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

ANNUAL REPORT
1984

10 Burlington Road, Dublin 4

Pl.3548

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 1984

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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 1984

School of Celtic Studies

A welcome development in 1984 was a relaxation of the embargo on appointments to the academic staff whereby Ministerial permission was granted for the recruitment of two Junior Research Assistants to fill vacancies which had existed since 1980. However, the year passed without the Board's request of 1982 for the appointment of Professor Proinsias Mac Cana to succeed the late Professor David Greene (who died in 1981) as Senior Professor being complied with.

In spite of restrictions on the number of the academic staff the School maintained the normal complement of scholars in training and continued its work of research and publications. Four new works and thirteen reprints were published, including a reprint of a volume which was originally issued in England in 1905 by the Henry Bradshaw Society. Outside publications by members of the School in periodicals, etc., numbered twelve.

Seminars were held by Professors Brian Ó Cuív and James Carney and by Mr. Fergus Kelly; and the annual symposium was held in April.

The triennial Summer School, held 9 - 27 July, was attended by 85 students from thirteen countries. Courses were given in Old Irish, Medieval and Classical Early Modern Irish, Modern Irish, Breton, Scottish Gaelic, Medieval Welsh, Comparative Celtic, and Irish Literature.

School of Theoretical Physics

The Chairman and Professor O'Raifeartaigh met the Delegation to Ireland from the Academy of Sciences of the USSR; the possibility of future exchange visits was discussed.

In addition to the use made by Staff, Scholars, and Research Associates of the School in their primary research activities, much use was made also by visitors, particularly during the summer months, of the School's facilities for research - especially of the opportunities for informal discussions, and of the library resources. Twenty-nine research workers from universities and other institutes of research or higher education were admitted as research associates of the School; thirty-three scientists from abroad visited the School during the year.

The Easter and Christmas Symposia were held as in previous years; seminars at DIAS and joint seminars (with UCD, TCD, Maynooth) in special subject areas were continued. Five courses, including three for final-year under-graduates (or first year graduates) from the Dublin area, were given at DIAS; one lecture was given at TCD. Two meetings of the Irish Mechanics Group, in association with DIAS, were held in the School, and the Third Dublin Summer School in Physics, organized by the School in association with TCD, UCD, and Maynooth, was held at DIAS from 25 June to 6 July. The Statutory Public Lecture was given at TCD by Visiting Professor D. Speiser; his subject was "The development of continuum mechanics in the 18th century".

The School continued its research. The primary areas of research were theoretical particle physics, classical statistical mechanics, quantum statistical mechanics, and quantum electronics; secondary areas were general relativity and gravitation, pure mathematics, and applied mathematics. Communication of the DIAS Series A (Theoretical Physics) No. 28, and fifty-two contributions to journals or scientific proceedings were published.

Members of the School attended nineteen conferences abroad, and gave seminars at eleven of these. They also gave twenty-seven seminars/lectures, 2 courses/series, and 1 poster session abroad.

School of Cosmic Physics

Astronomy Section:

The observational work of the Section during 1984 incorporated the first use of three types of facility. The 1-metre Jacobus Kapteyn Telescope on the island of La Palma was available for use from May 1984 and was used for high-speed photometry. The ESA satellite International Ultraviolet Explorer was used for observations of cepheid variable stars to investigate evidence for mass-loss. Associated computational programs were begun. Allocations for use of the EXOSAT x-ray satellite of ESA were secured by a Research Associate for work on the globular cluster M15. In addition, construction jointly with University College, Dublin, of the charge-coupled device camera reached an advanced stage in preparation for use with the Kapteyn telescope.

Work was put in hand to improve the access of the Section to astronomy computer networks (Starlink), using the facilities of University College.

Work on the history of Irish astronomy was carried out, particularly in preparation for the Dunsink Observatory bicentennial year of 1985.

Cosmic Ray Section

The launch of the Space Shuttle 'Challenger' on 6th April resulted in the exposure of the Ultra Heavy Cosmic Ray Experiment by the Long Duration Exposure Facility (LDEF) of NASA. The orbit is nearly circular at an altitude of 250 nautical miles. This is the first major space experiment from Ireland. Recovery during 1985/1986 will produce information on the prevalence of heavy nuclei in cosmic rays; this is needed in order to indicate the early history of cosmic ray material with respect to element formation in the Galaxy. Preliminary consideration has been given to ensuing work in this field.

