August 1974 to 30 September 1975.

Scholars:

Z. Horvath (to 30 April 1974); B. Mainland, A. O'Connor, E. Harper, W. Sullivan (to 30 September 1974); E. Manoukian; J. V. Pulè (from 1 May to 30 September 1974); G. Parravicini, S. Browne, T. N. Sherry, W. T. Coffey (appointed 1 October 1974); R. H. Critchley (appointed 1 November 1974).

Research Students without stipend:

T. N. Sherry (to 30 September 1974); P. N. Sisson (to 31 October 1974); J. A. Ziegler (to 12 December 1974); P. Berner.

Secretary and Assistant Librarian:

Evelyn R. Wills.

2. GENERAL

The death of Professor Cornelius Lanczos on 24 June 1974 while in Budapest on a visit to the Roland Eötvos Physical Society was a severe blow to the School. He had been Senior Professor from 1954 to 1968, when he was appointed Emeritus Professor.

A summer seminar on Current Problems in Particle Physics, in collaboration with University College and Trinity College, was held at DIAS and TCD from 15 to 19 July. It was attended by approximately eighteen local physicists and forty-six visitors from abroad. A decision was taken to hold a similar seminar on Current Problems in Probability and the Physical Sciences in August 1975.

3. STUDY AND RESEARCH

Professor Lanczos continued his researches in gravitation and Riemannian space, symmetry and the principles of geometry.

Professor Synge continued work on the Liouville equation as applied to star clusters. He also studied the possibility of extending the hypercircle method to non-linear problems.

Dr. McCrea completed work on the construction of shell sources for static axially symmetric gravitational fields, and is now preparing this work for publication.

Dr. Florides worked on a Newtonian analogue of the relativistic Oppenheimer-Snyder solution.

Professor Ó Raifeartaigh continued his work on unified gauge theory in collaboration with Dr. Mainland and Mr. Sherry. Some results on this work were presented at the Marseille Conference on Group Theory, and a further paper on the subject was accepted for publication. In September he began work on a new theory of symmetry called supersymmetry, and he has lectured on this subject at a number of centres. He also collaborated with Professor Lanczos in making a tape-recording on Einstein and the theory of relativity, for use in undergraduate courses. He continued to advise Mr. Sherry on his doctoral thesis.

Dr. Mainland continued his work on unified gauge theory and quantization of the minimally interacting spin-3/2 and electromagnetic fields. He began a study of possible applications of supersymmetry in high-energy physics.

Mr. Sherry studied the non-Abelian model using different gauges, and verified that the divergences of the unitary gauge for fourth order fermion-fermion scattering cancel. He then examined the charge renormalization constants of the theory in the two gauges, and verified that they are equal although the wave function renormalization constants were different.

Dr. Manoukian has continued his investigation of the stability of the Adler-Baker-Johnson eigenvalue condition for the fine-structure constant α in the presence of strong interactions. He has also investigated the high-energy behaviour of abelian gauge theory and,

as an application, he has studied virtual photon decay and obtained explicit high-energy estimates of magnetic form factors.

Dr. Browne continued work commenced previously with Dr. Šijački (Inst. Kidrich, Belgrade) on covariant wave equations. They examined the algebraic properties of the matrices occurring in the better known wave equations and also re-examined the representations of the Lorentz group, using a simple method, and prepared two articles on these subjects for publication.

Dr. Garavaglia completed work, in collaboration with Dr. J. Gomatam (Glasgow Inst. Tech.), on the Schrödinger equation in helical coordinates which they had begun last year. Dr. Garavaglia also studied the null-plane approach to non-linear interactions between electromagnetic quantum fields and prepared a paper on this subject for publication.

Dr. Tchrakian was engaged in the development of a method of constructing invariant amplitudes for two particle reactions of arbitrary spin after the completion of which he started a study of supersymmetry leading to an analysis of the higher spin constant of superfluids.

Dr. Acharya continued his work on gauge theories; a one-loop calculation of the baryon mass differences (both medium-strong and electromagnetic) in the "hybrid" model of Cornwall et al. was undertaken in collaboration with Dr. M. Huq (UCD). He also worked in collaboration with Dr. S. Sen (TCD) on a review paper on Callan-Symanzik equations.

Professor McConnell commenced research in statistical mechanics. In collaboration with Professors Lewis and Scaife he investigated the rotational Brownian motion of a sphere using a Langevin equation and compared the results with earlier ones deduced from a Fokker-Planck equation. He carried further his studies of the problem of the multiplication of Schur functions. He continued his collaboration with Dr. M. J. Newell, President of University College, Galway, on the characters of the classical groups.

Professor Lewis has continued his work on equilibrium statistical mechanics, collaborating with Dr. Critchley on Boson systems and with Mr. Sisson on a Fermi algebra for the Ising model. He worked with Dr. Pulè (Malta) on non-equilibrium statistical mechanics, studying quantum analogues of the Langevin equation. Professor Lewis continued to advise Mr. Sisson and Mr. Ziegler on their doctoral theses.

Mr. Sisson studied representations of the canonical anticommutation relations applied to the two-dimensional Ising model

Mr. Ziegler studied the approach to thermodynamic equilibrium in a number of models related to the Ehrenfest model.

Dr. O'Connor continued his work on problems of random chains and on some problems of the energies of bound states just below the continuous spectrum.

Dr. Solomon continued work on the application of the methods of Lie algebras to one-dimensional lattice models of thermodynamic systems, and by these means generalized the X-Y model to a hierarchy of algebraically equivalent, exactly solvable models involving long-range and many-body forces. He worked also, in collaboration with Dr. Critchley (Open U.), on a variational solution to the interacting boson problem as an alternative derivation of the Bogoliubov solution to the superfluid problem.

Mr. Coffey worked with Professor Scaife on the solution of some potential problems for a non-linear dielectric, and with Professor Lewis on stochastic differential equations.

Dr. Sullivan continued his study of Markov time evolutions of random fields. Two papers were accepted for publication and a third submitted. The techniques developed here allowed a unified treatment of the existence and ergodicity problems and of the individual jump and coherent-jump cases. A series of notes on Markov-processes of this type is in preparation.

Dr. Parravicini worked on the possible extensions of the known theorems of separation and measurable sections in Borel structure, with the aim of applying these theorems to the BMS group. He is also studying the possibility of implementing Harish-Chandra's representation theory for semisimple Lie groups.

Dr. Harper continued his work on the application of the unitary pole expansion for the trinucleon bound and scattering systems. He redeveloped a method of solution for the scattering case, using Padé approximants. He commenced work on trinucleon states bound by field theory generated "one-boson-exchange" potentials.

Dr. Golden attempted to build a theory of rubber friction using standard polymer models.

Professor Graham worked on the development and extension of methods of solution for viscoelastic boundary value problems that involve time-dependent regions of space and other complications.

4. SEMINARS AND REVIEW LECTURES

Review and seminar lectures were held throughout the year, and as in previous years they 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 seminars were given:

Dr. D. Abraham (Oxford): Recent work on the Ising model.

