

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

ANNUAL REPORT
1977

10 Burlington Road, Dublin 4

Pr1.7570

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 year ended
31 December 1977

Pr1.7570

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

Summary of Annual Report
of the work of the Constituent Schools
for the year ended 31 December 1977

School of Celtic Studies

Following the negotiations referred to in the Report for 1976 the academic staff was augmented by the appointment of a second Research Assistant and two Junior Research Assistants. However, a post as Professor was temporarily suspended to offset the additional junior posts. In all, eleven post-graduate scholars studied in the School, four from USA, three from England and one from Brittany.

Research in various areas of Irish language, literature, history and laws continued, and new work in Breton was begun.

Seven new volumes and two reprints were published. Sixteen articles by members of the School were published in periodicals. Parts 28, 29 and 30 of Roparz Hemon's Historical Dictionary of Breton were published in Rennes. A new Catalogue of Publications was issued towards the end of the year. Interest in the School's publications continued to grow and over 8,000 volumes were sold during the year.

Seminars, attended by many outside scholars as well as by members of the School, were held as usual. Seven papers were presented at the annual symposium held in March, two of them by staff members.

The Statutory Public Lecture was delivered in Trinity College on 18 February 1977 by Professor Dr. Karl H. Schmidt of the University of Bonn who lectured on 'The Languages of Gaul and Britain in Roman Times.'

School of Theoretical Physics

The School continued its research in the areas of general relativity, statistical mechanics, Lie Groups, and high-energy physics. One number of Series A of the Communications of the Institute and thirty papers were published during the year. Members of the School attended eighteen international conferences and gave twenty lectures in other institutions. Seventeen scientists from abroad visited the School.

Events which were continued from the previous year 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, entitled 'The Quest for a Unified Theory of Matter: How Significant is the Recent Progress?' was given in University College, Dublin, on 7 December 1977 by Professor O'Raifeartaigh.

School of Cosmic Physics

Astronomy Section:

Photographic plates taken with the UK Schmidt telescope at Siding Spring, New South Wales, are intended to delineate accurate information on period changes in Cepheid Variables in the Magellanic Clouds. This work is a new undertaking in the task of providing substantial data on these stars, which has been continuing for ten years.

The question of how Hill's Equation serves to describe the stability of orbits of minor planets and comets is proving to be of considerable importance in investigation of solar system motions.

A start has been made on work connected with the absorption produced by simple molecules in the upper atmospheres of cool stars.

The work of the Section was severely disrupted by a disastrous fire in October that destroyed all the laboratory equipment except for the computer installation, which was badly damaged, and all the modern scientific journals. Irreplaceable antique items were not seriously damaged or destroyed, but the photographic plate stock was almost destroyed in entirety.

Cosmic Ray Section:

The Bristol-Dublin collaboration continued successfully during the year. New results for the charge and energy spectra of ultra heavy cosmic rays have been obtained, based on improved analysis, further calibration and increased statistics. A long standing controversy between the Bristol-Dublin collaboration and the Berkeley-Houston collaboration concerning the form of the ultra heavy energy spectrum has been resolved in favour of the Bristol-Dublin groups. The Bristol-Dublin ultra heavy data along with the Berkeley Skylab data are now considered to be the standard material in the field for testing astrophysical models proposed by theorists.

The investigation of the very difficult cosmic ray transcobalt region begun last year, has already yielded very valuable results. This is the only significant track work in the transcobalt region to date.

A very successful balloon flight between Sicily and Spain was carried out in collaboration with the Bristol and Madrid groups. This was the first time such a flight was carried out successfully.

The theory of tachyons and superluminal Lorentz transformations has been investigated as an extension of the quaternionic formulation of classical electrodynamics. An attempt was made to ascribe a physical meaning to the particles and the complex space-time involved.

Geophysics Section:

Marine magnetic work was carried out in three areas - off the northwest coast of Donegal, southwest of the Kerry and Cork coasts from the Dingle Peninsula to Mizen Head and off the east coast of Wexford and Wicklow from Wicklow Head to Carnsore Point. The results were not always predictable from previous surveys on the land and the nature of

the magnetic rocks unsuspected off the coasts of Kerry and Wicklow requires investigation. In the Irish Sea some of the graben structures close to the coast can be delimited.

Site investigations for a tripartite seismic array were carried out and recordings have been made at Killmashogue, Co. Dublin, Croghan Hill Co. Offaly and Kingscourt, Co. Cavan.

In co-operation with the University of Birmingham a seismic crustal experiment was carried out in the Irish Sea using the explosion method. The stations in Ireland were in a line from Loughrea to Tullow. Bad weather at sea limited the exercise to one half.

The series of lectures on geophysics for Geological students was given during the Michaelmas term with an average attendance of thirty and a field exercise for the previous year's students took place in the Ox Mountains in the summer.

The Statutory Public Lecture of the School was delivered in University College, Dublin, on 31 May 1977 by Dr. Máire T. Brück of the University of Edinburgh. The lecture was entitled 'From here to Andromeda: The Local Group of Galaxies'.

INSTITIUID ARD-LÉINN BHAILE ÁTHA CLIATH
(Dublin Instituted for Advanced Studies)

Annual Report of the work of the Institute and
its Constituent Schools presented by the Council
for the year ended 31 December 1977

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 year ended 31 December 1977.

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 1977.

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 1977.
- 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.

1 - Constitution of the Council of the Institute and of the Governing Boards of the three Constituent Schools on the 31st December 1977

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; George F. Mitchell, M.A., D.Sc., 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 J. T. Lewis, B.Sc. Ph.D.; Dr. A.J. McConnell, M.A., M.Sc., Sc.D., F.T.C.D.; Professor T. Murphy, D.Sc.; Professor E. F. Fahy, M.Sc., Ph.D.

2. GOVERNING BOARD OF THE SCHOOL OF CELTIC STUDIES

Chairman:

Proinias Mac Cana, M.A., Ph.D.

Senior Professors:

James P. Carney, B.A., Fil.Dr.; David Greene, M.A.; Brian Ó Cuív, M.A., D.Litt.

Appointed Members:

Tomás de Bhaldraithe, M.A., Ph.D., D.Litt.; Gearóid Mac Eoin, M.A., Ph.D.; Archbishop Tomás Ó Fiaich, M.A., Lic.Hist.Sc.; Seán Ó Tuama, M.A., Ph.D.; Ernest Gordon Quin, M.A., F.T.C.D.; Gerard Victory, B.A., Mus.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:

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

Appointed Members:

Michael A. Hayes, M.Sc., Ph.D.; Thomas E. Nevin, D.Sc.; Patrick Quinlan, B.E., D.Sc., Ph.D.; Thomas D. Spearman, M.A., Ph.D. (Cantab.); Seán Seosamh Tóibín, M.Sc., Ph.D.; William Wright, M.A., Ph.D., Sc.D., C.Eng., F.I.C.E., F.Inst.Prod. E., F.I.E.I., F.R.S.E.

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.; Brian Henderson, B.Sc., M.A., Ph.D., F.I.P.; George F. Imbusch, Ph.D., D.Sc.; 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., M.Sc., Ph.D., D.Sc., F.T.C.D.

5. ADMINISTRATIVE STAFF

Registrar:

Lt. Col. John P. Duggan

Senior Clerk:

Maura Devoy.

Accounts Clerk:

Mary A. O'Rourke.

Clerks:

Angela Stubbs; Noreen Granahan; Desmond Pender.

II - Annual Report of the Governing Board of the School of Celtic Studies for the year ended 31 December 1977 adopted at its Meeting on the 28th April 1978.

1. STAFF, SCHOLARS AND EXTERN RESEARCH WORKERS

Professor Emeritus:

D.A. Binchy.

Senior Professors:

Brian Ó Cuív, Director of the School; James Carney; David Greene.

Professor:

Breandán Ó Buachalla.

Assistant Professors:

Pádraig de Brún; Fergus Kelly; Rolf Baumgarten.

Assistants (Part-time):

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

Research Assistants:

Mícheál Ó Siadhail; Malachy McKenna (appointed 1 August 1977).

Junior Research Assistant:

M. Katharine Simms (appointed 1 September 1977).

Research Associates:

Proinsias Mac Cana; Heinrich Wagner; Gearóid Mac Niocaill.

Technical and Clerical Staff:

Máire Breatnach; Máire Bean Uí Chinnseala.

Scholars:

Malachy McKenna (1 April - 31 July 1977); John Armstrong III (to 30 September 1977); Pádraig Ó Ciardha (to 30 September 1977); Nancy Stenson (to 31 December 1977); Virginia Blankenhorn; Christopher McAll; Kim R. McGone; Liam Ó Murchú; Hermann Moisl (from 1 October 1977); Cornelius G. Buttner (from 1 October 1977); Gwenael Leduc (from 1 October 1977).

Visiting Scholar:

R. Mark Scowcroft.

Extern Research Workers:

Dr. Cecile O'Rahilly; M. Louis Paul Nemo (Roparz Hemon);
Dr. Ludwig Bieler; Tomás Ó Cathasaigh; Mr. Ronald Black;
Dr. Brian Murdoch; An tAthair Pádraig Ó Fiannachta; Dr.
Nancy Dorian; Professor Pádraig Ó Riain; Dr. Donncha
Ó hAodha; Dr. Joan Radner; Professor Tomás Ó Concheanainn.

Two members of the Governing Board resigned during the year: Máirín Bean Uí Dhálaigh and Professor James H. Delargy. Following protracted negotiations the junior academic staff was strengthened by the appointment of a second Research Assistant and two Junior Research Assistants. As a consequence of the establishment of the posts of Junior Research Assistant an existing post of Professor has been temporarily suspended.

2. RESEARCH AND EDITING

Professor D. A. Binchy checked final proofs of Corus Iuris Hibernici and first proofs of 28 pages of introductory matter. See also section 7.

Professor Brian Ó Cuív continued his examination of the manuscript sources of the poems in T. F. O'Rahilly's Dánta Grádha and extended his researches to unpublished material belonging to this genre; completed some articles on topics in onomastics, metrics and phonology, as well as a short contribution for the Atlas of Ireland (to be published by RIA); saw Celtica XII through its various proofs stages and began editorial work for Celtica XIII; read revised proofs of Dán na mBráthar Mionúr; in the latter half of the year he joined Professor Binchy and Mrs. O'Sullivan in the task of seeing Corpus Iuris Hibernici through its final stages. See also sections 4, 5, 6 and 7.

Professor James Carney continued to work on early Irish poetry. See also section 6.

Professor David Greene continued work on (i) Saltair na Rann and (ii) History of the Irish Language. An article on 'The development of the -eó- future' was prepared for publication in Ériu XXIX and one entitled '"after" as an aspect marker' was accepted for publication in Studia Celtica 14. See also sections 4, 5, 6 and 7.

Professor Breandán Ó Buachalla continued his survey of the manuscript material appertaining to the history of Irish in Ulster which entailed several visits to Belfast. He continued his study of 'Vision' poetry in Irish and his field-work on the dialect of Cape Clear, Co. Cork. See also sections 6 and 7.

Dr. Pádraig de Brún completed the preparatory work on the introduction, appendices and indices of a Catalogue of Irish MSS. in Cambridge libraries. The following articles were accepted for publication in Éigse: (i) 'Lámhscríbhinní Gaeilge i Ros Cré'; (ii) 'Two additions to the Franciscan collection'; (iii) 'Father Paul O'Brien's Irish manuscripts - a note'. An article entitled 'Amhrán a bhaineann le Cogadh na nDeachaithe' was accepted for publication in the Journal of the Cork Historical and Archaeological Society. See also section 6.

Mr. Fergus Kelly continued work on an edition of Bechbretha and brought the index of Saltair na Rann up to date (lines 2513 - 3812). See also sections 6 and 7.

Mr. Rolf Baumgarten worked on the collection, arrangement and indexes of the Bibliography of Irish Linguistics and Literature, 1942 - 71. See also section 7.

Mrs. Nessa Doran checked proofs of Fasc. IV of Catalogue of Irish MSS. in the National Library of Ireland which was published during the year. MSS. G 177 - 188, 194 - 198, 201 - 207 of Fasc. V were catalogued. MS. R. 14.48 (Medical) Trinity College, Cambridge was catalogued for Pádraig de Brún.

Mrs. Anne O'Sullivan worked on proofs of Corpus Iuris Hibernici. She began re-cataloguing Irish manuscripts in the Library of Trinity College, Dublin and completed first drafts of MSS. 1316 (h. 2. 15a), 1317 (H. 2. 15b), 1322 (H. 3.3).