In the projected Epona experiment on the Giotto Mission to Comet Halley in 1986, tests of the hardware and the ground support equipment were completed and the particle telescope delivered to the launch authority. The measurement of particle densities is expected to be an important feature of the cruise phase of the mission, as well as at encounter with Comet Halley.

Geophysics Section:

In collaboration with the Geological Survey the area around Carnsore Point was investigated using the Research Vessel Lough Beltra. The studies covered magnetics, shallow seismics and depth soundings. Owing to deficiences in the navigational aids the results were disappointing.

To complete sheet No. 13 of the half-inch gravity map areas in Cavan and Louth were surveyed.

The Palaeomagnetic studies on Danish lake sediments have been correlated with similar work carried out in the U.K. with the help of radiocarbon dating. Discrepancies between the two sets seem to have arisen due to systematic dating errors.

The seismic networks continue to yield information of local events. Of the latter the most interesting occurred on 19 July and resulted in the section being swamped by inquiries from the news media and the public for information. It required additions to our staff to cope with the situation.

This event was strongly felt in Wales, England and Ireland just before 8. a.m. (Summer Time) on Thursday the 19th of July 1984. In the period up to the end of August the network of stations operated by us has recorded about 120 aftershocks. In Fig. 1 we show a map of the Irish stations and the nearest of the large network operated by the British Geological Survey. All the aftershocks seem to lie very close to the site of the main event. The main shocks in July and August were:

(1)	19 July	0756	ML = 5.4
(2)	27 July	1356	4.0
(3)	29 July	2118	4.2
(4)	6 August	0822	3.8
(5)	18 August	1237	4.5

All these were at about 53.0° N, 4.4° W near the western coast of the Lleyn peninsula. The magnitude, ML, is the Richter Local Magnitude, and it is roughly equivalent to the Richter Magnitude which is often quoted in the press. The biggest aftershock so far was on the 18th of August and the waves it generated were only a little more than 0.1 of those experienced

on the 19th of July. The only event of the five which was not reported to us as being felt in Ireland was no. 2. This was not the smallest, but it happened in the middle of a normal weekday and was thus less likely to have been widely noticed. We have about 1000 written and telephoned reports for the main shock and this may be less than 1% of the number of people who actually felt or heard something.

The depth of the earthquake of the July event was about 20km below the surface.

Seismic work continued on the north-south profile which crosses the Caledonian Suture Zone. It is of about the same length as the 1982 one but should provide better near-surface control as the shot points are more closely spaced.

INSTITIÚID ARD-LÉINN BHAILE ÁTHA CLIATH

(Dublin Institute for Advanced Studies)

Annual Report of the work of the Institute and its Constituent Schools presented by the Council for the year ended 31 December 1984

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 1984.

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 31 December 1984.

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

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

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

I Constitution of the Council of the Institute and of the Governing Boards of the three Constituent Schools on the 31 December 1984.

1 THE COUNCIL OF THE INSTITUTE

Chairman

T.K. Whitaker, D.Econ.Sc.

Ex-Officio Members

T. Murphy, M.D., D.P.H., B.Sc.Pub.H., President, University College, Dublin; W.A. Watts, M.A., Sc.D., Provost, Trinity College, Dublin and President, Royal Irish Academy.

Members appointed by the Governing Board of Constituent Schools

B.Ó Cuív, M.A., D.Litt.; P. Mac Cana, M.A., Ph.D.; J.T. Lewis, B.Sc., Ph.D.; A. J. McConnell, M.A., M.Sc., Sc.D., F.T.C.D.; T. Murphy, D.Sc.; E.F.Fahy, M.Sc., Ph.D.

2 GOVERNING BOARD OF THE SCHOOL OF CELTIC STUDIES

Chairman

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

Senior Professors

J.P. Carney, B.A., Fil.Dr., D.Litt.; B.Ó Cuív, M.A., D. Litt.

Appointed Members

T. de Bhaldraithe, M.A., Ph.D., D. Litt.; G. Mac Eoin, M.A. Ph.D.; T.Ó Floinn, M.A.; S. Ó Tuama, M.A., Ph.D.; E.G. Quin, M.A., F.T.C.D.; G. Victory, B.A., Mus.D.; T.K. Whitaker, D.Econ. Sc.