Professor G. Bluman (British Columbia): Group methods in differential equations.

Professor B. Gruber (WÜrzburg): Classical Lie algebras in atomic and nuclear physics.

Dr. J. Gunson (Birmingham): Solving the Green's equations for ϕ^4 field theories.

Dr. K. Hannabus (Oxford): Maslov index and the WKB method.

Dr. H. Hopkins (Kevin St.): Experimental background to neutral currents.

Professor J. T. Lewis (DIAS): Dynamical theories of Brownian motion.

Dr. D. Lyth (Lancaster): Pion photo- and electro-production.

Dr. V. McBrierty (TCD): The NMR of polymers.

Dr. P. Mac Carthy (Cambridge): Bondi-Metzner-Sachs (BMS) group and its induced representations.

Dr. C. Nash (Imperial College): Current amplitudes and asymptotic freedom.

Professor J. Nilsson (Göteborg): Non-leptonic scattering at high energy.

Professor L. Ó Raifeartaigh (DIAS): Principles of supersymmetry.

Dr. G. Parravicini (DIAS): Induced representations of groups of the BMS type.

Dr. M. Pennington (Rutherford Lab.): π-π scattering.

Dr. J. Pulè (Malta, Oxford and DIAS): The Bloch equations.

Dr. S. Sen (TCD): Principles of phase transitions in high energy physics.

Dr. D. Tchrakian (Maynooth & DIAS): Supersymmetry for any spin and isospin.

Dr. D. Wallace (Southampton): Critical phenomena.

5. COURSES

The M.Sc. courses provided jointly by the universities in the Dublin area and the Institute were continued. The Institute's contribution was provided by Professor Ó Raifeartaigh who lectured during Michaelmas term on "Symmetry groups in quantum theory". Two series of informal seminars, one on "Pseudo-differential operators" and the other on "Several complex variables" run in collaboration with the Mathematics departments of Trinity College Dublin and University College Dublin commenced in October. A course on "Stochastic differential equations" was given by Professor Lewis in the Michaelmas term.

6. STATUTORY PUBLIC LECTURE

A Statutory Public Lecture, under the auspices of the School, was delivered in Trinity College, Dublin, on "Some pages from a mathematical notebook" by Professor Mark Kac, on 22 November 1974.

7. VISITORS

For lectures given by Visiting Professors and other Visitors see Sections 4 and 6.

Dr. D. B. Abraham (Oxford) 20-22 November.
Dr. A. Böhm (Texas) 8-10 April.
Dr. G. Bluman (British Columbia) 18 October.
Professor M. Gell-Mann (California Inst. Tech.) 26 June.
Professor B. Gruber (Würzburg) 6-25 September.
Dr. J. Gunson (Birmingham) 5-6 June.
Dr. K. Hannabus (Oxford) 19 June.
Professor Mark Kac (Rockefeller) 22 November.
Dr. D. Lyth (Lancaster) 30 April - 2 May.
Dr. P. MacCarthy (Cambridge) 4-7 December.
Dr. C. Nash (Imperial College) 9 October.
Professor J. Nilsson (Göteborg) 25 October.
Dr. M. Pennington (Rutherford Lab.) 8 May.
Professor I. E. Segal (MIT) 5-11 April.
Dr. D. Wallace (Southampton) 15 May.

8. SYMPOSIA

Two mathematical symposia were held - on 10-11 April and on 19-20 December 1974. The attendances (37 in April, 40 in December) included Professors, Lecturers, and Graduate Students from the several Irish universities.

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

April:

Dr. M. L. Newell (UCG): Supplements in groups.
Dr. I. G. Ó Muircheartaigh (UCG): Misclassification probabilities in statistical discrimination.
Dr. T. Laffey (UCD): Permutation matrices with normal sum.
Dr. W. S. Hall (UCG): A convergent two variable procedure for partial differential equations.
Mr. P. McGill (UCG): Henstock variation and measure.
Dr. F. Holland (UCC): Harmonic analysis on amalgams of L^p and ℓ^q.
Professor I. E. Segal (MIT): Mathematical cosmology and extragalactic astronomy. (Invited lecture.)

December:

Dr. D. Hurley (UCC): Entropy.
Dr. R. S. Dark (UCG): A complete group of odd order.

Professor M. Hayes (UCD): Energy propagation in solids.
Dr. S. Vernon (UCC): On power series with non-negative coefficients.
Dr. D. Lewis (UCD): Forms over real algebras.
Dr. S. Sen (TCD): Large transverse momenta phenomena.

9. WORKING SEMINAR

A Working Seminar on Current Problems in Particle Physics was held, in collaboration with University College and Trinity College, from 15 to 19 July 1974. There were 46 participants from abroad, and 18 local participants. The programme included five courses of three lectures each and a number of voluntary fifteen-minute talks. The courses were:

T. Appelquist (Harvard): Developments in unified gauge theory.
K. Johnson (MIT): Extended hadron models.
D. Gross (Princeton): Asymptotic freedom and dynamical symmetry breaking.
S. Coleman (Harvard): Effective potentials in spontaneous symmetry breaking.
J. Polkinghorne (Cambridge): Partons.

10. EXTERNAL ACTIVITIES

Professor Ó Raifeartaigh attended the June Conference on Group Theoretical Methods in Physics in Marseille where he acted as a session chairman and gave a short invited talk. He attended the International Conference on High Energy Physics in London in July. During August he spent three weeks at the Aspen (Colorado) Center for Physics, and gave four lectures there on supersymmetry. He gave these lectures also at the Strobl (Austria) working seminar on weak interactions in September. He spent a short period at the CNRS, Marseille, and at the Institut des Hautes Études, Paris, in the autumn, and gave a lecture on supersymmetry at each centre. He also made a brief visit to CERN. In October he gave a talk on Einstein and the Theory of Relativity to the Dublin University Mathematics Society in Trinity College.

Dr. Mainland attended the Rutherford Conference on High Energy Physics from 2 to 4 January, and the Bonn Summer School from 29 July to 9 August.

Dr. Tchrakian visited the Chalmers Tekniska Högskola (University of Gothenburg) for a month approximately, in September, and collaborated there with Professor J. S. Nilsson in completing the analysis of superfluids they had started in Dublin.

Dr. McCrea and Dr. Florides attended the 7th International Conference on General Relativity and Gravitation (GR7) in Tel-Aviv, 23-28 June.

Dr. Solomon presented a paper on "Three novel applications of Lie algebra" to the Third International Colloquium on Group Theoretical Methods in Physics at Marseille, in June, and gave a talk to the York University Mathematics Seminar on "Algebraic approach to superfluidity" in October.

Professor McConnell attended in August the International Congress of Mathematicians at Vancouver, giving a talk on Schur functions. He visited the physics department of the University of Alberta, Edmonton, in September and gave a seminar on the use of group theory in physics. He attended the Congress on Cultural Collaboration between the Countries of the European Community held in Rome in October, being elected chairman of the working party on scientific research and reading a paper on scientific research in Ireland.