Mícheál Ó Siadhail checked and passed for press proofs of Téarmaí Tógála agus Tís as Inis Meáin and completed the preparation of Learning Irish - An Introductory Self-tutor (based on the Irish of Cois Fhairrge).

Dr. Malachy McKenna worked on (i) The Breton of Guémené-sur-Scorff Part III - Morphology of the noun; (ii) a linguistic analysis and normalizing the text of The Spiritual Rose. The following articles were accepted for publication in Zeitschrift für Celtische Philologie 36 (i) 'The Breton of Guémené-sur-Scorff Part II: Morphology of the Verb'; (ii) 'An index of words and their variants occurring in Part 1 of The Breton of Guémené-sur-Scorff'; (iii) 'A list of words with phonetic transcription from the speech of Guémené-sur-Scorff'; (iv) 'Addenda and corrigenda to Part 1 of The Breton of Guémené-sur-Scorff'.

Dr. M. Katharine Simms completed a card-index of first lines of bardic poetry from published manuscript catalogues and commenced compiling skeleton profiles of individual poems (subject, date, provenance, metre, etc.) with a view to subjecting the whole corpus of such poetry for analysis at the T.C.D. computer centre. An article on 'The O'Reillys and the kingdom of East Breifne' was accepted for publication in Breifne (1978). See also sections 6 and 7.

Mr. John Armstrong III completed his doctoral thesis on 'Syntax of the VN in Modern Irish prose 1600 - 1650' and prepared an edition of the Old Irish poem Tuathal Techtmar ba rí Temrach.

Pádraig Ó Ciardha worked on the eighteenth century Co. Leitrim School of Poetry of Tadhg Ó Rodaighe and did some preparatory editorial work on some of the poems. He collaborated with Dr. Nancy Stenson in work on the Irish of Rath Cairn. An article on Tadhg Ó Rodaigh was accepted for publication in Breifne.

Dr. Nancy Stenson revised and re-wrote her dissertation 'Topics in Irish Syntax and semantics' with a view to publication. She continued field work in Ráth Cairn (i) studying noun plural formation; (ii) collecting data on verb morphology; (iii) providing data from Ráth Cairn to correspond to that in the Linguistic Atlas for other dialects; elicited and transcribed responses to Atlas questionnaire in Ráth Cairn (both from Connemara-born and Ráth Cairn-born speakers) for comparison with points recorded in Connemara. Work began on editing a manuscript in the Public Record Office of three sermons from East Galway (ca. 1800). An article on 'Plural Formation in Ráth Cairn Irish' was accepted for publication in Éigse. See also sections 6 and 7.

Miss Virginia Blankenhorn continued work on the intonation used in the Irish of coastal Connemara and investigated the stylistic and structural features of Irish vocal melody with a view to drawing some conclusions about the historical development of Irish song. An article on 'Intonation in Connemara Irish: a preliminary study of kinetic glides' was submitted for publication in Phonetica. See also section 6.

Mr. Christopher McAll revised and completed work on the text and translation of his edition of Uraicecht Becc and prepared the introduction and notes. He commenced work on the preliminary chapters of the Commentary on the Law of Status which is to accompany the edition.

Mr. Kim R. McCone continued work on his D. Phil. thesis on 'Aspects of Indo-European sentence patterns and their role in the constitution of the Old Irish verbal system'. An article entitled 'The Dative Singular of the Old Irish Consonant Stems' was accepted for publication in Eriu. See also section 6.

Liam Ó Murchú continued work on an edition of Cúirt an Mheán Oíche based on the Cambridge ms. Add. 6562. An article entitled 'Dearbhaithé ó Cho. an Chláir' was accepted for publication in Éigse XVII.

Mr. Hermann Moisl worked on his D.Phil. thesis: Aspects of the Relationship between Secular and Ecclesiastical Learning in England and Ireland in the Early Post-Conversion Centuries.

Mr. Cornelius G. Buttimer worked on: (i) bardic poems addressed to members of the Roche family, Co. Cork in RIA MS. 23 E 29; (ii) 'A Chaisil as dimbrig soin' an elegy on Fedlimid mac Crimthain in the Book of Lismore; (iii) the use of Early Irish linguistic forms and literary motifs in the writings of Máirtín Ó Cadhain.

Mr. Gwenaël Leduc worked on establishing the texts and translations of three mystery plays in Breton from manuscripts of the Institute: Life of S. Julite (Vannetais Dialect), Life of S. Genevieve (2mss. in late Middle Breton) and prepared an edition of the late Middle Breton printed text of The Mirror of Confession. The following articles were accepted for publication in Études Celtiques: (i) 'Notes to the Latin Grammar in Middle Breton'; (ii) 'Note on an Old Breton Gloss on an Anglo-Saxon phrase'.

Mr. R. Mark Scowcroft worked on (i) his doctoral thesis 'The hand and the Child: Studies in the Northern Hero'; (ii) 'Chastity and the Composition of the Four Branches'; (iii) an edition of the early Irish story of the three children who spoke at their birth.

Professor Gearóid Mac Niocaill re-corrected first proofs of the pre-Patrician text of The Annals of Ulster,

Professor Ludwig Bieler, General Editor of Scriptores Latini Hiberniae, completed work on his edition of The Patrician Texts in the Book of Armagh which was sent to press in October 1977.

Dr. Cecile O'Rahilly worked on a synthesis and discussion of the extant versions of Táin Bó Cuailnge. See also section 7.

M. Roparz Hemon checked final proofs of his edition of Doctrin an Christenien which was published as Volume IV in the Mediaeval and Modern Breton Series. See also section 7.

Tomás Ó Cathasaigh checked final proofs of The Heroic Biography of Cormac Mac Airt which were passed for press during the year.

Mr. Ronald Black continued his work of cataloguing the Irish manuscripts in the National Library of Scotland. Descriptions of the following manuscripts were submitted to Professor Greene:- 73.1.17-24; 73.2.1-24; 73.3.1-21; 73.4.1-6; 73.5.1.

Dr. Brian Murdoch saw The Irish Adam and Eve Story Vol. II through the press.

An tAthair Pádraig Ó Fiannachta checked proofs of Clár Lámhscríbhinní Gaeilge: Leabharlanna na Cléire agus Mionchnuasaigh Fascúl 1.

Dr. Nancy Dorian read proofs of East Sutherland Gaelic.

Professor Pádraig Ó Riain checked proofs of his edition of Cath Almáine which is to be published as Volume XXV in the Mediaeval and Modern Irish Series.

Dr. Donncha Ó hAodha checked first and revised proofs of his edition of Bethu Brigte.

Dr. Joan Radner read revised proofs of her edition of Fragmentary Annals of Ireland.

3. STATUTORY PUBLIC LECTURE

A statutory lecture entitled 'The Languages of Gaul and Britain in Roman Times' was delivered by Prof. Dr. Karl Schmidt (University of Bonn) in Trinity College, Dublin on 18 February 1977.

4. SEMINARS

Professor Brian Ó Cuív held a weekly seminar on The Manuscript Tradition of the Poems in O'Rahilly's Dánta Grádha during Hilary Term.

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

5. SYMPOSIUM

On March 11 and 12 1977 a symposium was held for university and college staff and research workers. The following papers were read:-

Tomás Ó Concheanainn:	Gnéithe den Dinnsheanchas
E. G. Quin:	the f-future revisited
Brian Ó Cuív	Some Early Modern Irish love-poems.
Tomás Ó Maílle:	Roinnt sloinnte
Gearóid Mac Eoin:	Suithchern 7 Rónan - scéal as Cúige Mumhan
David Greene:	The perfective constructions in Modern Irish
Pádraig Ó Riain	St. Finbarr : a study in a cult

6. EXTERNAL ACTIVITIES

Professor Brian Ó Cuív attended (i) the meeting of the Council for Names Studies in Great Britain and Ireland, London, April 16; (ii) Conference on Celtic Phonology, Coleraine, June 28 - July 1, and lectured on 'Metrics and Irish Phonology'; lectured on 'Mediaeval Irish Grammar and Grammatical Theory' in the Mediaeval Studies Seminar in U.C.D. on November 10; in his capacity as the representative of the Hebdomadial Council of the University of Oxford attended two meetings (in October and December) of the Board of Electors to the Jesus Professorship of Celtic in Oxford.

Professor James Carney, at the invitation of the Cultural Relations Committee, attended and delivered a lecture at the Conference of Irish Studies held at Denver, Colorado, from 25 April - 2 May 1977.

Professor David Greene held a seminar in Uppsala University in June 1977 on 'The Vikings' and delivered a paper on 'The influence of Scandinavian on the Irish Language'.

Professor Breandán Ó Buachalla attended the Third International Conference of Historical Linguistics held at Hamburg 21 - 26 August 1977. At Magee College, Derry, on 21 October 1977, he lectured on 'Edward Bunting'.

Mr. Fergus Kelly lectured on 'Early Irish Law' to the Kiltiernan Branch of the Irish Countrywomen's Association on 8 March 1977.

Dr. Malachy McKenna delivered a lecture on 'The development of stress in the Celtic languages, with special reference to Breton' at University College, Galway, 28 November 1977.

Dr. M. Katharine Simms lectured to The Dublin University Medieval Society on 'The O'Neills and the Gaelic Resurgence' at Trinity College, Dublin, on 19th October 1977.

Dr. Nancy Stenson attended the Netherlands Linguistic Society Annual Meeting at Amsterdam and delivered a paper on 'Semantic Coding in Surface Structure' on 21 January 1977.

Miss Virginia Blankenhorn attended the Celtic Phonology Conference in Coleraine in June 1977 and read a paper entitled 'Intonation in Connemara Irish'. On 14 October 1977 at University College of Wales at Aberystwyth she lectured on 'Cerddoriaeth Draddodiadol yng Nghorllewin Iwerddon'.

Mr. Kim R. McCone attended the Graduate Seminar at University College, Galway, in April 1977 and read a paper entitled 'Irregularities after Pretonic Preverbs and the Absolute and Conjunct Endings in Old Irish'.

7. PUBLICATIONS

Despite continuing difficulties with printers seven new works were published and two works were reprinted. Seventeen further works (including seven for reprinting) were with the printers at the end of the year and most of these, including the six volumes of Professor Binchy's *Corpus Iuris Hibernici*, are due to be published in 1978. A new Catalogue of Publications, replacing that issued in 1971, was compiled and issued towards the end of the year. Sales of publications continued to expand and over 8,000 volumes were sold during the year.

(a) Books published by the Institute:

The Irish Adam and Eve Story from *Saltair na Rann*, Volume I: Text and Translation, Edited by David Greene and Fergus Kelly. 113pp. £3.60

The Irish Adam and Eve Story from *Saltair na Rann*, Volume II: Commentary, Brian Murdoch. 169pp. £6.00

Catalogue of Irish MSS. in National Library of Ireland, Fasc. III, MSS. G 70 - G 114. Nessa Ní Sheághdha. 137pp. £2.70.

Catalogue of Irish MSS. in National Library of Ireland, Fasc. IV, MSS. G 115 - G 159. Nessa Ní Sheághdha. 135pp. £4.80

Doctrin an Christenien. (Mediaeval and Modern Breton Series Volume IV) Edited by Roparz Hemon. xii + 83pp. £2.10.

Celtica Volume XII. Edited by Brian Ó Cuív. 222pp. £9.00.

The Heroic Biography of Cormac Mac Airt. Tomás Ó Cathasaigh. xii + 137pp. £4.50.

(b) Books published outside the Institute:

David Greene:

Ériu XVIII. Published by The Royal Irish Academy and edited by David Greene and Proinsias Mac Cana.

Roparz Hemon:

Historical Dictionary of Breton: Rannou 28, 29, 30. (Saourus-Skein). Published by Preder, Rennes.

(c) Reprints

1. Gaeilge Chois Fhairrge
2. Merugud Uilix Meic Leirtis

(d) Contributions to periodicals and other publications:

Brian Ó Cuív:

Some Possible Congeners of English Slang 'to sock'. Celtic Linguistics 1976 (=Word 28, 140-45).

Donnchadh Mór's Poem on the Wren. Éigse XVII. 13-18

The Earl of Thomond and the Poets, A.D. 1572. Celtica XII. 125-45.

David Greene:

The 'Act of Truth' in a Middle-Irish story. Saga och Sed 1976 (1977). 30-37.