3. GOVERNING BOARD OF THE SCHOOL OF THEORETICAL PHYSICS

Chairman

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

Senior Professors

J.T. Lewis, B.Sc., Ph.D.,; J. R. McConnell, M.A., D.Sc.; L. O'Raifeartaigh, M.Sc., Ph.D.

Appointed Members

J.N.Flavin, M.Sc.,Ph.D.; M.A. Hayes, M.Sc., Ph.D.; P. Quinlan, B.E., D.Sc., Ph.D.; T.D. Spearman, M.A., Ph.D.(Cantab.); S.S. Tóibín, M.Sc., Ph.D.; W. Wright, M.A., Ph.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

E. F. Fahy, M.Sc., Ph.D.

Senior Professors

T. Murphy, D.Sc.; P. A. Wayman, Ph.D.

Appointed Members

A. Brock, M.A., Ph.D.,F.R.A.S., F.Inst.P.; D.J. Bradley Ph.D., F.R.S.; P.K. Carroll, M.Sc., Ph.D.; M.de Groot, Ph.D.; G.F. Imbusch, Ph.D., D.Sc.; D.L.Linehan, B.Sc., B.E.; N.A. Porter, Ph.D.; E.T.S. Walton, M.A., M.Sc., Ph.D., D.Sc., F.T.C.D.

5 ADMINISTRATIVE STAFF

Registrar

Lt. Col. J. P. Duggan, B.A., H.Dip.Ed., M.Litt., MIL.

Senior Clerk

Maura Devoy, B.A.

Accounts Clerk

Mary A. O' Rourke, B.A.

Clerks

Angela Stubbs; Noreen Granahan; Caitríona Tubridy; Desmond Pender.

II - Annual Report of the Governing Board of the School of Celtic Studies for the year 1984, adopted at its meeting on 19 April 1985.

1. STAFF, SCHOLARS, VISITORS and EMERITUS PROFESSOR

Senior Professors:

Brian Ó Cuív, Director; James Carney.

Professor:

Heinrich Wagner.

Assistant Professors:

Pádraig de Brún; Fergus Kelly; Rolf Baumgarten; Mícheál Ó Siadhail.

Research Assistant:

Malachy McKenna

Assistant (part-time):

Mrs. Nessa Doran

Assistant Librarian/Clerk:

Máire Breatnach.

Secretary/Publications Officer:

Máire Uí Chinnseala.

Clerical Staff

Patricia Dunne

Scholars:

Fredrick Biggs(to 1 June); David Sproule (to 14 August); Máire Bhreathnach, Aoife Nic Ghiollamhaith, David Johnston (to 30 September); Anthony Harvey, Neil McLeod; Máirín Ní Dhonnchadha, Erich Poppe, James Fife, Colmán Etchingham (from 1 October).

Visitor:

Professor Fredrik Otto Lindeman, University of Olso (to March).

Professor Emeritus:

D.A. Binchy

The work of the School, consisting of research, teaching and publishing continued during the year. The triennial Summer School, held in July,was a conspicuous success, as well as the annual Tionól held in the period preceding Easter.

2 RESEARCH AND EDITING

Professor D. A. Binchy checked proofs of his article 'The Original Meaning of co nómad náu (nó); Linguists v. Historians?' for Celtica xvi. See also § 9(d).

Professor Brian Ó Cuív completed the editing and proof-correcting of Celtica xvi and read the manuscript draft of the introduction, text and notes of Professor Kenneth Jackson's edition of Aislinge Meic Con Glinne. He continued his work on linguistic, literary, historical and onomastic topics, including preparation of a number of lectures and articles. He did preparatory work for a course of lectures to be given in the University of Toronto in January - April 1985. He continued work on the Irish manuscripts in the Bodleian Library in Oxford and on contributions for a New History of Ireland. See also §§ 4, 6, 7, 8, 9(a), (b), (d).

Professor James Carney's work on the investigation of Archaic Irish verse continued. He supervised the work of scholars Anthony Harvey and Erich Poppe. See also §§ 4, 6.