Professor Lewis attended the Science Research Council conference on "Functional Integration" in London 2-4 April, and delivered an invited lecture. He gave seminars on his work at the Universities of Nottingham, Oxford, Warwick, and at Bedford College, London. He was the invited speaker at the meeting in Bradford of the Yorkshire Pure Mathematics Colloquium. Together with Professor B. H. Murdoch (Trinity College, Dublin) he organized a joint meeting of the London Mathematical Society and the National Committee for Mathematics on "Probability and the Physical Sciences", from 17 to 19 September. Talks at this meeting were given by Professor Sullivan (Markov evolution of random fields), Dr. O'Connor (Limit theorems for the random chain), and Professor Lewis (Dynamical theories of Brownian motion).

Dr. Sullivan presented a paper entitled "Relaxation time for the evolution of Markov fields" at a meeting of the American Mathematical Society in New York in April.

Professor Scaife attended a meeting of the Dielectrics Discussion Group in Swansea, 1-3 April, and gave a lecture there on "Electrets and related high-field phenomena".

Dr. Golden attended the Nottingham Conference of the Institute of Physics, 9-12 July, on "Inter-relation of structure, properties and applications of polymers."

11. PUBLICATIONS

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

(1) Books:

*The Einstein decade: 1905-1915. By C. Lanczos. Paul Elek Scientific Books, London, 1974.

*Studies in numerical analysis. Presented to Prof. Lanczos for his 80th birthday. Edited by B. K. P. Scaife. Academic Press, 1974.

(2) Contributions to periodicals and other publications:

Published:

J. L. Synge:

*Anti-Compton scattering. Proc.R.I.A. 74A (1974), 67-72.

*The hypercircle method. Studies in Numerical Analysis. Academic Press, 1974, 201-217.

J. McConnell:

*Multiplication of Schur functions. Internat. Congress Mathematicians, Vancouver, 1974, Abstracts of communications, p.179.

*Critical Notice of "The Rules of the game: Cross-disciplinary essays on models in scholarly thought", ed. by T. Shanin, Tavistock Pr. (London), 1972. Phil. Studies 22 (1973), 223-226.

J. T. Lewis, J. R. McConnell & B. K. P. Scaife:

The rotational Brownian motion of a sphere. Phys.Lett. 49A (1974), 303-05.

J. T. Lewis & L. C. Thomas:

A characterization of regular solutions of a linear stochastic differential equation. Z. Wahrscheinlichkeitstheorie verw. Gebiete 30 (1974), 45-55.

J. T. Lewis & P. N. Sisson:

A Fermi algebra for the Ising model on an infinite lattice. Phys.Lett. 50A (1974), 197-98.

J. T. Lewis:

Charles Alfred Coulson, FRS, FIMA, 1910-1974. Bull. IMA 10 (1974), 294-95.

A. J. O'Connor:

*Exponential decay of bound state wave function. Commun.Math. Phys. 32 (1973), 319-40.

A. J. O'Connor & J. L. Lebowitz:

Heat conduction and sound transmission in isotopically disordered harmonic crystals. J.Math.Phys. 15 (1974), 692-703.

B. K. P. Scaife:

On the analysis of thermally stimulated depolarization phenomena. J.Phys.D: Appl. Phys. 7 (1974), L171-73.

L. Ó Raifeartaigh &. U. H. Niederer:

Realizations of the unitary representations of the inhomogeneous space-time groups. I. General structure. Fort.d.Phys. 22 (1974), 111-29.

L. Ó Raifeartaigh & U. H. Niederer:

Realizations of the unitary representations of the inhomogeneous space-time groups. II. Covariant realisations of the Poincaré group. Fort.d.Phys. 22 (1974), 131-57

G. B. Mainland:

Poincaré generators for the free spin 3/2 field. Proc.R.I.A. 74A (1974), 87-90.

G. B. Mainland & L. Ó Raifeartaigh:

Derivation of unified gauge theory from a generalized minimal principle. Nuovo Cim.Lett. 10 (1974), 733-36.

G. B. Mainland, L. Ó Raifeartaigh & T. N. Sherry:

Point transformations and renormalization in the unitary gauge. Nuclear Phys. 79B (1974), 503-25.

G. B. Mainland & L. Ó Raifeartaigh:

Postscript to Nijmegen talk on unified gauge theory. Proc. 3rd Internat. Coll. on Group Theoretical Methods in Physics, Marseille, June 1974. Univ. Nijmegen Fac. Sci. I, 201-09.

E. B. Manoukian:

*Stability of the eigenvalue condition for the fine-structure constant α and short-distance behaviour in strong interaction. I. Phys.Rev. 10D (1974), 1883-94.

*do., II. ibid. 1894-1901.

D. H. Tchrakian:

On the application of higher rank spinors in general relativity. GRG 5 (1974), 331-43.

*A formulation of linearized gravity. GRG 5 (1974), 379-86.

R. Acharya & Z. Horvath:

*Electrodynamic determination of fine-structure constant and electron-muon mass ratio from Weinberg's renormalization group equations. Nuovo Cim. Lett. 10 (1974), 710-14.

J. Gomatam:

A new model for interacting populations. I. Two species systems. Bull.Math.Biol. 36 (1974), 347-53.

A new model for interacting populations. II. Principles of competitive exclusion. Bull.Math.Biol. 36 (1974), 355-64.

A. I. Solomon:

Three novel applications of Lie algebras. Proc. 3rd Internat. Colloq. on Group Theoretical Methods in Physics, Marseille, June 1974. Univ. Nijmegen Fac. Sci. I, 318-27.

E. P. Harper:

*Unitary pole expansion applied to the trinucleon problem. Phys.Rev. 9C (1974), 2106-2113.

W. Coffey & B. K. P. Scaife:

On the theory of dielectric saturation in polar fluids. Proc. Conf. on Molecular electric moments and properties, Univ. de Nancy, July 1974, 7pp.

In the Press:

C. Lanczos:

Symmetry and the principles of geometry. Conf. Univ. of Calgary, August 1974.

J. L. Synge:

Note on a paper by Anderson and Arthurs. Quart.Appl.Math.

J. R. McConnell:

Problems of scientific research in Ireland. Enciclopedia Italiana.

Critical Notice: Fields of Force: the development of a world view from Faraday to Einstein, by W. Berkson, Routledge & Kegan Paul, 1974. Phil. Studies.

G. B. Mainland & L. Ó Raifeartaigh:

Point transformations and renormalization in the unitary gauge for non-Abelian fields. Phys.Rev.

D. H. Tchrakian:

Construction of covariant bases for massive two-particle reactions. Fort.Phys.

J. T. Lewis & L. C. Thomas:

How to make a heat bath. Functional integration, ed. A. Arthurs, Oxford Univ. Press.

On the existence of a class of stationary quantum stochastic processes. Ann. Inst. H. Poincaré.

J. T. Lewis & J. Pulè:

The free boson gas in a rotating bucket. Comm.Math.Phys.