Feras, Banas and some related abstracts. Ériu XXVIII. 155-161.

'Cheap' and 'dear' in Modern Irish. ibid. 161-167.

Archaic Irish. Indogermanisch und Keltisch. (Wiesbaden 1977), 11-33.

Formy passivnogo preterita v drevneirlandskom jazyke. Teorija jazyka; Anglistika; Keltologija. Moscow 1976 (1977).

Breandán Ó Buachalla:

Nótaí ar Ghaeilge an Tuaiscirt I. Éigse XVI. 285 - 316.

Reviews. Celtica XII. 211-22.

Ní and cha in Ulster Irish. Ériu XXVIII. 92-141.

Pádraig de Brún:

A seventeenth-century translation of the first psalm. Éigse XVII. 61-6.

Rolf Baumgarten:

'The Irish settlements in Wales' by M. Dillon. Edited for Celtica XII. 1-11.

M. Katharine Simms:

The Concordat between Primate John Mey and Henry O'Neill (1455).
Archivium Hibernicum XXXIV. 71-82.

Niall Garbh II O'Donnell, king of Tír Conaill 1422-39. Donegal
Annual XII 7-21.

Cecile O'Rahilly:

Varia. Celtica XII. 185-196

8. MANUSCRIPT CATALOGUING

Cataloguing of the Irish manuscripts in the National Library of Ireland has now reached G 207. Work was continued on collections of Irish manuscripts in diocesan colleges in Ireland and in libraries in Scotland. The Catalogue of the Irish Manuscripts in Cambridge was completed and publication is expected in 1978. Discussions took place between the Director and the Keeper of Western Manuscripts in the Bodleian Library in Oxford with a view to possible co-operation in the compilation and publication of a catalogue of Irish manuscripts in Oxford.

III - Annual Report of the Governing Board of the School of Theoretical Physics for the year 1977 adopted at its Meeting on 23rd June 1978.

1. STAFF AND SCHOLARS

Emeritus Professor:

John L. Synge

Senior Professors:

John T. Lewis, Director from 1 January 1975; Rev. James R. McConnell; Lochlainn S. O'Raifeartaigh.

Visiting Scientists:

M. F. Atiyah, 7-9 December; A. O. Barut, 20-30 May; E. Corrigan, 24-25 March; J. Eells, 13-15 April; D. E. Evans, 21 August - 5 September; G.W. Ford, 8 August - 11 September; L. Gross, 25-28 June; P.W. Higgs, 25-26 May; W. Israel, 9 June; L. Jánossy, 11 July - 11 August; S. Kamefuchi, 31 August - 4 September; J. Madore, 14-25 February; U. H. Niederer, 18-30 September; R. F. O'Connell, 1 June - 15 August; M. Scheunert, 1 January - 31 December; K. C. Wali, 10-16 July; E. C. Zeeman, 2 - 4 May.

Assistant Professors:

Z. Perjes to 30 June; J. H. Rawnsley from 1 October.

Research Associates:

P. A. Hogan, M. Tuite (Maynooth), W. Sullivan (UCD) from 1 October; S. Dineen, D. J. Judge, Rev. J. D. McCrea (UCD); P. S. Florides, B. K. P. Scaife (TCD); A. I. Solomon (Open University); Rev. J. Spelman, D. H. Tchrakian (Maynooth); J. M. Golden (Foras Forbartha); T. Garavaglia (Kevin St. College of Technology); M. J. Conneely, M. J. Newell (UCG); J. R. Saraf (NUU); all appointments to 31 December 1978.

Scholars:

R. Wilson, J. H. Rawnsley, to 30 September; W. Mecklenburg, D. O'Brien; M. Tuite, from 1 January to 30 September; N. Baaklini, M. F. Fry, G. O'Brien, from 1 October.

Research Student without stipend:

B. Goldsmith (Kevin St. College of Technology).

Secretary and Assistant Librarian (to 31 March):

E. R. Wills.

Librarian-Executive (from 1 April):

E. R. Wills.

2. GENERAL

A party of twenty-five students from the Technische Hogeschool Eindhoven (Studievereniging voor technische Natuurkunde "Johannes Diderik van der Waals") visited the School on 18 October. Prof. Lewis and Prof. O'Raifeartaigh gave them two short talks.

3. STUDY AND RESEARCH

Prof. Lewis continued his work on the approach to equilibrium in classical and quantum statistical mechanics in collaboration with Prof. J. V. Pulè (Malta). He completed work on the manuscript of "Dilations of irreversible evolutions in algebraic quantum theory" (See § 100.

Professors Ford, Lewis and McConnell continued their collaboration in the study of Brownian motion; they studied inertial effects, and their implications for complex polarizability and nuclear magnetic relaxation.

Prof. McConnell calculated the correlation functions for spherical harmonics resulting from rotational Brownian motion of a linear molecule. He worked on problems related to dielectric relaxation in collaboration with Prof. B.K.P. Scaife and Dr. A. Morita (TCD), and on aspects of electrical conduction in collaboration with Professor J. H. Calderwood (Salford). Professor McConnell continued his studies of symmetric functions in collaboration with Professor Newell and the late Professor H. D. Foulkes (Swansea).

Most of Professor O'Raifeartaigh's work during 1977 was directed towards completing an article on spontaneously broken gauge theories, for the Institute of Physics (to be published in Reports on Progress in Physics); these theories are now believed to underlie the fundamental physical interactions, and will, it is hoped, lead to a unified theory of the weak and electromagnetic interactions. He also continued his research on soliton (finite action and finite energy) solutions of the field equations for such gauge theories. There is great topical interest in these solutions, because of their relationships to soliton solutions of non-linear equations in other branches of physics and mathematics.

Dr. Scheunert continued his research on the theory of graded Lie algebras and their representations; in collaboration with Dr. V. Rittenberg (Bonn) he prepared a work on the elementary construction of graded Lie groups for publication. Dr. Scheunert also investigated the irreducible representations of the $osp(3,2)$ algebra, and he prepared a review on the classification of simple graded Lie algebras.

Prof. Perjes studied the coupled Einstein-Maxwell equations, and found a new solution for them, corresponding to an irradiated Schwarzschild source. In research on twistor theory he investigated the mass splittings of hadron multiplets, and he refined the nonet operator which he had previously constructed in collaboration with G. Sparling.

Prof. Rawnsley developed a simplified approach to the pairing of half-forms in geometric quantization, and extended Kostant's results to complex polarizations; he applied these results to the Kepler manifold and obtained the first example of a non-unitary pairing. He refined results of Tyupkin et al. on the existence of solutions of the monopole equations with finite energy, and showed that these solutions are regular. He used these improved results in a collaboration with Prof. O'Raiheartaigh in work on the high-isospin limit of the monopole equations. Prof. Rawnsley analysed the results on self dual Yang-Mills fields described by Prof. M. F. Atiyah (Oxford), and found a simpler expression for them, in terms of quaternions. He extended some results on the non-linear $\bar{\partial}$ -operator, and found some applications for them in the representation theory of semi-simple Lie groups.

Prof. Rawnsley and Dr. Tchrakian collaborated in the study of some problems in theories of magnetic monopoles; they defined the electromagnetic field on a t'Hooft-Polyakov gauge theory, with gauge groups $SO(N)$ and $SU(N)$. They also collaborated on the construction of exact (pseudoparticle) solutions of the Yang-Mills field equations, with $SO(5)$ and $SO(6)$ internal symmetry. Dr. Tchrakian studied some aspects of the supergravity theory of Deser and Zumino.

Dr. Tchrakian and Dr. Hogan collaborated in a generalisation of the initial value problem for the Maxwell equations to the case of linearised Einstein equations.

Dr. Hogan made a model of a globular cluster - a reconstruction in Minkowskian space-time of Einstein's assembly of test-particles. He supervised the work of Miss M. Imaeda, and with her studied the Penrose-Process for extracting energy from a rotating black hole; they adopted a new approach, which utilises the equation of geodesic deviation. They obtained some results concerned with the scattering of scalar, electromagnetic and (weak) gravitational waves from a rotating black hole; in this work they used the characteristic surfaces of the respective field equations on the background of the black hole. These studies are continuing. Dr. Hogan began a systematic approach to the extraction of the motion of the sources of the Robinson-Trautman solutions of Einstein's equations from the field equations. These solutions represent the Liénard-Weichert solutions of Einstein's equations, and play a central role in the study of the dynamics of point masses in general relativity. Dr. Hogan collaborated with Dr. G. O'Brien in a study of some of these solutions; they obtained a solution they believe to be new: this solution is a representation of a radiating, fast-moving particle, and the radiation is entirely electromagnetic.

Dr. G. O'Brien continued her work in collaboration with Dr. Mc Crea on the motion of rotating bodies in general relativity; they used the Synge approximation.

Professor Florides studied the complete field of a general static spherically symmetric distribution of charge in general relativity, and the Newtonian analogue of the relativistic Oppenheimer-Snyder solution.

Dr. Golden worked on a general solution of the problem of the contact between a rigid punch and a visco-elastic half-plane; this work has been prepared for publication.

Dr. Solomon worked with Dr. W. Montgomery (Amsterdam) on an extension to the two-dimensional Ising lattice, and to other systems, of the algebraic technique they had already used in their XY model.

Dr. Wilson continued work, begun during the previous year, on the re-formulation of the quantum theory of infinite component fields as a model for composite objects such as hadrons; he also considered applications of this work.

Dr. Tuite worked on the problem of two particles with classical isospin interacting through a Yang-Mills field. He began a study of the classical description of the interaction of a particle with a non-Abelian field; he considered the use of anti-commuting classical variables in such a description. With Dr. O'Brien he studied the properties of the meron solutions for a Yang-Mills field theory; they considered the relevance of these properties to the problem of quark confinement.

Dr. D. O'Brien and Dr. Mecklenburg investigated instanton and monopole type solutions of non-Abelian gauge theories; this work has been written up for publication, in two papers. Dr. O'Brien and Dr. Baaklini worked on gravitational instantons and a paper arising from this work is in course of publication. Dr. O'Brien worked also on relativistic wave equations, and arising from this work two papers have been prepared for publication.

Dr. Mecklenburg continued previous work on associated neutrino production, and began some work on high dimensional theories.

Dr. Baaklini completed an investigation of a non-linear de Sitter generalization of the Cartan-Einstein-Weyl theory of gravity, and of supergravity, within the frame-independent framework and formalism of differential forms; he deduced some implications concerning the gauge-group theoretical structure of these theories, and concerning an effective geometrical model of quark confinement. He also studied the origin of the gravitational constant in weak and strong gravity, considered the effect of introducing a fundamental cutoff, of the order of Planck's length, in quantum gravity, and obtained a gravitational instanton solution within the $SL(2, C)$ gauge-invariant Vierbein theory of gravity.

Dr. Fry used techniques recently introduced by Zipatov and others to calculate the leading growth of the coefficients of the (Feynman) perturbation series for the ground-state energy of the anharmonic oscillator and the super-renormalizable field theories of ϕ_2^4 and Y_2 . By assuming sufficient analyticity in the coupling constant plane, and saturating the functional integral for the partition function by instantons, and with Gaussian fluctuations about the instantons, Dr. Fry calculated the leading growth of the expansion coefficients. Dr. Fry began work on the divergence of the renormalized perturbation series for the two-dimensional scalar Yukawa interaction, and also, in collaboration with Dr. S. Sen (TCD), on large-order behaviour of the ground-state energy density of ϕ_2^4 .

Dr. Sullivan, in collaboration with Mr. R. Flood (Kevin St. Coll. of Tech.), studied the relationship between conditional probabilities and potentials in classical lattice particle systems with exclusion, using certain techniques from algebraic topology. Work towards extending the lattice results to the continuous case is in progress.

Dr. Garavaglia continued his research on the analytical and numerical solutions for the energy levels of macromolecules. He also developed analytical and numerical methods for the study of polarization effects in electromagnetic interactions.

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 Cosmis Physics.