Professor Heinrich Wagner worked on the preparation of a monograph on 'Das Hethitische vom Standpunkte der typologischen Sprachgeographie' which is to be published as one of a series of monographs edited by Professor E. Campanile of the University of Pisa. He assisted (i) Dr. George Broderick in his work on 'A Handbook of Late Spoken Manx'; (ii) Dr. Séamus Ó Cathain of Dept. of Irish Folklore, UCD in the preparation of an edition of Folklore texts from the Cruacha Gorma;(iii) Dr. Malachy McKenna in his work on S.E. Ulster Irish. Professor Wagner edited ZCP 40 and prepared the following articles for publication in the journal:- (i) 'The etymology of Celtic Nordons'; (ii) 'An edition of phonetic texts collected in 1946 from Dunquin and Ring'. See also §§ 3, 5, 6, 9(d).

Dr. Pádraig de Brún continued to catalogue the Irish manuscripts in TCD (with Máire Bhreathnach). He annotated the list of The Irish Society's Bible teachers, 1818-27 and worked on the life and works of Piaras Feiritéar. Information relating to uncatalogued manuscripts was collected. The following articles were accepted for publication: '"Barántas" ón mbliain 1714', and 'The Irish Society's Bible teachers, 1818-27 III, (Éigse); 'Kildare Place Society in Kerry IV, Summary and Discussion' (Kerry Archaeological and Historical Society Journal).
See also §§ 8,9(d).

Mr. Fergus Kelly continued work on the preparation of a volume on Early Irish Justice which is to be published in the Early Irish Law Series. He supervised Neil McLeod's work on an edition of Do Fastud Chor. See also §§ 4, 6, 9(d).

Mr. Rolf Baumgarten checked first proofs of the Bibliography of Irish linguistics and literature (593 galleys) and commenced the collection of material for the next volume of the Bibliography. An article entitled 'The geographical orientation of Ireland' was accepted for publication in Peritia 3.

Mícheál Ó Siadhail continued work on the Syntax of Modern Irish dialects and worked on a book entitled 'Aspects of Modern Irish dialects'. He acted as supervisor of Anthony Harvey and James Fife. See also §§ 6, 9(d).

Dr. Malachy McKenna continued research on his edition of 'The Spiritual Rose'. He completed the preparation of an Index to a series of articles on the Breton of Guémené and checked proofs of his article for Celtica xvi. He prepared a course on the Vannetais dialect of Breton for the Summer School and spent some weeks on field-work in Brittany to continue his project on the spoken Breton of S. E. Cornouaille. See also §§ 6, 9(d).

Mrs. Nessa Doran checked proofs of Catalogue of Irish MSS in the National Library of Ireland Fasc. VIII which was published during the year. Descriptions of MSS. G374 - G433 for Fasc. IX were drafted and typed. See also §§ 6, 7, 9(a),(b),(d).

Frederick M. Biggs continued work on an edition of 'Dúan in choíscat cest'. See also § 5.

David Sproule continued his work on dynastic ancestors of early Ireland which involved a study of several texts including 'Cath Maigh Mucrama', 'Cath Maigh Léana', and 'Tochmarc Momera'. He corrected proofs of his article 'Origins of the Éoganachta' for Ériu xxxv. See also § 5.

Máire Bhreathnach revised the final draft of the new edition of Togail Bruidne Da Derga, completed an introduction to the text and reviewed all extraneous and annalistic sources for the Conaire cycle. She checked proofs of her edition of 'Tochmarc Becfhola' which is to appear in Ériu xxxv. The following reviews were written (i) A. Bammesberger: A Handbook of Irish, A Grammar of Modern Irish, Modern Irish Prose for Indogermanische Forschungen; (ii) Patrick Ford ed. Celtic Folklore and Christianity for ZCP. See also § 7.

Aoife Nic Ghiollamhaith continued her research into the political history of Gaelic Munster in the medieval period, concentrating particularly on the early medieval genealogies and origin legends in Bodley, Laud Miscellany 610, and on the rise of the Dál Cais in the tenth and eleventh centuries. See also §§ 7, 9(d).

Dr. David Johnston completed his doctoral thesis on the Welsh poet Iolo Goch and was awarded the degree of Ph.D. by the University of Wales. He read proofs of two reviews (A. O. H. Jarman's Llyfr du Caerfyddin and E. G. Bowen's St. David) which were accepted for publication in Celtica xvi. See also § 7.