W. G. Sullivan:

Mean square relaxation times for evolution of random fields. Comm.Math.Phys.

A unified existence and ergodic theorem for Markov evolution of random fields. Z. Wahrscheinlichkeitstheorie verw. Gebiete.

W. Coffey & B. K. P. Scaife:

On the solution of some potential problems for a non-linear dielectric. J. Electrostatics.

T. Garavaglia & J. Gomatam:

The Schrödinger equation in helical coordinates. Ann.Phys.

P. Florides:

Rotating spheroid as a possible source of the Kerr metric. Ill Nuovo Cim.

Newtonian analogue of the relativistic Oppenheimer-Snyder solution. Izvestia Vusov, Physica. Invited paper in honour of Prof. D. Ivanenko.

(3) Research Reports:

DIAS-TP-13: G. B. Mainland, L. Ó Raifeartaigh & T. N. Sherry: Point transformations and renormalization in the unitary gauge.

14: J. L. Synge: An astrophysical model.

15: G. B. Mainland & L. Ó Raifeartaigh: Derivation of unified guage theory from a generalized minimal principle.

16: R. Acharya & Z. Horvath: Absence of free quarks in a finite four-dimensional field theory.

17: G. B. Mainland & L. Ó Raifeartaigh: Point transformations and renormalization in the unitary gauge for non-Abelian fields.

18: A. J. O'Connor: A central limit theorem for the disordered harmonic chain.

19: C. Lanczos: Symmetry and the principles of geometry.

20: W. G. Sullivan: A unified existence and ergodic theorem for Markov evolution of random fields.

21: G. B. Mainland & L. Ó Raifeartaigh: Postscript to unified gauge theory.

22: J. T. Lewis & L. C. Thomas: How to make a heat bath.

23: D. Tchrakian: Construction of covariant bases for massive two-particle reactions.

24: J. T. Lewis & L. C. Thomas: A characterization of regular solutions of a linear stochastic differential equation.

25: D. H. Tchrakian: Superfluids for any spin.

26: G. W. Ford & J. T. Lewis: Measured correlations and the Wigner distribution.

27: J. T. Lewis & L. C. Thomas: On the existence of a class of stationary quantum stochastic processes.

28: J. T. Lewis, J. R. McConnell & B. K. P. Scaife: The rotational Brownian motion of a sphere.

29: J. R. McConnell: Book review: W. Berkson - Fields of force: The development of a world view from Faraday to Einstein.

30: J. L. Synge: Talking about relativity, North-Holland 1970 - translated into Japanese and into Polish.

31: J. R. McConnell: Multiplication of Schur functions.

32: L. Ó Raifeartaigh: Survey of supersymmetry using weight diagrams and subsymmetries.

33: J. L. Synge: A hollow water bag.

34: T. Garavaglia: Null-plane approach to non-linear interaction between electromagnetic quantum fields.

DIAS-TP-35: J. T. Lewis & J. Pulè: The free boson gas in a rotating bucket.

36: J. T. Lewis & P. N. Sisson: A Fermi algebra for the Ising model on an infinite lattice.

37: J. R. McConnell: Problems of scientific research in Ireland.

38: P. N. Sisson: An extension of the method of Kaufmann for the transfer matrix in the two-dimensional Ising model.

39: L. Ó Raifeartaigh: Spontaneous breakdown of internal symmetry in internal symmetry ⊗ supersymmetry.

40: W. G. Sullivan: Processes with infinitely many jumping particles.

41: J. R. McConnell: Scientific collaboration among EEC countries.

42: L. Ó Raifeartaigh: Weight diagrams for superfluids.

43: R. H. Critchley: On the convergence of the chemical potential.

44: J. T. Lewis: Charles Alfred Coulson, FRS, FIMA, 1910-74.

45: R. H. Critchley & J. T. Lewis: On the free boson gas with spin.

46: L. Ó Raifeartaigh: Parity-preserving spontaneous breakdown of supersymmetry.

47: J. Nilsson & D. Tchrakian: On the higher spin content of superfluids.

48: J. L. Synge: Note on a paper by Anderson and Arthurs.

49: E. P. Harper: Unitary pole expansion applied to the nucleon-deuteron scattering system.

50: E. P. Harper: Boson exchange interaction.

51: E. P. Harper: Electric and magnetic form factors for the three nucleon system bound by a one boson exchange interaction.

52: E. B. Manoukian: High-energy behaviour in Abelian gauge theory, application to γ^* decay and high energy estimates for form factors.

53: P. S. Florides: Rotating spheroid and possible source of the Kerr metric.

54: P. S. Florides: Newtonian analogue of the relativistic Oppenheimer-Snyder solution.

12. LIBRARY

The library continued to expand and now contains approximately 9,000 items, of which approximately 4,000 are textbooks. During the year the holdings of periodicals were scrutinized with regard to greatest needs, availability elsewhere in Dublin, and cost; a small number of subscriptions were dropped, some reluctantly, and a small number of essential new subscriptions taken out. Guide-lines for the use of the library by members of the School, and by non-members with borrowing privileges, were drawn up and circulated to persons concerned. Material required by members of the School but not available in the library was sought in libraries at home and abroad, and in most cases obtained. The updating of the classification was continued. Gifts of books were received from Mr. R. Anderson, Professor Sz.-Nagy, KEK (Japan), The Roumanian Academy of Sciences, Professors J. R. McConnell, L. Ó Raifeartaigh and J. L. Synge, and Mr. Ziegler, and gifts of periodicals from the French Embassy (Service Culturiel), IEEE, ICI, and Professors Lanczos, McConnell and Synge. Non-members of the School using the library included members of Departments of Mathematics, Mathematical Physics, Physics, Engineering, and Computer Science of the Irish universities, especially of Trinity College, Dublin and University College, Dublin.

IV - Annual Report of the Governing Board of the School of Cosmic Physics for the period 1 April - 31 December 1974 adopted at its meeting on 19 March 1975.

A. Astronomy Section

1. STAFF AND SCHOLARS

Senior Professor:

P. A. Wayman.

Professor:

T. Kiang.

Research Assistants:

I. Elliott; P. B. Byrne (from 1 October 1974).

Experimental Officer:

B. D. Jordan.

Research Associate:

Dr. M. Hoey, UCD.

Technical and Clerical Staff:

Miss A. M. Callanan; Mr. R. P. Murphy; Mr. W. M. Dumpleton; Mrs. V. Bond (part-time from 9 September 1974).

Scholars:

P. B. Byrne (to 30 September 1974); M. J. Stift.

Professor Kiang was on leave of absence to work at the University of Glasgow up to 30 June.

Dr. P. B. Byrne was awarded the degree of Ph.D. at the University of Dublin in November 1974. He was appointed Research Assistant through the support of the National Science Council from 1 October 1974.

Mr. B. D. Jordan worked at the Boyden Observatory from 16 July to 2 September and Dr. P. B. Byrne from 16 July to 16 September. Mr. M. Dunne, UCD, worked as a Vacation Student for eight weeks from 24 June.