The following review and seminar lectures were given:

- Professor A. O. BARUT (Boulder, CO): Remarkable consequences of the anomalous magnetic moment of elementary particles.
Remarkable properties of the magnetic monopole models of hadrons - Betti numbers as quantum numbers.
- Dr. E. CORRIGAN (Durham): Instantons.
- Prof. J. EELLS (Warwick): Stochastic Riemannian geometry
(2 lectures)
- Prof. P. W. HIGGS (Edinburgh): Gravity, supersymmetry and secret symmetry.
- Prof. W. ISRAEL (Edmonton): Black holes, particle creation and thermodynamics.
- Prof. L. JÁNOSY (Budapest): Wave mechanics and the photon.
Theory of relativity based on physical reality.
- Dr. J. MADORE (Inst. H. Poincaré, Paris): Monopole solutions of gauge theories.
- Dr. J. H. RAWNSLEY (DIAS): Hilbert space methods in the calculus of variations.
- Dr. M. SCHEUNERT (Bonn & DIAS): Classical simple graded Lie algebras (3 lectures).
- Prof. K. C. WALI (Syracuse): Monopoles and strings.
- Prof. E. C. ZEEMAN (Warwick): Catastrophe theory: Catastrophe model for the stability of ships.

A series of 6 seminars on Twistors and Instantons was given by Dr. J. H. RAWNSLEY (DIAS). A series of 7 seminars on the Geometry of Instantons was given by Prof. L. O'RAIFEARTAIGH and Dr. J. H. RAWNSLEY (DIAS), Dr. S. SEN (TCD), Dr. M. SCHEUNERT (Bonn & DIAS), and Prof. M. F. ATIYAH (Math. Inst., Oxford). Seminars of the Relativity Theory Group (Dublin) were given at DIAS by Dr. P.A. HOGAN (Maynooth & DIAS) and Mr. C. O'CARROLL (UCD) on The Re-Construction in Minkowskian Space-Time of Einstein's Swarm of Test Particles, and on Junction Conditions in the Einstein-Cartan Theory, respectively.

5. COURSES

A Course of 4 lectures was given by Prof. J. T. LEWIS (DIAS) on Statistical Mechanics of Infinite Systems. A series of lectures suitable for final year undergraduates, and beginning graduate students, in Mathematics and Mathematical Physics, given by Prof. LEWIS on Statistical Mechanics, commenced in October and will continue through the academic year to June 1978.

6. STATUTORY PUBLIC LECTURE

A Statutory Public Lecture under the auspices of the School was delivered by Professor O'RAIFEARTAIGH on 7 December, in University College Dublin; the title of the lecture was 'The Quest for a Unified Theory of Matter: How Significant is the recent progress?'

7. SYMPOSIA

Two mathematical symposia were held during the year, 6-7 April, and 19-20 December. The attendances (49 in April, 47 in December) included professors, lecturers and graduate students from the several Irish universities, the Colleges of Technology, and other Irish institutes and colleges.

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

APRIL:

- Dr. F. HOLLAND (UCC): Conditions for membership of H^P involving the area function.
- Dr. S. DINEEN (UCD): Zero-one laws for probability measures on locally convex spaces.
- Prof. M. L. NEWELL (UCG): Power endomorphisms are quite normal!
- Dr. P.K. CURRIE (UCD): Rayleigh waves on viscoelastic materials.
- Dr. J. McDERMOTT (UCG): A topological approach to infinite permutation groups.
- Dr. N. O'MURCHADHA (UCC): Extremal slices in Riemannian manifolds.

DECEMBER:

- Dr. P. A. HOGAN (Maynooth & DIAS): A new version of the Kerr solution.
- Dr. J.D. McCREA (UCD & DIAS): Spin precession in binary star systems.
- Dr. P. DOLAN (Imperial Coll.): Encke's problem.
- Prof. M. HAYES (UCD): Energy flux for plane waves.
- Dr. J. DUNWOODY (QUB): Steady flow of heat conducting simple fluids.
- Dr. W.G. SULLIVAN (UCD & DIAS) &
Mr. R. FLOOD (Kevin St. Coll. Tech): Homology and conditional probability.

8. VISITORS.

For lectures given by visitors, see Section 4.

- Prof. M. F. Atiyah (Oxford) 7-9 December;
- Prof. A. O. Barut (Boulder, CO) 20-30 May;
- Dr. E. Corrigan (Durham) 24-25 March;
- Prof. J. Eells (Warwick) 13-15 April;
- Dr. D. E. Evans (Oslo) 21 August - 5 September;
- Prof. G. W. Ford (Ann Arbor, MI) 8 August - 8 September;
- Prof. L. Gross (Cornell, NY) 25-28 June;
- Prof. P. W. Higgs (Edinburgh) 25-26 May;
- Prof. W. Israel (Edmonton) 9 June;
- Prof. L. Jánosy (Budapest) 11 July - 10 August;
- Dr. S. Kamefuchi (Tsukuba, Tokyo) 31 August - 4 September;
- Dr. J. Madore (Inst. H. Poincaré, Paris) 14-25 February;
- Dr. U. H. Niederer (Zurich) 18-30 September;
- Prof. R. F. O'Connell (Baton Rouge, LA) 1 June - 15 August;
- Dr. M. Scheunert (Bonn) continuing;
- Prof. K. C. Wali (Syracuse) 10-16 July;
- Prof. E. C. Zeeman (Warwick) 2-4 May.

9. EXTERNAL ACTIVITIES

From 19-23 January Prof. Lewis visited the Istituto di Scienze Fisiche of the University of Milan and gave two lectures on Non-Equilibrium Statistical Mechanics. He visited the Laboratorio di Cibernetica, Arco Felice, near Naples from 23-29 January, and gave a seminar there on Irreversible Flows. He also gave a lecture on Boson condensation at the University of Salerno on 26 January. He lectured to the Irish Mathematics' Teachers Association at their meeting in St.

Patrick's College, Drumcondra, on 30 October. He attended the Irish Mechanics Group meetings in Dublin, 25-26 February, and in Limerick, 7-8 October; at the Limerick meeting he gave a lecture on the Mean Motion of a Rigid Body driven by a Random Couple. He visited the University of Malta from 14-24 June to continue his collaboration with Prof. J. V. Pulè. With Dr. W. Sullivan he attended the Conference on Vector Space Measures at TCD, 26 June to 2 July. He gave a lecture to the UCD Mathematical Society on 25 November.

Professor McConnell attended the meeting of the Dielectrics Society, at Cambridge, 29-31 March. He visited the University of Salford 5-20 May. He attended the IUPAP Conference on Statistical Physics in Haifa 24-30 August, and reported on research in the School on the rotational Brownian motion of an asymmetric body. He was an Invited Speaker at the Conference on Electrical Insulation and Dielectric Phenomena, Colonie, N.Y., 17-20 October; during October and November he gave seminars and lectures at Louisiana State University (Baton Rouge), Duke University (North Carolina), St. Bonaventure University (New York), the Rockefeller University (New York), and the State University of New York at Stony Brook.

From 5-14 January Professor O'Raiheartaigh visited the Swiss National Institute for Nuclear Research, Villigen, and gave a course of four lectures on Spontaneously Broken Gauge Theory. From 1-5 February he visited the University of Paris-Sud (Orsay), and gave a seminar on Functional Integrals and Effective Potential. On 17 February he visited the University of Liverpool, and gave a seminar on Spontaneously Broken Gauge Theory; he visited University College Galway on 2 March, and lectured to the Students Mathematical Society on Fundamental Interactions. He participated in the International Conference on the Mathematical Problems in Theoretical Physics, Rome, 6-15 June, and the VI International Colloquium on Group Theoretical Methods in Physics, Tübingen, 18-22 July, and gave talks entitled 'Static Solitons in More than One Dimension' at both of these conferences. He participated in the III School of Elementary Particles and High Energy Physics, Primorsko (near Sofia), 5-15 October, and gave a course of four lectures on soliton solutions of gauge field equations. From 21-23 November he participated in a Workshop on Developments in Soliton Solutions of Gauge Theories, at ICTP, Trieste. He visited the Max Planck Institute, Munich, on 13 December, and gave a seminar on Static Soliton Solutions of Non-Abelian Gauge Theories. On 24 December he commenced a one-month visit to the Institut des Hautes Études Scientifiques, Bures-sur-Yvette, France.

Dr. Scheunert and Prof. Rawnsley attended the Conference on Differential Geometrical Methods in Mathematical Physics, Bonn, 13-16 July. Prof. Rawnsley attended the British Mathematical Colloquium, Edinburgh, the Oxford Relativity Meeting in April, the Arbeitstagung, Bonn, 21-25 June, the Oberwolfach Meeting on 'Representations of Semi-Simple Lie Groups', 26 June to 2 July, and the SRC/LMS Research Symposium on the Representation of Lie Groups, 3.14 July.

Dr. Hogan attended the Meeting of the Irish Mechanics Group, Limerick, 7-8 October, and gave a seminar on A Reconstruction in Minkowskian Space-Time of Einstein's Assembly of Test-Particles.

Dr. McCrea and Prof. Florides attended the Eighth International Conference on General Relativity and Gravitation, 7-12 August, at Waterloo (Ontario); Dr. McCrea gave a talk on Spin Precession in Relativistic Binary Systems, and Prof. Florides gave a talk on The Complete Field of a General Static Spherically Symmetric Distribution of Charge.

Dr. Tchrakian attended the Rutherford High Energy Meeting in January. In October he commenced a visit, under the Royal Irish Academy / Royal Society Exchange Programme, to Imperial College (London).

Dr. Solomon attended the IUPAP Conference on Statistical Physics, Haifa, 24-30 August; he gave a seminar on Non-Standard Analysis at the Oxford Meeting of the British Mathematical Association on 1 December.

Dr. Tuite attended the International Conference on the Mathematical Problems in Theoretical Physics, Rome 6-15 July.

Dr. D. O'Brien attended the 1977 Cargèse Summer Institute, on Hadron Structure and Lepton-Hadron Interactions, 4-23 July.

Dr. Mecklenburg visited Vienna for one week in July, in connection with computer work in support of his research on associated neutrino production.

10. PUBLICATIONS

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

- (1) Communications of the Dublin Institute for Advanced Studies, Ser. A. (Theoretical Physics)

Published:

No. 24 Dilations of irreversible evolutions in algebraic quantum theory.
By D. E. Evans and J. T. Lewis. Price £3.15. pp.v. + 104. Published 15 December 1977.

- (2) Contributions to periodicals and other publications:

Published:

J. R. McConnell:

* Diffusion equation study of rotational Brownian motion. Proc. RIA 77A (1977), 13-30.

G. W. Ford, J. T. Lewis & J. R. McConnell:

Rotational Brownian motion of an asymmetric top. Phys. Lett. 63A (1977), 207-208.

J. T. Lewis & M. E. Muldoon:

* Monotonicity and convexity properties of zeros of Bessel functions. SIAM J. Math. Anal. 8 (1977), 171-178.

D. E. Evans & J. T. Lewis:

*Some semigroups of completely positive maps on the CCR algebra. *J. Funct. Anal.* 26 (1977), 369-377.

D. E. Evans:

*On the spectrum of one-parameter strongly continuous representation. *Math. Scand.* 39 (1976), 80-82.

*On the spectral type of one-parameter groups on operator algebras. *Proc. Amer. Math. Soc.* 61 (1976), 351-352.

Unbounded completely positive linear maps on C-algebras. *Pacific J. Math.* 66 (1976), 325-346.

Complete positivity and asymptotic Abelianness. *Ann. Inst. H. Poincaré* 26A (1977), 213-218.

P. N. M. Sisson:

An extension of Kaufmann's transfer-matrix method in the Ising model. *Physica* 80A (1975), 595-606.

J. Rayski:

Eight-dimensional unified theory. *Nuovo Cim. Lett.* 18 (1977), 422-424.

L. O'RaiFeartaigh:

*Gauge and representation-independent proof of the Guth-Weinberg theorem. *Nuovo Cim. Lett.* 18 (1977), 205-208.

Present status of supersymmetry. *Group Theoretical Methods in Physics, Proc. 4th Internat. Coll., Nijmegen 1975.* Springer (LNP) 1976, 11-23.

L. Michel, L. O'RaiFeartaigh & K. C. Wali:

Static finite-energy solutions of gauge fields with separated radial variable. *Phys. Lett.* 67B (1977), 198-202.

Radially separated monopole solutions in non-Abelian gauge models. *Phys. Rev.* 15D (1977), 3641-3655.

U.H. Niederer & L. O'RaiFeartaigh:

Covariant wave-equations, the Galilei group, and the magnetic moment of the electron. *Ann. Inst. H. Poincaré*, 26A (1977), 313-321.

T. N. Sherry:

Point transformations and renormalization in the unitary gauge: Renormalization effects. *Phys. Rev.* 15D (1977), 1068-1072.