Anthony Harvey worked on: (i) 'Early Spelling and Phonology in the Celtic British Isles' for a Ph. D. dissertation; (ii) 'Preliminary Report on the Glosses in the Cambridge Juvencus, University Library MS f. 4.42'; (iii) further research on 'Gemination in the Ogam Inscriptions'. An article entitled 'The Significance of Cothraige' was accepted for publication in Ériu. See also §§ 5, 9(d).

Neil McLeod completed the preparation of his edition of the law text 'Di Astud Chor' together with an essay (100 pages) on early Breton Contract Law. He worked on fosterage law and animal diseases in the Law tracts. An article on 'Interpreting Early Irish Law' was accepted for publication in two parts in ZCP. See also §§ 5, 9(d).

Máirín Ní Dhonnchadha worked on (i) linguistic and textual notes for her edition of Cáin Adamnáin; (ii) collection of references to cána in the Corpus Iuris Hibernici; (iii) preparation of an article on grants and bequests to the early Irish church.

Dr. Erich Poppe worked on editions of 'Laíd cluic Éimíne' and 'Cáin Éimíne Báin' and collected information on the genealogical background to Éimíne and other persons named in the Cáin.

James Fife completed his Ph.D. thesis 'Semantic Structure of the verb in Modern Welsh' which was submitted to the University of Wales. He did preparatory work on two articles: 'Object mutation in Middle Welsh' and 'The abnormal sentence order in Welsh'. He studied the semantics of Old Irish ro, the grammar of Early Modern Welsh, Old and Modern Irish and Breton. The following articles were accepted for publication: 'The impersonal Verb in Welsh' (Bulletin of the Board of Celtic Studies. Vol. 31/32) and 'Copulation and existence' (Linguistic Notes from La Jolla. Vol. 13).

Colmán Etchingham worked on a doctoral thesis 'Monasteries, "paruchiae" and politics in Ireland from the eighth to the tenth century', using annals, saints' lives and genealogies.

3. STATUTORY PUBLIC LECTURE

A Statutory Lecture entitled 'The Celtic Invasions of Ireland and Britain: Facts and Theories' was delivered by Professor Heinrich Wagner at University College, Belfield, Dublin on 7 December 1984.

4. SEMINARS

Mr. Fergus Kelly resumed an informal reading of the legal Heptads, beginning at Corpus Iuris Hibernici 19.3 (= Ancient Laws of Ireland V 190). He also read the short law-text Cis lir cenéla airechta dochusin la Féniu? (CIH 601.20 - 602.23) during the Hilary term.

Professor James Carney held a seminar on the archaic poem Conailla Medb míchura during the Hilary term and one on Early Irish Poetry during the Michaelmas term.

Professor Brian Ó Cuív conducted a seminar on Aspects of the Phonology of Classical Early Modern Irish during the Michaelmas term.

5. SYMPOSIUM

On 13 - 14 April a symposium was held for university and college staff and research workers. The following papers were read:-

Deirdre Ní Cheallaigh : 'Then they learned to pronounce it'

Anthony Harvey : The Significance of Cothraige

Liam Breathnach	: Bretha Nemed with special reference to the Nero A7 version
An tAth. M. Mac Conmara	: Conversio Corporis Christi in panem et Sanguinis in vinum
Fred Biggs	: Dúan in Choícat Cest: a few answers
Donall Mac Giolla Easpaig	: The names Manannán and Manawydan
Heinrich Wagner	: New light on Nuadu
Diarmuid Ó Sé	: Non-initial stress in Irish
Eoghan Mac Éinrí	: A Computer Analysis of the Linguistic Atlas of Ireland
Máirin Ní Dhonnchadha	: Written Evidence in Old Irish
David Sproule	: Politics and pure narrative in the stories about Corc of Cashel
Máirtín Ó Briain	: 'Án sin, a maig Meic in Óc' ag Cinead Ua hArtacáin
Neil McLeod	: Rescission and Damages in Early Irish Contract Law

6. SUMMER SCHOOL

An International Summer School in Celtic Studies was held from 9 - 27 July under the direction of Mr. Fergus Kelly. The School was attended by 85 students representing Canada, Denmark, England, France, Germany, Holland, Ireland, Norway, Scotland, Sweden, Switzerland, United States of America, Wales.