Miss M. Callanan received the Diploma in Information Studies of Trinity College, Dublin, in July 1974.

2. RESEARCH WORK

Photographic Photometry: P. A. Wayman, M. J. Stift.

The photographic brightness measurements of standard stars and

cepheid variables in the LMC I region of the Large Magellanic Cloud have been brought to the stage of final reduction from 'Galaxy' brightness measure to magnitude. A comprehensive least-squares fitting procedure shows that the systematic accuracy of the measures is indicated by mean "photographic-photoelectric" differences of around 0.08 magnitude. A similar figure applies to the mean accidental error of a single photometric measurement. Correction for the effect of background fog has been incorporated semi-empirically. Probelms in identification of the non-standard stars have been resolved as far as possible, but it is found that some measurements have to be rejected because of unexplained errors during the automatic measuring sequence on 'Galaxy' machine.

Cepheid Variables: P. A. Wayman.

The tabulation of the detailed results for the cepheid variables of the Small Magellanic Cloud has been completed by Dr. C. J. Butler, now at Armagh Observatory, and a complete description written for publication. Similar work for the variables in the LMC II region is still in preparation. One important result additional to those reported previously is that the long-period group of cepheid variables in the SMC is found to obey a linear period-luminosity-colour relation with r.m.s. residual as low as 0.06 magnitude. The main groups cannot usually be fitted better than to 0.20 magnitude.

Binary X-ray Sources: P. B. Byrne.

Arrangements were made with the Mullard Space Science Laboratory that simultaneous observations should be attempted for the X-ray source SMC X-1 and the optical counterpart SK 160. The Newtonian spectrograph on the 60-inch telescope at Boyden Observatory was successfully used to register optical spectra of this 12^m star, but unfortunately the cooperative period (Aug. 12-19) had uniformly cloudy nights; the fine winter weather came to an unusually early close. Twenty spectra of the binary X-ray source HD 153919 with the 60-inch and UBV photoelectric measurements with the 16-inch Nishimura telescope were secured on other nights.

Magnetic Variable Stars: M. J. Stift.

The means whereby observations of the field strength and polarity reversals in the spectra of magnetic variable stars can be represented by variants of the oblique rotator model have been examined. Landstreet's model of a displaced dipole in an oblique rotator, giving a 3-parameter model, has been applied successfully to the data of six

magnetic variable stars and among these and other stars no evidence is found for the existence of a low-obliquity group. Further generalization for the position and orientation of the dipole produces a six-parameter model and this has been applied so as to provide an explanation for at least two previously intractable magnetic stars.

Statistical Astronomy: T. Kiang.

Work has continued, on a new basis, concerning the probability of a multiple system of specified multiplicity and angular size arising from a random distribution of a given number of points on a sphere. A rigorous expression for such probability in the form of a series with alternating sign has been found. With reference even to the first term of such a series, there appear to be errors in the classical formulae of Michell (1767) and F. G. W. Struve (1827). It is found advantageous to abandon the traditional way of defining a multiple system by a circular area, and to use instead a square area with a pre-assigned orientation, for, with this re-definition, simple and practical expressions can be derived for both the first and the second terms. Further terms are increasingly complicated, and only in the case of double systems have expressions for terms up to the sixth been obtained through combinatorial enumeration. The results, confirmed by Monte Carlo simulation, can be applied to a consideration of the physical connection supposed to exist in groupings of astronomical objects on the sphere, either for newly-discovered types of object such as the quasars, or for the long-established groupings such as constellations.

Interferometric Investigations: P. A. Wayman, M. Hoey, P. B. Byrne.

This project is supported by the National Science Council. In the period from 1 October, the objects of the Southern sky requiring investigation by interferometric methods have been reviewed. Work on the design of a Fabry-Perot interferometer using an image-tube has begun in conjunction with the Physics Department of University College, Dublin.

3. INSTRUMENTS, ETC.

Electronics Laboratory: B. D. Jordan.

The programmable control and recording mechanism for the two-channel photometer, for use at the Cassegrain focus of the Boyden Observatory 60-inch telescope was completed and consigned to Blömfontein where the necessary mechanical work was carried out on the photometer box. There is provision for automatic recording of data on paper tape in accordance with a chosen sequence of filter settings by motor drives.

The system has been returned to Dublin for completion of the photometric channels and improvements to the filter position control.

Repairs to part of the electronic equipment of the 60-inch telescope at Boyden Observatory were carried out in September.

Computer Installation: I. Elliott.

The IBM 1620 computer was removed on 8 April, having been purchased for instructional purposes.

Equipment added to the installation during the period of the Report includes a Nova 2/10 Processor with 16K core store and an ADDS 580 visual display unit. Hardware for connection of four peripherals to either processor (Nova 2/10 or Nova 1220) has been provided; the visual display unit permits non-printed operation at a band-rate of 2400 instead of teletype speed of 110.

Use of Cartrifile now includes subroutines called under FORTRAN programming. Choice of BASIC programmes is available to suit a variety of users' requirements. Facilities for using high level language routines in real-time operation are being prepared.

4. BOYDEN OBSERVATORY - Dr. E. M. Lindsay.

The Chairman of the Boyden Observatory, Professor G. B. Field, (Smithsonian Astrophysical Observatory), announced in November 1974 that it would not be possible for Smithsonian support of Boyden Observatory to continue beyond 1 July 1976. Some existing scientific institution is being sought with whom arrangements may be made for transferring responsibility for astronomical work at this fine site. The difficulties that follow from this decision are also of concern to the Board of Governors of Armagh Observatory. At Armagh a very serious loss has occurred by the death on 27 July 1974 of Dr. E. M. Lindsay, director of Armagh Observatory from November 1938. Because of these events, continuation of astronomical work at Boyden Observatory by the staff and associates of the Astronomical Section of the School is in jeopardy. Not least among the problems is the question of the Armagh-Dunsink-Harvard telescope, jointly owned by Armagh Observatory and Dunsink Observatory, in the latter case ownership being vested in the Dublin Institute for Advanced Studies. This telescope requires re-housing and renovation, and possibilities for future work with other telescopes at other sites makes the execution of this renovation less imperative than it otherwise would be.

Dr. Eric Mervyn Lindsay, a member of the Governing Board of the School of Cosmic Physics since 1948, has been associated with astronomy in Ireland and especially with exploitation of the opportunities for

observational work at Boyden Observatory, for the whole period of existence of the School. He worked throughout this time in close association with the Astronomical Section of the School. Dr. Lindsay played a leading part in the discussions which led to the re-opening of Dunsink Observatory as part of the Dublin Institute for Advanced Studies; also in determining the agreement to construct the ADH telescope and the setting-up of the Boyden Observatory Council. He strove for many years to encourage observational work in the Southern Hemisphere. His other main interest was the stimulation of popular interest in astronomy in Ireland both through the Irish Astronomical Journal and, since 1967, through building up the Armagh Planetarium and the Hall of Astronomy that now bears his name. His encouragement and advice will be greatly missed.