J. H. Rawnsley:

Spherically symmetric monopoles are smooth. *J. Phys. A: Math. Gen.* 10 (1977), L139-L141.

Coherent states and Kähler manifolds. *Quart. J. Math. Oxford* (2) 28 (1977), 403-405.

J. H. Rawnsley & D. H. Tchrakian:

Comment on the magnetic charge of Yang-Mills fields with large

- internal symmetry groups. J. Phys. A 10 (1977), L87-L90.
- A class of pseudoparticle solutions of the SO(5) Yang-Mills equations. J. Phys. A: Math. Gen. 10 (1977), L195-L198.
- D. H. Tchrakian;
- Uniqueness of the BPST instanton. LMP 2 (1977), 39-47.
- * Construction of covariant bases for two-particle reactions. Fort. Phys. 23 (1975), 165-184.
- On higher spin superfields. Internat. Sym. Istanbul 1975. Topics in Mathematical Physics, ed. H. Odabasi & O. Akyuz, Colorado Assoc. Univs. Pr., Boulder CO, 1977. 231-246.
- P. A. Hogan & D. H. Tchrakian:
- Initial-value problem for Maxwell and linearised Einstein fields. J. Phys. A: Math. Gen. 10 (1977), 899-908.
- Z. Perjés:
- An irradiated Schwarzschild object. GRG 8 (1977), 689-693.
- Perspectives of Penrose theory in particle physics. Repts. Math. Phys. 12 (1977), 193-211.
- P. S. Florides:
- The complete field of a general static spherically symmetric distribution of charge. II Nuovo Cim. 42A (1977), 343-359.
- The Newtonian analogue of the relativistic Oppenheimer-Snyder solution. Phys. Lett. 62A (1977), 138-140.
- T. H. Yao:
- A remark on the construction of quantum fields from Markow fields. J. Math. Phys. 18 (1977), 1892-1897.
- W. T. Coffey & B. K. P. Scaife:
- *On the theory of dielectric saturation of polar fields. Proc. RIA 76A (1976), 195-216.
- In the press:
- J. R. McConnell:
- Correlation functions for spherical harmonics resulting from rotational Brownian motion of a linear molecule. Proc. RIA.
- Recent theoretical investigations of inertial effects in dielectric relaxation. Conf. on Electrical Insulation and Dielectric Phenomena 1977, Colonie, NY (Abstract).
- G. W. Ford, J. T. Lewis and J. R. McConnell:
- Correlation times and complex permittivity for linear and spherical top molecules. Physica A.
- The rotational Brownian motion of an asymmetric body. Proc. 1977 IUPAP Conference on Statistical Physics.

L. O'Raifeartaigh:

Static solitons in more than one dimension. Proc. Rome Conference (Mathematics, Physics, 1977), Springer. (*)

Finite energy solutions of gauge theories. III Sch. Elem. Parts. and H.E. Physics. Primorsko (Bulgaria), 1977.

Classical static gauge-field solitons in three space dimensions. Many Degrees of Freedom in Field Theory, Bielefeld 1976. Ed. L. Streit, NATO ASI Ser. B (Phys.), v. 30, Plenum.

L. O'Raifeartaigh & J. H. Rawnsley:

Mass-spectrum for monopoles of integral isospin bag-model as the high isospin limit. Phys. Lett. B.

J. H. Rawnsley:

On the pairing of polarizations. Commun. Math. Phys.

P. A. Hogan:

A reconstruction in Minkowskian space-time of Einstein's assembly of test particles. GRG.

W. Montgomery & A. I. Solomon:

Generalised XY model. J. Phys. A.

J. M. Golden:

The problem of a moving rigid punch on an unlubricated viscoelastic half-plane. Quart. J. Mech. Appl. Math.

V. Rittenberg & M. Scheunert:

Elementary construction of graded Lie algebras. J. Math. Phys.

M. P. Fry:

Multipseudoparticles and perturbation theory in large order of the anharmonic oscillator. Phys. Rev. D.

W. Mecklenburg & D. O'Brien:

Factorized gauge solitons in n dimensions. Phys. Rev. D.

A time-dependent property of the Prasad-Sommerfield monopole. Phys. Rev. D.

N. S. Baaklini:

Hadron universes and quark confinement from non-linear de Sitter invariance. Phys. Rev. D.

Non-linear de Sitter symmetry and restricted propagation universes. Nuovo Cim. Lett.

Non-linear de Sitter symmetry and restricted space-time regions in gravity and supergravity. GRG.

(*) and Tübingen Conference (Applications of Group Theory in Physics, 1977)

A. O. Barut, A. Inomata & R. Wilson:

Relativistic quantum theory of two interacting particles, I:
Scalar four-point functions. Ann. Phys.

A. O. Barut, C. K. E. Schneider & R. Wilson:

Quantum theory of infinite component fields, I. J. Math. Phys.

A. O. Barut & R. Wilson:

K_{l_3} decay form factors. Phys. Rev. D.

B. Goldsmith:

A topological approach to a problem of Nunke, Arch. d. Math.

Essentially-rigid families of Abelian p-groups. Proc. Lond.
Math. Soc.

Endomorphism rings of torsion-free modules over a complete
discrete valuation ring. Proc. Lond. Math. Soc.

W. T. Coffey & B. V. Paranjape:

Dielectric and Kerr effect relaxation in alternating electric
fields. Proc. RIA.

(3) Research Reports:

Research work during the year was written up in the first instance
as research reports. Two lists of titles of these reports (preprints)
were circulated to approximately 150 research institutes and university
departments of mathematics and physics, at their request, throughout the
world; as far as available copies of these preprints were supplied,
on request, to research workers in these institutes and departments.

- DIAS-TP-77-01: A. O. Barut, A. Inomata, & R. Wilson: Relativistic
quantum theory of two interacting particles. I. Scalar
four-point functions.
- 02: A. O. Barut, C. K. E. Schneider & R. Wilson: Quantum
theory of infinite component fields, I.
- 03: A. O. Barut & R. Wilson: K_{l_3} decay form factors.
- 04: A. O. Barut & R. Wilson: Decays of hadrons from SO
(4,2) dynamics.
- 05: Z. Perjes: An irradiated Schwarzschild object.
- 06: D. H. Tchrakian & J. H. Rawnsley: Comment on the
magnetic charge of Yang-Mills fields with large
internal symmetry groups.
- 07: J. H. Rawnsley: A non-unitary B-K-S pairing of two
polarizations of the Kepler manifold.
- 08: J. H. Rawnsley: Existence of the pairing of two
polarizations of the Kepler manifold.
- 09: J. H. Rawnsley: Seminar notes: Existence and
regularity of solutions of gauge field equations.

- 10: D. O'Brien & W. Mecklenburg: A time-dependent property of the Prasad-Sommerfield monopole.
- 12: G. W. Ford, J. T. Lewis & J. R. McConnell: The rotational Brownian motion of an asymmetric body.
- 13: U. Niederer & L. O'Raifeartaigh: Covariant wave-equations, the Galilei group, and the magnetic moment of the electron.
- 14: L. O'Raifeartaigh: Analyses of the radical equations for monopoles of arbitrary isospin bag model as the high isospin (= strong coupling) limit.
- 15: J. H. Rawnsley: Spherically symmetric monopoles are smooth.
- 16: L. Michel, L. O'Raifeartaigh & K. C. Wali: On radially separated monopole solutions in non-Abelian gauge models.
- 17: Z. Perjes: Perspectives of Penrose theory.
- 18: L. O'Raifeartaigh: Static solitons in more than one dimension.
- 19: J. R. McConnell: Recent theoretical investigations of inertial effects in dielectric relaxation.
- 20: G. W. Ford, J. T. Lewis & J. R. McConnell: Rotational Brownian motion of an asymmetric top.
- 21: G. W. Ford, J. T. Lewis & J. R. McConnell: Correlation times and complex permittivity for linear and spherical top molecules.
- 22: D. H. Tchrakian & J. H. Rawnsley: On the pseudo-particles solutions of the SO (5) Yang-Mills equations.
- 23: J. R. McConnell: Correlation functions for spherical harmonics resulting from rotational Brownian motion of a linear molecule.
- 24: L. O'Raifeartaigh: Broken symmetry in particle physics.
- 25: N. S. Baaklini: Hadron universes and quark confinement from non-linear de Sitter invariance.
- 26: N. S. Baaklini: Non-linear de Sitter symmetry and restricted propagation universes.
- 27: N. S. Baaklini: Non-linear de Sitter symmetry and restricted space-time regions in gravity and super-gravity.
- 28: L. O'Raifeartaigh & J. Rawnsley: Mass-spectrum for monopoles of integral isospin. Bag-model as the high isospin limit.
- 29: N. S. Baaklini: On the origin of the gravitational

constant in weak and strong gravity.

- 30: D. E. Evans & J. T. Lewis: Dilations of irreversible evolutions in algebraic quantum theory.
- 31: G. W. Ford, J. T. Lewis & J. R. McConnell: Rotational Brownian motion of an asymmetric top.
- 32: N. S. Baaklini: A finite theory of quantum gravity.
- 33: W. Mecklenburg & D. P. O'Brien: Factorized gauge solitons in n dimensions.
- 34: N. S. Baaklini: Covariant classical solution and instanton in $SL(2, \mathbb{C})$ gravity.
- 35: M. P. Fry: Multipseudoparticles and perturbation theory in large order of the anharmonic oscillator.
- 36: P. A. Hogan: A reconstruction in Minkowskian space-time of Einstein's assembly of test particles.
- 37: B. Goldsmith: Essentially-rigid families of Abelian p -groups.
- 38: B. Goldsmith: Endomorphism rings of torsion-free modules over a complete discrete valuation ring.

11. LIBRARY

Approximately 240 new titles were added to the library stock during the year; approximately 200 current periodicals were taken, of which almost half were received by gift or under exchange arrangements. The holdings of subscription periodicals were regularly scrutinized with regard to greatest needs, cost and availability elsewhere in Dublin; a small number of subscriptions was dropped, and a small number of essential new subscriptions taken up. Contact with the Library of the RIA, the Dept. of Mathematics and Mathematical Physics at UCD, the School of Mathematics at TCD, and the Faculty of Science at Maynooth was maintained. Under the RIA 'permanent loan' scheme, the purpose of which is to make certain RIA holdings more generally accessible, arrangements were made to house runs of 18 series.

Gifts of books and journals were received during the year from the French Government, Mr. R. Anderson, Profs. Lewis, McConnell, O'Raifeartaigh and Synge, Dr. Tchakian, the Kazakh Inst. of Sciences (Alma-Ata), the Mathematisch Centrum (Amsterdam), Fermi National Accelerator Laboratory (Batavia, USA), KEK (Japan), the Science Council of Japan, the Centro de Investigacion del IPN (Mexico), the Slovak Academy of Sciences (Prague), and ICTP (Trieste); preprints were received from scientific institutes and university departments all over the world.

The party of students from the Technische Hogeschool Eindhoven who visited the School on 18 October (see 2) were taken by Profs. Lewis and O'Raifeartaigh on a tour of the Library; and a collection of mathematical and physical works by Irish authors, especially of the nineteenth century, and by members (present and past) of the School, together with photographs and other items of interest, was on display during this visit.

The National Science Council - Trinity College Dublin National Documentation (Use) Survey, in which the School took part (see previous Report), ended in March.

IV - Annual Report of the Governing Board of the School of Cosmic Physics for the year ended 31 December 1977 adopted at its meeting on 20 April 1978.

A. ASTRONOMY SECTION

1. STAFF AND SCHOLARS

Senior Professor:

P. A. Wayman

Professor:

T. Kiang

Research Assistant:

I. Elliott

Experimental Officer:

B. D. Jordan

Research Associate:

Dr. C. J. Butler (Armagh Observatory)

Technical and Clerical Staff:

Miss A. M. Callanan; W. M. Dumbleton; R. P. Murphy.

Scholars:

C. M. Sharp (from 1 October 1977); M. Gossler (from 1 December 1977).

Mr. N. Gibson (TCD) and Mr. P. Houlihan (TCD) were engaged as Vacation Students during July and August and Mr. P. Duane (technical assistant, Maynooth College) worked in the electronic laboratory for a similar period.

Dr. M. Gossler was granted the status of a Scholar for a period of four months, commencing 1 December 1977.

P. A. Wayman continued as Assistant General Secretary of the International Astronomical Union throughout the year. He continued also as Chairman of the National Committee for Astronomy; I. Elliott continued as Secretary of that Committee and as Observer for Ireland with the Board of the Joint Organisation for Solar Observations (JOSO). P. A. Wayman continued as a member of the Council of the Royal Irish Academy and a member of the Library Committee and was appointed to the Space Research Committee of the Academy. He also continued as a member of the Board of Governors of Armagh Observatory and rejoined the Board of Management of Armagh Planetarium. He continued as Chairman of the Astronomical Science Group of the Irish Astronomical Society and commenced serving as President of the Society in November 1977.

I. Elliott was appointed an Associate Editor of the Irish Astronomical Journal in January.

2. RESEARCH WORK

Photographic Photometry: P. A. Wayman and C. J. Butler

A paper entitled "Photometry of Cepheid Variables in the Large Magellanic Cloud" by C. J. Butler was accepted for publication during the year. This paper is the third major paper describing the work on cepheid variable stars commenced in 1966. In the paper, data are presented for 98 variables in the Dunsink LMC II region, with mean brightness between $B=13.5$ and $B=18.0$. The main conclusion derived from a detailed review of the data is that a theoretical Period-Luminosity-Colour Relation based on a "metal-content" of $Z=.02$ is consistent with the Large Magellanic Cloud data, while, on the same basis, $Z=.005$ is indicated for the Small Magellanic Cloud. This conclusion comes from examination of the behaviour of the blue edge of the instability strip in the colour-magnitude diagram. Further consideration of the data, in the light of the supposed Period-Luminosity-Amplitude relation of Sandage and Tammann, indicates that such a relation can only be poorly established. Nevertheless, it is likely that the amplitudes, being interpreted as evidence of non-linear behaviour, will eventually prove to be a useful indicator of structure.

The work on the 160 cepheid variable stars in the LMC I region is still not complete. Programs to evaluate accurate positions (0.5 arc-second accuracy) for identification purposes were completed and tables of data and light-curves in four colours (U,B,V,R) were prepared for publication.

In an observational programme to delineate possible period-changes for dozens of Magellanic Cloud cepheid stars, 22 plates have been received from the U.K. Schmidt Telescope Unit (Siding Spring, New South Wales), taken with the 48-inch Schmidt Telescope. The plates cover both Dunsink fields, LMC I and LMC II. These are short-exposure plates adequate for registration of stars to $B=18.5$ without appreciable fog from the sky background. In this respect they compare favourably with the ADH plates from Boyden Observatory, where a long exposure (three times greater) on one field only results in appreciable sky-fog of a troublesome nature.

Solar Research: I. Elliott

Analysis of $H\alpha$ chromospheric spectra was continued by the modification of existing power spectrum analysis programs and by the development of plotting programs to display data on the Visual Display Unit of the Nova computer.

Tests were made to assess the best means of viewing sequences of solar filtergrams which exist as 35mm half-frame exposures. The tests showed that the maximum repetition rate of a pair of "Carousel" projectors was too slow to follow the evolution of chromospheric features. Use of 16-mm prints in a variable-speed projector was found to be superior.

A literature survey was carried out for a review of the solar neutrino problem.

Dynamical Astronomy: T. Kiang

In 1972 the observed 600-year periodicity in the "Observed-Calculated" residuals for Comet Halley in the system Sun-Jupiter-Halley was investigated with the use of Hill's Equation of second order, where periodicity in the coefficients was shown to lead to the long periodicity for most values of the one arbitrary parameter. This parameter - λ_0^1 - describes the initial orbital position of Jupiter relative to perihelion of Comet Halley.

During 1977 the same technique was applied in other cases:

(i) Periodic Comet Tempel-Tuttle (period 33.2y) where the properties of the Leonid Meteor Stream indicated possible common origin provided a 300-year periodicity could provide the connection. Here it was found that the range of λ_0^1 values for a long-period oscillation was limited and the oscillation when present, was periodic with a period about twice that ascribed to the Leonids. The connection was therefore not established.

(ii) Comet Crommelin, period 27 y, where the long-period oscillation exists for 3/4 of the range of the parameter λ_0^1

(iii) Two hypothetical asteroids with principal periods exactly half that of Jupiter (Hecuba configuration) and low eccentricities compared with cometary paths; here the period was found to be 480 years agreeing with the work of Poincaré of c. 1900, but using wholly different methods.

These examples have drawn attention to the importance of the concept of "hyperperiods" and it seems possible to consider the stability of systems in terms of the existence or otherwise of long-period oscillations of the orbit.

Halley's Comet T. Kiang (with D. K. Yeomans, Jet Propulsion Laboratory).

Further investigation of the past orbit of Halley's Comet incorporated Yeomans' model with non-gravitational forces where empirical corrections are indicated by historical observations (Chinese). The integration is expected to be continued back to the 12 - 13th Century BC. Also, variations in the tail-length and intrinsic brightness of the comet are being evaluated using certain statistical considerations.

Galaxy Statistics: T. Kiang

The generalised C-method for 1976, is being applied to a large amount of data on the luminosities and diameters of galaxies. The idea that galaxies are clustered on all scales, put forward by Kiang in 1967, has recently been widely adopted through new evidence publicised at the Tallinn IAU Symposium in 1977 on "Large-Scale Structure of the Universe." The observational work of Peebles and his Princeton colleagues used the co-variance function involving only one parameter, whereas Kiang's models used more parameters and the results were less readily interpreted. Implicit in both approaches is the neglect of patchy absorption. The correct treatment of the problems caused by the effects of irregular absorption is being sought through a method similar to that applied by Kiang in 1974 to observational selection of asteroid statistics.

Stellar Atmospheres: C. M. Sharp

The contribution of diatomic molecules to opacity in the atmospheres of late-type stars is being investigated as a continuation of work carried out at St. Andrews. Since October 1977, the particular work undertaken has been to determine, from Franck-Condon and Hönl-London factors, the bound-bound opacity of common diatomic molecules and their contribution to the Rosseland Mean for particular atmospheres.

3 INSTRUMENTS, COMPUTER, ETC.

A disastrous fire on the night of 2/3 October 1977 destroyed most of the optical and electronic instruments of the Section, as well as the most important part of the library journals. The event is described in §6, below. Work done prior to the fire by I. Elliott, B. D. Jordan and P. Murphy is as follows:

The EMI dry-ice photomultiplier housing was modified to use solid dry ice, eliminating the spillage problem and the difficulty with filling. With new insulating material (expanded polystyrene) the performance of the housing was markedly improved.

The Motorola 6800 microprocessor was mounted in a cabinet and additional memory, a teletype interface, and a power supply were developed.

The data link Dunsink - 5 Merrion Square was improved by the addition of a pair of asynchronous 1200 baud modems and an ADDS 580 visual display unit. The peripheral switching network was modified to cater for the new modem and also for the proposed synchronous link to the CPDS computer installation at Kilmainham. The console interface board was provided with a fast crystal and a divider network to facilitate selection of baud-rate in the range 110 - 9600.

A second terminal interface board was added to the Nova 2/10 disk system, making it possible to have the VDU and teletype connected simultaneously. Two operators can use the system at the same time in foreground/background mode - e.g. with Text Editor in the foreground and a Fortran program in the background. Other combinations are possible including Basic or Algol programs but not two Fortran programs.

The Joyce-Loebl microdensitometer and its data acquisition system was thoroughly overhauled and restored to maker's specification. A paper tape punch unit was incorporated before despatching the equipment on loan to Armagh Observatory in June.

Prior to establishing a computer-link with the Kilmainham IBM 370 computers, visits have been made to that installation by C. Sharp in order to implement programs and data files transferred via magnetic tape from a similar installation at St. Andrews University.

4. CONFERENCES, LECTURES, ETC.

Dr. Máire T. Brück, University of Edinburgh, gave a Statutory Public Lecture of the School at University College, Dublin, on 31 May 1977, with the title "The Local Group of Galaxies".

P. A. Wayman, as Assistant General Secretary, attended the 43rd Meeting of the Executive Committee of the International Astronomical Union in Geneva, 29 August - 2 September. The main correspondence on IAU Symposia, Colloquia and Regional Meetings for the years 1977 - 79 was handled from the Section during the year.

I. Elliott attended the Board Meeting of the Joint Organisation for Solar Observations in Tenerife, 25 - 29 October, as an observer for Ireland.

The following scientific meetings were attended:

Meeting of the Astronomical Science Group of the Irish Astronomical Society at University College, Cork, on 2 June and at Queen's University, Belfast, on 21 December. At the Cork meeting, I. Elliott spoke on "The Solar Neutrino Problem" and on the previous evening (1 June) P. A. Wayman gave the first Annual Public Lecture of the Irish Astronomical Society at the Physics Department of U.C.C., "The Astronomical Revolution, 1963 - 1973."

T. Kiang at IAU Symposium No. 79, "The Large-Scale Structure of the Universe", at Tallinn, Estonia, USSR, 12 - 16 September.

P. A. Wayman at IAU Symposium No. 77, "The Structure of Nearby Galaxies", at Bad Munstereifel (near Bonn), F.R. Germany, 22 - 26 August.

P. A. Wayman at IAU Colloquium No. 45, "Chemical and Dynamical Evolution of the Galaxy", at Torun, Poland, 7 - 9 September.

I. Elliott and B. D. Jordan at the XXIst Herstmonceux Conference, "Digital Methods in Astronomy", at Herstmonceux, Sussex, 21 - 22 September.

B. D. Jordan at the European Southern Observatory Conference, "Optical Telescopes of the Future", at CERN, Geneva, 12 - 15 December.

I. Elliott at the Anglo-Australian Observatory Symposium at Jodrell Bank, Cheshire, 23 September.

P. A. Wayman at the European Space Agency Conference on "Programmes for the Large Space Telescope", at Trieste, Italy, 16 - 18 May.

At Meetings of the Royal Astronomical Society, London, T. Kiang on 11 February, 5 - 7 April (at Edinburgh) and 13 May; P. A. Wayman on 13 May.

P. A. Wayman gave eight lectures on "Radiation in Astronomy" to 4th Year Physics students in Trinity College, Dublin, in the Hilary Term. I. Elliott gave an Adult Education Course in the Vocational Education College, Dundrum, in October - December. The usual fourteen Public Open Nights were held at Dunsink Observatory, some ten other group visits were arranged, two RTE broadcasts were made, and approximately twenty society and other group meetings were addressed during

the year.

P. A. Wayman visited the National Astronomical Observatory, Mexico City, 7 - 11 November, and spoke at an informal colloquium on the organisation and work of the International Astronomical Union.

Visitors to Dunsink Observatory during the year included Professor and Mrs. H. A. Brück, Professor K. G. Emeleus, and Dr. E. Peytremann.

5. PUBLICATIONS

T. Kiang is producing, on behalf of a publishing house, translation copy of principal articles from the Chinese-language journal *Acta Astronomica Sinica*, under the title "Chinese Astronomy", with editorial responsibility of Mrs. G. St. Mark Kiang. Two issues were produced during the year.

The following papers and journal articles have been published:

T. Kiang:

"Recent Astronomical Research in China", *Sky and Telescope*, October 1977.

"More Evidence for a Closed Universe from QSO's", *Nature*, 270, 205-206, 1977.

C. J. Butler:

"Photometry of Cepheid Variables in the Large Magellanic Cloud", *Astronomy and Astrophysics Supplement* (in press, 1978).

I. Elliott:

"Computing in Astronomy", *Newsletter of the Irish Computer Society*, No. 9, p.26, 1977.

"Telescope Automation" and "Our Changing Universe" (Book Reviews), *Irish Astronomical Journal*, 13, March 1977.

6. MISCELLANEOUS

Armagh-Dunsink Harvard Telescope: Discussion was begun with Professor A. Poveda of the National Astronomical Observatory, Mexico, concerning possible renovation and removal of this telescope to a site in Baja, California, near Ensenada.

La Palma Observatory Project: Plans for a 10% Irish share in the 1-metre reflecting telescope of the United Kingdom Northern Hemisphere Observatory on La Palma continue, but as yet no formal agreement either with the Spanish authority or with the U.K. Science Research Council has been made.