5. MISCELLANEOUS

Classification of library books was carried out by Mrs. E. Stift during 1974. A computer program for retrieval of articles by key words in review volumes was completed by Miss Callanan.

A course on astronomy was arranged in conjunction with the Irish Science Teachers' Association for the four days 29 October to 1 November. Sixty teachers attended the course, which included the opportunity for practical work at Dunsink Observatory. The lectures and other sessions were conducted by the academic staff and scholars of the Astronomical Section, with added assistance from Professor L. Ó Raifeartaigh, Professor N. A. Porter, Dr. M. Hoey and Dr. G. K. Miley.

6. BUILDINGS

The use of the Meridian Room as a library began in September and a re-arrangement of all books, journals and observatory publications has been carried out during the year. The general appearance of this section of the premises has been greatly improved and a useful general purpose library area established. Following the completion of this work, the computer installation has been brought back to the basement of the main building.

7. LECTURES, ETC.

An afternoon colloquium with three principal speakers was held at Dunsink Observatory on 26 June. It is expected that in the future similar meetings of general interest will be held twice per year at the various institutions in Ireland where scientific work involving astronomical data is being carried out.

Six seminars were held at Dunsink Observatory during the Report period, including visiting speakers as follows:

Dr. G. K. Miley (Leiden), 30 April
Dr. D. H. Sadler (Royal Greenwich Observatory), 14 May
Dr. F. House (Bonn), 1 October.

Other visitors included Professor S. Sharpless, Dr. T. C. Weekes, Dr. M. Walmsley and Mr. J. E. Joly.

Professor Wayman and Dr. Byrne attended the 18th Herstmonceux Conference on "Positions and Structures of Optical, Radio and X-ray Objects" in April at the Royal Greenwich Observatory, the closing summary being provided by Professor Wayman.

Professor Wayman visited the Institute of Astronomy, Cambridge, in October and the Royal Greenwich Observatory in December.

The Public Open Nights have been held as in previous years. For demonstration on these and other occasions, tape-recorded programmes with synchronised slides have been prepared by R. J. Wayman and W. Dumpleton.

8. PUBLICATIONS

I. Elliott and W. Dumpleton:

"A new technique for Isophotometry", The Observatory, 94, 222, 1974.

M. J. Stift:

"The radii of the Ap stars", Astronomy and Astrophysics, 34, 153, 1974.

"The Decentred Dipole Model for Magnetic Stars", Mon.Not.Roy. Astr.Soc., 169, 471, 1974.

P. B. Byrne:

"A search for Optical Evidence of Condensed Matter", Thesis, Ph.D. Degree, University of Dublin, 1974.

B. Cosmic Ray Section

1. STAFF AND SCHOLARS

Senior Professor:

C. Ó Ceallaigh, Director of the School.

Professor:

K. Imaeda.

Assistant Professors:

D. O'Sullivan; A. Thompson.

Research Assistant:

Y. V. Rao.

Experimental Officer:

J. Daly.

Technical and Clerical Staff:

Miss D. Molloy; Miss E. Kee (to 30 November); Miss H. O'Donnell; Miss E. Rankin; Miss M. Cahill; Mrs. R. Horan (from 15 July); Miss C. Murphy.

2. RESEARCH WORK

Throughout the period, the work of the Section followed two main lines. Work was continued in the field of heavy cosmic ray primary particles and the production of recoil particles by fast proton bombardment. Professor K. Imaeda continued his theoretical studies of the mechanism of interaction at ultra high-energy and has been engaged in examining the possibility that quaternions may prove to be a useful tool in the field.

Study of Very Heavy and Ultra Heavy Cosmic Ray Nuclei.

C. Ó Ceallaigh, A. Thompson, D. O'Sullivan.

The collaboration with Professor Fowler's group at Bristol University continued successfully during the year. Calibration work on the nuclear emulsion batches used in the DIAS halves of the Colorado, Nevada and Minnesota stacks was completed by following back a further 150 Fe group nuclei from Lexan into emulsion and by using a micro-densitometer to make comprehensive ionisation measurements on each track.

The ammonia scanning and cylinder scanning of Lexan from the Cokato and Mississippi flights was completed. In addition, the nuclear emulsion from these flights was optically scanned for ultra-heavy candidates which were then followed on into Lexan. It should be noted that all stopping nuclei located during the optical emulsion scan were also found independently by the ammonia Lexan scan. A total of 74 transiron candidates were found in the DIAS halves of the Cokato and Mississippi stacks and of these 34 were found to have $Z \geq 30$. Selective etching of the relevant Lexan and all measurements have been completed and analysis is in progress. Approximately 500 Fe group nuclei were located and measured in order to calibrate the Lexan from the Cokato and Mississippi flights.

A new stack was constructed during June/July/August 1974 and exposed in September 1974. The stack profile consisted of 150 sheets of 250 μm Lexan Polycarbonate with one layer of 200 μm Ilford G5 nuclear emulsion at the top and a second layer of emulsion between Lexan sheets number 50 and 51. The stack was built as a set of six large modules having a total weight of 420 lbs. A modified module design was employed which gave improved thermal insulation and greater strength without an increase in weight. The total thickness of detecting material in the stack was 4.8 gm/cm^2 Lexan equivalent at 300 Mev/Nucleon.

The stack was launched from Sioux Falls, South Dakota, on 15th September 1974, using a Raven 11.1 Mcf balloon made from X-124 film. The launch was excellent and the balloon performed very well, reaching ceiling without incident. However, an unexpected and persistent fast easterly air stream made it necessary to cut down the payload after 46 hours in order to prevent it from passing over the Pacific seaboard. The mean atmospheric overburden was 4.0 mbars and the gondola was recovered, completely undamaged, from a region of sand and sage brush in a mountainous area near Cherry Creek, Nevada.

While the DIAS 11.1 Mcf balloon was aloft, a Bristol University 20.5 Mcf Winzen balloon was launched. However, this balloon failed catastrophically when it was released from the launching spool. The Bristol group then purchased another balloon, a Winzen 20.9 Mcf model which was 400 lbs heavier than the balloon which failed. The new balloon was used for a joint Bristol-DIAS flight and was launched on 22nd September 1974. The DIAS modules from the first flight were recovered in time to allow one of them to be reflown with the unexposed modules. The joint flight was extremely successful. The balloon remained at ceiling for 122 hours and this broke the world flight endurance record by a wide margin. The mean atmospheric overburden was 3.8 mbars and the gondola was recovered undamaged from the Chippewa river at Eau Claire, Wisconsin which is only 200 miles east of Sioux Falls.

Iron Isotope Work

During the year a total area of about 25 square metres of Lexan from the Cokato and Mississippi stacks was processed using a high precision etching technique. About 400 Fe group events were located and measured as a test sample, in order to judge the practicability of resolving Fe isotopes. The initial results were sufficiently encouraging to justify the continuation of this project, the ultimate objective of which is to obtain information concerning the relative abundances of the Fe group isotopes produced in nucleosynthesis. At present, this is a matter of considerable interest and controversy.