Outbreak of Fire at Dunsink Observatory: A fire of unknown origin started suddenly in the basement of the Meridian Room Library, occupied as the electronics laboratory, in the early hours of Monday, 3rd October 1977. Flames were first seen at 01.20 and the Fire Brigade arrived at 01.40, approximately. The building of the Meridian Room was so badly damaged by the fire that only the main walls now remain standing. Many apartments, both domestic and office, were badly damaged by smoke. All the electronic, optical and photographic equipment in the area below the Meridian Room was totally destroyed and all the principal journals in the main part of the Library were destroyed or very badly damaged. However, few really irreplaceable items were lost and a start has been made on getting in material to restock the library. The Data General Nova computer installation and other equipment in the remainder of the basement was rescued in damaged condition by being removed during the course of the fire. Data on the twenty disc cassettes were preserved almost without loss and, after extensive overhaul, the Nova 2/10 was re-installed satisfactorily in December.

Discussion on "Contents" insurance was on the basis of a claim that approximately 80% of the scientific value of the contents of the main building was lost in the fire, thus indicating the extent of the damage. Some antique items were damaged but few seriously. The antique books and early records of the observatory survived with only slight damage.

B. COSMIC RAY SECTION

1. STAFF AND SCHOLARS

Senior Professor:

C. Ó Ceallaigh

Professor:

K. Imaeda

Assistant Professors:

D. O'Sullivan and A. Thompson

Research Assistant:

Y. V. Rao (to 31 March)

Experimental Officer:

J. Daly

Technical and Clerical Staff:

Mrs. E. Clifton; Miss H. O'Donnell; Miss E. Rankin; Miss M. Cahill; Miss C. Murphy (to 30 September); Miss R. Toner (to 31 October); Miss U. Donnelly.

2. RESEARCH WORK

Charge and Energy Spectra of Cosmic Ray Nuclei: C. Ó Ceallaigh, D. O'Sullivan and A. Thompson.

The completion of measurements on the large sample of heavy cosmic ray nuclei by the end of 1976 afforded a welcome opportunity for some further in depth analysis of the problems of charge and energy evaluation by ourselves and Professor Fowler's group at Bristol University. Further calibration was undertaken in some Lexan stacks where it was deemed useful to supplement the existing statistics. The final results of our analysis, representing the world's largest sample (274) of ultra heavy nuclei with well determined energies were prepared for presentation at the 15th International Cosmic Ray Conference in August 1977.

The most significant feature observed was the peaking of the abundance around Platinum as seen in our earlier results. Nuclei with $Z > 88$ are clearly present and have a relative abundance of 0.24 ± 0.08 of the Platinum group. The corresponding value determined from the Skylab experiment of Price and Shirk is 0.15 ± 0.06 .

The energy spectrum of the ultra heavy nuclei was determined by a study of the particles with $Z \geq 65$ which are free of any major selection biases. Our results were at great variance with the results of the Berkeley-MSU group thus confirming the trends in our earlier publications. The Dublin-Bristol data is now considered the most appropriate material taken in conjunction with the Skylab data for comparison with various astrophysical models proposed by theorists.

During the year the investigation of the relative abundances of cosmic ray nuclei in the very difficult transcobalt region ($28 \leq Z \leq 36$)

continued. Analysis of lexan polycarbonate track detectors flown from Sioux Falls at an atmospheric depth of 38km/m^2 has now yielded over 300 transcobalt nuclei. This work was made possible by the development of special scanning procedures designed to discriminate against the overwhelming background of iron peak particles and 25 m^2 of lexan have been examined so far.

Within the limitations of the available statistics the transcobalt cosmic ray abundances were in general agreement with solar system material. In conjunction with this work a sample of 1500 events, chosen and analysed in depth for earlier iron peak isotope studies, was employed to determine the Ni/Z = (25,26,27) ratio. The value obtained, 0.044 ± 0.009 , is consistent with that found by the Washington University Group (14th International Cosmic Ray Conference), namely 0.050 ± 0.005 .

A Bristol/Dublin/Madrid balloon flight, using facilities offered by the Spanish National Commission for Space Research (CONIE) was very successful. The detector stack consisted of six modules with a collecting area of two square metres altogether. The stack configuration involved three layers of dilute nuclear emulsion and approximately ninety layers of polymer plastics. Four different polymers were used. The balloon was launched in Sicily and recovered in Southern Spain, the first flight of this type.

The Cosmic Ray Section has been offered facilities at the Manchester heavy ion accelerator and at the Berkeley Bevalac to carry out a wide range of exposures largely directed towards calibrating and evaluating lexan and other polymers. It is hoped to avail of these facilities when suitable beams are available.

Finally, it has been noted with satisfaction that the Berkeley group, in their latest paper on the Skylab material (to be published in the Astrophysical Journal during 1978) have confirmed the Bristol/Dublin energy spectrum of the form $\gamma^{-1.5}$ for ultra heavy cosmic ray nuclei with $Z > 65$. This matter has been the subject of considerable controversy for more than four years.

Application of the Quaternionic Formulation to Tachyons and Superluminal Transformations: K. Imaeda

As an extension of the quaternionic formulation of classical electrodynamics, the theory of tachyons and superluminal Lorentz transformations have been investigated. The compatibility of the existence of tachyons with the principles of physics (especially of special theory of relativity) has been accepted by most physicists, there are still many difficulties in accommodating those particles which are moving with a velocity greater than that of light into the present frame-work of space-time when the theory is extended from two to four dimensions.

In an attempt to resolve the difficulties, the quaternionic formulation has been applied to represent superluminal transformations and to tachyons. The "biquaternionic" formulation was found to be especially suited to the purpose. The theory may be extended not only to particles with velocity greater than that of light but also those having complex velocities. An attempt has also been made to ascribe a physical meaning to those particles and the complex space-time involved.

No definite conclusions were reached. It would appear that the resolution of the problems of tachyons and complex space-time must await

the finding of tachyons in nature.

3. WORKSHOP AND TECHNICAL DEVELOPMENT - J. Daly

A period of two weeks was spent at the Spanish National Commission for Space Research working on the construction and assembly of detector stacks consisting of dilute nuclear emulsions and plastic detectors.

In addition to the continued maintenance of equipment within the section, a new measuring station comprising a Leitz microscope and a Z-axis high precision measuring equipment was installed. In addition new high precision Z-axis measuring equipment was fitted to an existing microscope measuring station. Both sets of measuring equipment were calibrated over a range of 2mm using a Fizeau type interferometer each set reaching the usual high standard.

4. COMPUTING FACILITIES

The existing computer link to Dunsink Observatory was operating satisfactorily prior to the fire. Arrangements are being made to provide new computer facilities for the coming year.

5. EXTERNAL ACTIVITIES

D. O'Sullivan and A. Thompson attended the 15th International Cosmic Ray Conference at Plovdiv, Bulgaria (13 to 24 August 1977). Recent results of the Bristol-Dublin Collaboration were presented.

Several working visits by members of the academic staff were made to the Physics Department, Bristol University during the year in furtherance of the Bristol-Dublin Collaboration.

D. O'Sullivan and A. Thompson visited the Spanish National Commission for Space Research (Comision Nacional de Investigacion del Espacio) in Madrid during October 1977 to carry out experimental work concerning the Bristol/Dublin/Madrid balloon flight.

K. Imaeda was on leave of absence from 1st April to 31st December 1977.

Principal places visited:

a) High Energy Physics Laboratory, Kobe University (1 April to 30 September).

b) Cosmic Ray Laboratory, University of Tokyo (1 October to 31 December).

a) At the High Energy Physics Laboratory he took part in experimental work on multiple particle production in hadron-nucleus collisions produced by accelerator beams in the energy range 100 - 300 GeV. He engaged in a work on the statistical thermodynamics of hadronic matter already developed to explain multiple particle production in hadron-nucleus collisions. During his stay he gave 30 hour lectures at the Physics Department on the subject "Special topics in High Energy Nuclear Interactions".

b) At the Cosmic Ray Laboratory he had contact with several research experiment groups working on Cosmic Rays and their interactions. In collaboration with the emulsion group there he investigated a model of the interactions of high energy heavy nuclei in the atmosphere to explain several very high energy phenomena observed in emulsion-chambers exposed at mountain altitudes and on aircraft. A special study was made of the "Centaurus Events" observed by Brazil-Japan collaboration which had exposed large emulsion chambers at ≈ 5000 meters (altitude).

During his stay at the above and other laboratories, many lectures on Quaternions and high energy nuclear interactions were given.

As a member of the Scientific and Technical Committee of Euratom C. Ó Ceallaigh attended a meeting in Brussels, Belgium (2,3 March), as a member of the SC Committee of CERN he attended a meeting in Geneva (22 March) and as a representative of the Scientific and Technical Committee on the Groupe de Liaison Fusion he attended a meeting in Rome (14, 15 November).

C. Ó Ceallaigh attended a symposium to mark the retirement and granting of an honorary degree to Professor Marian Danysz by the University of Warsaw. He gave a brief account of the work in progress of the Cosmic Ray Section of the School of Cosmic Physics.

6. LECTURES

D. O'Sullivan delivered a series of 16 lectures on Nuclear and High Energy Physics to final year physics students at University College Galway, during Trinity Term.

7. PUBLICATIONS

Published:

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

Measurement of the Cosmic Ray Element Abundances between ≈ 300 and ≈ 750 MeV/N in the Region from Nickel to Krypton using Lexan Track Detectors. Nucl. Instr. Meth. 147, 201 (1977).

High Resolution Study of Nucleonic Cosmic Rays with $Z \geq 34$. Nucl. Instr. Meth. 147, 195 (1977).

The Charge Spectrum of Low Energy Cosmic Ray Nuclei in the region from Cobalt to Krypton. Proceedings of the 15th International Cosmic Ray Conference, Plovdiv, Bulgaria, August, 1977.

Charge and Energy Spectra of Ultra Heavy Cosmic Ray Nuclei. Proceedings of the 15th International Cosmic Ray Conference, Plovdiv, Bulgaria, August, 1977.

Ultra Heavy Cosmic Ray Nuclei - a Compilation of Events. Proceedings of the 15th International Cosmic Ray Conference, Plovdiv, Bulgaria, August, 1977.

In Preparation:

C. O. Ceallaigh:

A Statistical study has been carried out of the rainfall distribution at Leinster Lawn for the 30-year period, 1948-78. This work was based on the School's records.

K. Imaeda:

Quaternionic Formulation of Superluminal Transformations and of Tachyons.

In Progress:

C. O. Ceallaigh and K. Bolster:

A statistical study of daily rainfall at Valentia 1948 - 77 and Belmullet, 1958 - 77.

C. GEOPHYSICS SECTION

1. STAFF AND SCHOLARS

Senior Professor:

T. Murphy

Professor:

A. W. B. Jacob

Research Assistant:

Vacant.

Experimental Officer:

J. C. Davies

Technical and Clerical Staff:

K. Bolster; Miss A. Byrne; Miss E. Ryan; Miss V. Ward and G. Wallace.

Scholar:

D. W. Howard

Field Assistant:

D. Coffey (from 30 May - 22 July).

2. RESEARCH WORK

a) Gravity:

An International agreement now requires gravity information to be standardised according to the "International Formula 1967" and "International Gravity Standardisation Net 1971" and has necessitated converting all our data. This is being carried out using a computer but re-drafting the results has delayed publication.

E. Ryan and V. Ward surveyed a small part of Co. Wexford and Co. Kilkenny to complete an area for publication.

David Howard prepared for publication the interpretation of the gravity data of the Lee Valley, Co. Cork which indicates the presence of a very light narrow asymmetrical body at the surface, 70 km in length coupled with an abrupt change in density of the basement beneath.

b) Magnetics:

Three cruises, two of which were in collaboration with the Geological Survey, were undertaken on the Research Vessel Lough Beltra, using a marine magnetometer. The areas in order were off the north-west coast of Donegal May 14 - 21, south-west of the Kerry and Cork coasts from the Dingle peninsula to Mizen Head June 11 - 25 and off the east coast of Wexford and Wicklow from Wicklow Head to Carnsore Point out to the median line with the United Kingdom August 1 - 13.

During these cruises the system of navigation was by Decca and this was found on subsequent analysis to be inadequate. So much so that the

position of the vessel at night was not known with sufficient accuracy for magnetic survey purposes and large amounts of information cannot be used. The broad features of the magnetic field can be ascertained and these are as follows.

On the Donegal cruise the rock type exhibits similar characteristics to that of the adjacent land being considerably magnetic in general with evidence of the Tertiary dyke system known on land. No detailed analysis was undertaken.

Off the Kerry-Cork coast in the vicinity of the Blasket Islands the magnetic activity known to occur was delimited. Further south, unexpectedly since the rocks ashore are non-magnetic, areas of magnetic rocks showed up, for example the Skelligs are distinctly magnetic. The Tertiary dyke system mapped on land (already published) was traced between peninsulae and its extent to the north ascertained.