Study of the Production of Heavy Nuclear Fragments in High Energy Proton Interactions.

The UV system which was developed for enhancing the "latent images" of tracks in Lexan and enabling double parameter measurement to be made (for details, see Annual Report 1973-74), has now been applied to the Lexan stacks which were exposed at CERN. Using this system a sample of ~ 4500 heavy fragment events were located and measured.

The problem of calibration in this work is particularly difficult since the standard relationship between etching rate and ionisation appears to break down at the extremely low energies involved (< 5 Mev/N). However, identification of the fragments can be achieved by means of an empirical calibration network of etching rates and ranges of known ions.

The Linear Accelerator Laboratories, Manchester University, offered to provide DIAS with exposure services. As a result, 50 sheets of Lexan were exposed to beams of Neon, Sulphur, Copper, Iron and Krypton at 9.6 Mev/Nucleon and to beams of Carbon, Nitrogen, Oxygen, Neon, Phosphorus and Sulphur at both 4.14 Mev/Nucleon and 1.04 Mev/Nucleon. Lexan samples representing most of these ions have been processed and measured using the UV technique and calibration is in progress. In order to complete the set of calibration ions, it is hoped that some more exposures can be made at Manchester during the coming year, as the relevant beams become available on the accelerator schedule.

Study of Application of Quaternions to Electrodynamics and Very High Energy Nuclear Interactions.

K. Imaeda.

Professor Imaeda commenced an investigation of the application of quaternions to ultra high-energy interactions.

In recent years there has been considerable interest in the

application of quaternions and hypercomplex numbers to the theory of relativity, electrodynamics, elementary particles and high energy nuclear interactions. A difficulty arises from the non-commutativity of a quaternion variable to express physical quantities. However, by introducing regular functions of a quaternion variable as has been done by a Swiss mathematician, R. Fueter, and those of a complex quaternion variable it appears reasonable to expect that the main difficulty in the application of quaternions to the theory of electromagnetic field, electromagnetic interactions and many particle collisions may be overcome. The formulation shows promise in dealing with Lorentz transformations, electrodynamics and very high energy nuclear interactions.

Rising Inelastic Cross-Section and its Contribution to Steep Slope of the Cosmic Ray Energy Spectrum at High Energies.

Y. V. Rao.

Recent accelerator experiments have shown that the proton-proton cross section increases by about 10% between 20 and 200 GeV proton lab energies. This increase was predicted earlier by an analysis of cosmic ray data that also suggests that cross section continues to increase up to 2×10^4 GeV. An increase in total cross section will result in an increase in the interaction probability of cosmic ray particles with interstellar matter, particularly, if the cosmic ray beam contains an appreciable fraction of heavy primaries with inherently large cross sections.

In the present investigation the contribution of an increasing total cross section to steepening of the cosmic ray energy spectrum ($E \gtrsim 1$ T$_e$V) has been estimated. We have deduced the density of a nuclear species in the Galaxy using the relation $N = Q(\frac{1}{\lambda_e} + \frac{1}{\lambda_N})^{-1}$, where λ_e and λ_N are leakage mean free path and interaction mean free path respectively. Q denotes the cosmic ray source strength. In the case of protons and He, where $\lambda_e << \lambda_N$, a change in proton-proton cross-section will not effect the equilibrium of light cosmic rays. There are indications, however, that at extensive air shower energies there may be a large fraction of heavy nuclei in primary spectrum. Also, there are strong indications from several experiments that the ratio of Galactic secondary nuclei to primary nuclei decreases very steeply when the energy of the observed nuclei is above 30 GeV/nucleon. Therefore, to obtain an upper limit on the steepening in the primary spectrum we assumed a pure iron primary flux with spectral index $\gamma = 2.5$. Our preliminary calculations suggest that increasing total cross section contributes only in part to the steepening of primary energy spectrum at very high energies even if the

composition of the primary flux is assumed to be iron. The shape of the energy spectrum at high energies is of great astrophysical significance and any discussion of the structure of the primary cosmic ray spectrum at these energies must take into account the effect of increasing cross section.

3. WORKSHOP AND TECHNICAL DEVELOPMENT - J. Daly.

Throughout the year there was continued maintenance of the chemical etching apparatus. Modifications have been incorporated to prevent catastrophic increase in temperature in the event of breakdown of the controlling mechanism. This has proved successful. In addition, there was increased maintenance of the optical and electronic equipment used within the Section.

With the help of the technical staff, all the plastic detectors (1800 sheets 90 cm x 30.5 cm x 250 μm Lexan polycarbonate resin) for a high altitude balloon flight were cut and prepared. These were then sent to Bristol University. From 29/7/74 to 3/8/74 Mr. Daly, accompanied by Miss H. O'Donnell and Miss M. Cahill, was in Bristol to prepare the nuclear emulsion detectors for this flight. All of the detectors were then mounted in their respective modules and left ready for despatch to the launching site at Sioux Falls, South Dakota.

4. COMPUTING FACILITIES

During the year a remote access terminal was installed in No.5. The terminal, which was a standard teletype, was obtained from Time Sharing (Ireland) Ltd. on a rental basis. The system involves dialling the Dublin Time Sharing office via the local public telephone network. Access to a set of PDP 10 computers in London is then automatically provided via a private Dublin/London link.

The computing service provided by Time Sharing Ltd. is excellent. However, in practice great difficulty was experienced in using the system via the local lines from No.5. It is hoped that the situation will improve when the new telephone system is installed in the building. In August, Time Sharing was asked to take the terminal back temporarily and all rental charges for the months September to December 1974, inclusive, have been cancelled.

5. EXTERNAL ACTIVITIES, CONFERENCES, MEETINGS

Professor Ó Ceallaigh lectured by invitation at the University of Liverpool on 23rd May 1974. As a member of the Scientific and Technical Committee of Euratom and one of its representatives on the Groupe de Liaison Fusion he attended meetings at Ispra, Italy, (26th June 1974), Erice, Sicily, (September 1974) and Brussels (4th October and 18th December 1974). As a member of the Physics III Committee of CERN he attended meetings at Geneva on 25th June and 6th December 1974.

Professor Imaeda attended the Conference on Physics at Ultra High Energies held at Westfield College, University of London, from 3 to 7 September 1974.

Collaboration with Professor Fowler's Group at Bristol required working visits to Bristol from time to time by members of the academic and technical staffs. Drs. O'Sullivan and Thompson were in U.S.A. from 30th August to 29th September to assist field work and operations in connection with the 1974 flight expedition.

6. PUBLICATIONS

In preparation:

Quaternion Electrodynamics I and II. K. Imaeda.

7. PERSONAL

Miss H. O'Donnell was appointed to the position of Technical Assistant.

C. Geophysics Section

1. STAFF AND SCHOLARS

Senior Professor:

T. Murphy.

Professor:

Vacant

Assistant Professor:

D. G. G. Young (to 31 May 1974).

Research Assistant:

Vacant

Senior Technical Assistant:

T. J. Morley (to 2 June 1974).

Research Associates:

Rev. G. McGreevy (Maynooth College); R. P. Riddihough (Geological Survey); K. W. Robinson (Geological Survey).