On the east coast in conjunction with the sea work, readings were taken to link airborne data in our possession which does not extend to the coast. The primary object of connecting the work in Ireland to earlier airborne observations of the United Kingdom and its shelf area was achieved and the effects of the Irish Sea graben observed. The details, however, due to the uncertainties of the position have been left aside until some of the doubtful sections can be repeated.

Throughout the cruises the magnetometer gave considerable trouble and emergency repairs and adaptations had to be carried out. The agents accepted liability and the instrument was returned for rectification.

c) Meteorology:

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

d) Seismology:

Extensive site investigations for the tripartite array were carried out and the three best sites have been chosen for the network. These are at Killmashogue, Co. Dublin, Croghan Hill, Co. Offaly and Muff near Kingscourt, Co. Cavan. These are code named DKM, DCN and DMU respectively. The site at Dunsink (DDK) had electrical interference problems but recordings were continued via the telephone link at Merrion Square up to October 3 and for a short period in November-December until the telephone links failed on December 6.

Because it proved difficult to get more than very limited permission to use radio links, recorders at the three main sites of the network are required. As an interim measure we have been able to borrow recording equipment from the Atomic Energy Authority at Blacknest. Although this is not compatible with the other recording system it will allow preliminary simultaneous recording at the three sites DCN, DMU and DDK.

Readings for 1977 were submitted on a trial basis to Blacknest, and their quality was considered so high that we have been requested to transmit, via a phone link, simultaneous transmission to Blacknest from the Dunsink station.

Through the courtesy of the Institute of Geological Sciences the teleseismic events from our magnetic tapes were transcribed by J. C. Davies onto a library tape to allow the original tapes to be reused. Suitable equipment for accomplishing this is not available in Ireland.

In June, two large shots fired by Cambridge University in the North Sea were recorded at some of the DNET trial sites. A most interesting seismic record section has been produced for the distance ranges 540-620 km which gives information about structure in the lower lithosphere.

A Birmingham University project named the South Irish Sea Seismic Experiment, was carried out with stations in Wales and Ireland with the object of investigating the crustal structure of the South Irish Sea. We co-operated in this experiment and occupied stations along a line in central Ireland from Loughrea to Tullow. Unfortunately because of delays caused by bad weather at sea, shots on only one of the two planned lines could be carried out. This line of 140 km ranged southwestwards from Tremadoc Bay. Although from our point of view this was not favourable, crustal delay times at about 20 sites on the station line were obtained. These will allow a first estimate of crustal thickness along our line. Birmingham hope to carry out in 1978 shots on the other line which is in alignment with our stations.

3. LECTURES AND FIELD EXERCISES

A series of eight weekly lectures on geophysics for geological students was given during the Michaelmas Term. Students from the two Dublin and the Cork Colleges attended. Average attendance was about thirty. A field geological exercise for Trinity College students took place in the Ox Mountains district. Magnetic and gravity anomalies were traced out and the use of various geophysical equipment demonstrated. In particular a northwestward trending Tertiary dyke was encountered and followed for several kilometers.

A one day seminar was given by Dr. Stuart Crampin of the Institute of Geological Sciences, Edinburgh.

4. PUBLIC INQUIRIES

Members of staff and research students from various universities called to consult the library and geophysical data.

Besides geophysical information members of commercial concerns call for advice and in particular mineral prospecting companies are using the gravity data extensively. At one period about five crews were operating at the same time on various projects including water supply problems.

5. EXTERNAL ACTIVITIES

A. W. B. Jacob and T. Murphy attended the following meetings:

- a) International Association of Seismology, Durham, August.
- b) The European Geophysical Society, Munich, September.

A. W. B. Jacob attended the United Kingdom Geophysical Assembly, Edinburgh, April.

6. PUBLICATIONS

A. W. B. Jacob:

"Observations of PS Reflections from the Moho" (1977).

Zeit. für Geophysik, 43, 687 - 692 (with D. C. Booth).

"LISPB-III. Upper Crustal Structure of Northern Britain" (1977).

J. Geol. Soc., 133, 481-488 (with Bamford, Nunn, Prodehl).

In Press:

"LISPB-IV. Crustal Structure of Northern Britain", (1978).

Geophys. J.R. astr. Soc., (with Bamford, Nunn, Prodehl).

D. W. Howard:

Submitted:

"A note on the Remagnetisation of the Lower Carboniferous Rush Conglomerate, Rush, Co. Dublin, Ireland" to Earth Plan. Sci. Letters.

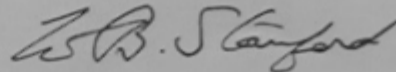
INSTITIÚID ARD-LÉINN BHAILE ÁTHA CLIATH
(Dublin Institute for Advanced Studies)

Income and Expenditure Account
for the year ended 31 December 1977

<u>1976</u>			<u>NOTES</u>	<u>1977</u>
£	<u>INCOME</u>			£
553,500	Oireachtas Grants in Aid		1(a), 2	622,100
11,216	Sales of Publications		3	12,681
	Vernam Hull Bequest		4	5,827
<u>2,783</u>	Miscellaneous		5	<u>9,848</u>
567,499				650,456
	<u>EXPENDITURE</u>		6	
117,228	Administration			141,470
135,390	School of Celtic Studies			153,485
77,836	School of Theoretical Physics			89,417
201,587	School of Cosmic Physics			227,511
<u>10,707</u>	Adaptation of Premises			<u>5,189</u>
542,748				617,072
24,751	<u>SURPLUS</u> for the year		7	33,384

Notes 1 to 12 form part of these accounts

Signed:



W. B. STANFORD

CHAIRMAN - COUNCIL OF THE INSTITUTE

26th September, 1978.

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

Balance Sheet at 31 December 1977

<u>1976</u>		<u>NOTES</u>	<u>1977</u>
£	<u>CURRENT ASSETS</u>		£
73,626	Cash on hands and at bank		116,906
12,049	Debtors and Prepayments		19,311
<u>85,675</u>			<u>136,217</u>
	Less		
	<u>CURRENT LIABILITIES</u>		
15,374	Creditors and accruals		32,532
<u>70,301</u>	<u>NET CURRENT ASSETS</u>		<u>103,685</u>
	Represented by		
<u>70,301</u>	<u>INCOME and EXPENDITURE</u> - Accumulated Surplus	7	<u>103,685</u>

Notes 1 to 12 form part of these accounts

Signed:

W. B. Stanford

W. B. STANFORD
CHAIRMAN - COUNCIL OF THE INSTITUTE

26th September, 1978.

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

NOTES TO THE ACCOUNTS

1. Accounting policies

- (a) Oireachtas Grants-in-Aid: Income shown in the Accounts as Oireachtas Grants-in-Aid is the actual cash received in the period of the Account.
- (b) Furniture and Equipment: Expenditure on Furniture and Equipment is written off in the period in which it is incurred.
- (c) Publications: Expenditure on Publications is written off in the period in which it is incurred.

<u>1976</u>		£	£
£	2. <u>Oireachtas Grants-in-Aid</u>		
120,400	Administration	143,000*	
129,000	School of Celtic Studies	152,300	
80,700	School of Theoretical Physics	87,400	
217,400	School of Cosmic Physics	235,400	
6,000	Adaptation of Premises	<u>4,000</u>	<u>622,100</u>
553,500			

* £1,500 was transferred from Administration to Adaptation of Premises.

£	3. <u>Sales of Publications</u>	£	£
11,148	School of Celtic Studies	12,556	
(8)	School of Theoretical Physics	19	
76	School of Cosmic Physics	<u>106</u>	<u>12,681</u>
11,216			

4. Vernam Hull Bequest

A sum of \$10,000 was received in the year from the estate of Professor Vernam Hull and is included in income of the School of Celtic Studies.

£	5. <u>Income</u>	£	£
1,563	<u>Miscellaneous</u> : Administration	9,209	
70	School of Celtic Studies	611	
50	School of Theoretical Phys.	28	
1,100	School of Cosmic Physics	<u>--</u>	<u>9,848</u>
2,783			

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

NOTES TO THE ACCOUNTS

6. Analysis of Expenditure

<u>1976</u>		Total	Administration	School of Celtic Studies	School of Theoretical Physics	School of Cosmic Physics
£		£	£	£	£	£
308,101	Salaries, Wages & Superannuation	366,513	66,264	99,035	55,823	145,301
26,226	Scholarships	26,153	-	11,712	11,696	2,745
2,628	Visiting Lecturers	-	-	-	-	-
3,100	Honoraria	2,700	-	2,650	-	50
19,689	Library	17,889	-	1,861	8,766	7,262
39,339	Publications (Note 1c)	35,008	-	32,607	2,295	106
33,884	Furniture & Equipment (Note 1b)	40,754	2,093	964	5,205	32,490
56,038	General Administration (Note 8)	66,581	66,581	-	-	-
18,486	Travelling & Survey Expenses	20,383	246	2,780	2,195	15,162
876	Symposium & Seminar Expenses	689	-	190	419	80
7,077	Consumable Equipment	11,597	-	-	-	11,597
2,233	Special Commitments (Note 9)	2,705	-	-	-	2,705
14,164	General Expenses	15,363	2,514	1,686	3,018	8,145
-	Fire Replacement:					
-	'Contents' (Note 10)	1,800	22	-	-	1,778
-	Buildings " "	3,748	3,748	-	-	-
532,041	Sub-Total	611,883	141,470	153,485	89,417	227,511
10,707	Adaptation of Premises	5,189	-	-	-	-
542,748	Total	617,072	-	-	-	-

7. Surplus/Deficit Position

	Balance 1/1/77	Year to 31/12/77	Balance 31/12/77
	£	£	£
Administration	17,277	9,239	26,516
School of Celtic Studies	8,543	17,809	26,532
School of Theoretical Physics	5,153	(1,970)	3,183
School of Cosmic Physics	39,553	7,995	47,548
Adaptation of Premises	(225)	311	86
	70,301	33,384	103,685

This surplus is available towards meeting the Institute's expenditure on commitments outstanding at 31 December 1977 (see Note 12).

<u>1976</u>	<u>8. General Administration Expenses</u>	£	£
£			
33,538	Rent, Rates & Insurance	35,466	
6,059	Premises Maintenance	10,157	
6,468	Postage & Telephones	8,338	
9,214	Fuel, Light & Power	11,686	
759	Sundry Supplies	934	66,581
56,038			

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

NOTES TO THE ACCOUNTS

<u>1976</u>		<u>1977</u>
£	<u>9. Special Commitments</u>	£
2,233	Contribution to Boyden Observatory	---
---	Balloon Flight - Special emulsion purchased for use in long duration test flight	2,705
<u>---</u>		<u>2,705</u>
	<u>10. Fire Replacement Costs</u>	
	Costs were incurred due to fire at Dunsink on 3/10/77. Contents claim was settled with Insurance Brokers for £53,518 (8/3/78). Building claim is to be made as work progresses, i.e. on a reinstatement basis.	
	<u>11. Superannuation</u>	
	Expenditure arising under superannuation schemes is met out of Oireachtas Grants-in-Aid in the year of payment.	
	<u>12. Outstanding Commitments</u>	
<u>31/12/76</u>	The estimated cost of commitments outstanding at 31 December 1977, exclusive of Current Liabilities shown on the Balance Sheet, is as follows:	
£		£
17,178	Administration	28,100
8,464	School of Celtic Studies	26,350
5,156	School of Theoretical Physics	2,960
<u>40,584</u>	School of Cosmic Physics	<u>47,440</u>
<u>71,382</u>		<u>104,850</u>

Report of the Comptroller and Auditor General

I have examined the foregoing Income and Expenditure Account and Balance Sheet which, as required by Acht um Institiúid Ard-Léinn 1940, are in the form approved by the Minister for Education with the concurrence of the Minister for Finance. I have obtained all the information and explanations which I have considered necessary for the purpose of my audit.

In my opinion:-

- (a) proper books of account have been kept by An Institiúid and the Income and Expenditure Account and Balance Sheet are in agreement with them,
- (b) The Income and Expenditure Account and Balance Sheet, together with notes 1 to 12, give, respectively, a true and fair view of the transactions of An Institiúid for the year ended 31 December 1977 and of the state of its affairs on that date.

SEÁN Mac GEAFAILT
Comptroller and Auditor General.
28 Míán Fómhair 1978.