Technical and Clerical Staff:

Miss A. Byrne; Miss E. Ryan; Miss V. Ward (from 8 July, 1974); G. Wallace.

Scholars:

D. Howard; G. Reynolds (to 31 July 1974); A. M. Correig Blanchar (from 3 June to 3 September, 1974).

Regarding the staff and scholars the year has been remarkable for the decrease in the number of personnel and in the inability to fill the vacant posts. The Senior Technical Assistant, T. J. Morley, retired on reaching the age limit and as this post was a personal one, it could not be filled forthwith. Protracted negotiations to have the post redesignated as one of Experimental Officer are still proceeding. On Dr. Young's resignation from Assistant Professorship efforts were made by advertising to attract candidates for the post of Professor or Assistant Professor which resulted in only one application, later withdrawn. The net result was that the Section had only one staff member for most of the period covered by this report and hence research activities were severely curtailed.

Mr. A. M. Correig Blanchar, an assistant in the Departamento de Fisica de la Tierra del Cosmos of the University of Barcelona, came as

a summer scholar, but no other suitable candidates offered themselves as Scholars.

2. RESEARCH WORK

(a) Gravity:

A brief survey was made by Dr. Young and Miss Ryan in the Monasterevin area following a geochemical and gravity survey carried out by a commercial prospecting company. The combined results confirmed our earlier geological interpretation of this district that the phenomenon associated with the decomposition of limestone strata was widespread. Some prospection drilling was carried out which partly bore out this interpretation and further development was suspended.

Due to printing difficulties the coloured contour gravity map on the scale of 1:750 000 was delayed in publication but eventually was produced satisfactorily.

(b) Magnetics:

An exploratory survey was carried out in a limited area SSW of Tipperary over a reported (by commercial prospecting company) magnetic anomaly, by Misses Ryan and Ward. A preliminary analysis indicates the causative body to be of sill-like form and because of the unusual palaeomagnetic effects reported by Morris in connection with Carboniferous volcanics further work is planned. A commercial firm is drilling in the area and has promised us the results of their investigation.

After the discovery made during the field exercises for University College students (Report for 1973-74) Mr. Howard, assisted by Mr. Wallace, carried out further surveys in the same area and followed it up with exploratory drilling. A sample of strongly magnetic rock was recovered, unlike the Ordovician rocks of the neighbourhood, appearing to be much younger but there was some doubt that the sample was from rock in situ.

It has been known to us from a commercial airborne survey carried out in Co. Wexford that some strong magnetic effects occurred in areas where no magnetic rocks had been encountered. With this information, and in view of the results obtained in Co. Kilkenny, Mr. Howard surveyed the likely areas resulting in the discovery of pieces of magnetic rock similar to those mentioned above. This opens up a fresh field of investigation.

Following these unusual occurrences Murphy investigated on the ground part of an airborne magnetic survey in Co. Waterford (made available to us by a commercial prospecting firm) and reached the

conclusion that intrusives of Tertiary age must occur although none have ever been recognised in this part of Ireland.

Dr. Riddihough working with magnetic data collected by the United States Naval Oceanographic Office, a copy of which is lodged with the Geological Survey, produced a map of the Total Magnetic Field west of Ireland and this forms the basis of a Bulletin now in press.

(c) Meteorology:

Routine observations of the meteorological elements were continued throughout the year, the autographic records tabulated and the results published.

(d) Seismology:

The number of portable seismic equipments was increased to ten and completely re-equipped by Mr. Wallace with amplifier-modulators using more up-to-date subassemblies resulting in much more compact units and eliminating the wet cells hitherto used. A complete single component seismic outfit can now be contained in an easily carried steel box. Trials of this equipment were undertaken in connection with work described later and proved very satisfactory.

During July and August when the Lithosphere Seismic Profile in Britain was undertaken the portable seismic stations were set up at various sites in the country depending on the location of the large detonations. One of the objects was to test the handling and operation of the new equipment and the main one was to ascertain the limits of detection following the most unusual effects noted and reported last year.

The exercise proved successful and the analogue records on magnetic tape are in the process of analysis.

Mr. Correig investigated the spectral characteristics of the head waves received at Bantry from the Porcupine Bank and Seabight explosive programme (Report 1973-74) using Fourier Analysis. His results confirmed the visual analysis that frequencies higher than 8 Hz occur on records from shots whose azimuths as viewed from the receiving stations are confined to certain sectors. These particular shots, from a different analysis, can be fitted into categories depending on their "time terms". The significance of these results is being investigated.

(e) Palaeomagnetism:

An extensive sampling program has been carried out by Mr. Howard on both sedimentary and igneous rocks of Devonian age all over Ireland in an attempt to establish an ancient Pole position for this period.

The subsequent results of palaeomagnetic studies on these rocks show unique pole positions for the Lower and Upper Devonian at 20S, 150E and 24N, 158E respectively. The Middle Devonian rocks sampled did not give interpretative results.

From a comparison of these pole positions with those from Silurian and Carboniferous rocks, the ancient pole appears to have remained more or less stationary from at least Upper Silurian (a pole for this age has been tentatively established in the present work) to Lower Devonian times and in possibly Mid-Devonian times moved to its Upper Devonian position. This was followed by a movement to its Lower Carboniferous position at the end of the Devonian.

These apparent movements of the ancient pole are encouraging and should enhance dating processes for rocks of these ages.

3. LECTURES AND FIELD EXERCISES

The series of eight weekly lectures on geophysics for geological students from the Universities was given during Michaelmas term. Students from both Dublin Colleges and one from University College, Cork, attended. The numbers were up to forty-five which was abnormally high because changes in Trinity College curriculum enabled two classes to attend.

The field geological exercise for Trinity College students took place in Co. Mayo and a very good example of Spontaneous Polarisation produced by graphite was demonstrated. Dr. Robinson of the Geological Survey demonstrated the use of a hammer refraction seismics.

4. PUBLICATIONS

(a) Published:

P. Morris:

A Tertiary Dyke System in South-West Ireland. Proc. R.I.A., 74B, No.13, 179-184, 1974.

D. G. G. Young and R. J. Bailey:

An interpretation of some magnetic data off the west coast of Ireland. Geological Journal, 9, Pt.2, 137-146, 1974.

Gravity Anomaly Map of Ireland. Communications of the Dublin Institute for Advanced Studies, Series D, No.32.

(b) In Press:

D. Howard:

Deep seated igneous intrusives in Co. Kerry, Ireland. Proc.R.I.A.

R. P. Riddihough:

A Magnetic Map of the Continental Margin west of Ireland including part of the Rockall Trough and the Faeroe Plateau. Communications of the Dublin Institute for Advanced Studies, Series D, No.33.

D. G. G. Young:

A geophysical interpretation of the structural development of the Kingscourt graben. Proc.R.I.A.

W. B. Stanford

7th October, 1975 CHAIRMAN.