The following courses were offered:- (1) Elementary Old Irish (Fergus Kelly); Advanced Old Irish (Kim McCone, Liam Breatnach); Elementary Modern Irish (Mícheál Ó Siadhail); Introduction to the Vannetais dialect of Breton (Malachy McKenna); Scottish Gaelic (William Gillies); Medieval Welsh (Proinsias Mac Cana); Medieval and Early Modern Irish (Brian Ó Cuív); Comparative Celtic (Heinrich Wagner); Irish Literature Brian Ó Cuív, James Carney, Fergus Kelly, Mícheál Ó Saidhail, Malachy McKenna, Nessa Uí Dheoráin and Proinsias Mac Cana.

Study Grants were awarded to 26 overseas students and ranged in value from £120 - £280.

Excursions were organised to Lough Crewe on Saturday 14 July and to the Boyne Valley on 21 July. The majority of students took part in both excursions.

7. EXTERNAL ACTIVITIES

Professor Brian Ó Cuív attended the 16th Annual Conference of the Council for Names Studies in Great Britain and Ireland in Aberdeen, 30 March - 2 April, and read a paper on 'The family of Ó Gnímh in Ireland and Scotland: a look at the sources'; on 2 - 3 April he visited Edinburgh to discuss with Professor Jackson the latter's edition of Aislinge Meic Con Glinne; he attended the third International Conference on the History of the Language Sciences at Princeton University, 19 - 23 August, and read a paper on 'The observations of medieval Irish scholars on sandhi phenomena in Irish'; he attended the inaugural colloquium of the Henry Sweet Society at St. Peter's College in Oxford on 17 September; on 28 November he lectured on 'Donnchadh Mór Ó Dálaigh († 1244) agus a chomhaimsearaigh' in a series on 'Scoláirí Éireannacha sa Léann Eaglasta' in Milltown Institute of Theology and Philosophy; and on 13 December he lectured on 'Medieval Irish Scholars and the Learning and Matter of the Classical World' in the Medieval Studies programme in University College, Dublin.

Mrs. Nessa Doran delivered the R.I. Best Memorial Lecture 'Collections of Irish Manuscripts: Motives and Methods' in Academy House on 24 October.

Máire Bhreathnach lectured to visiting American university students on 'Early Irish History', 'The earliest Celtic Mythology' and 'The three-fold death theme in Early Irish Literature' in Trinity College and the Gresham Hotel, Dublin 25 - 30 September.

Aoife Nic Ghiollamhaith attended the International Colloquium 'Ireland and Europe in the Early Middle Ages' held at University College, Dublin in August.

Dr. David Johnston attended a colloquium on Hengerdd which was held in Aberystwyth 26 - 28 June.

8. CATALOGUING OF IRISH MANUSCRIPTS

Negotiations were concluded for the publication by Cambridge University Press of A Catalogue of Irish Manuscripts in Cambridge Libraries, compiled by Pádraig de Brún and Máire Herbert, and a memorandum of agreement between the Syndics of the Press and the Institute was signed by the Director.

Mrs. Nessa Doran's work of cataloguing the Irish manuscripts in the National Library of Ireland continued. Fasciculus VIII, which contains MSS G350 - G373, was published during the year and preparatory work on Fasciculus IX comprising MSS G374 - G433 was completed.

Dr. Pádraig de Brún continued work, with some assistance from Máire Bhreathnach, on the Irish manuscripts in Trinity College Library.

Professor Brian Ó Cuív continued work on the Irish manuscripts in the Bodleian Library, Oxford.

9. PUBLICATIONS

Following negotiations with the Henry Bradshaw Society arrangements were made for the publication by the Institute of a reprint edition of Félire Óengusso Céli Dé: The Martyrology of Oengus the Culdee which was first issued to members of the Society for the year 1905.

(a) Works in course of Printing at December 31

The Annals of Ulster - Part 11 (containing an Introductory note and 3 Indexes compiled by G. Mac Niocaill).

Corpus Genealogiarum Sanctorum Hiberniae edited by P. O'Riain.

Bibliography of Irish Linguistics and Literature 1942 - 71 compiled by R. Baumgarten.

(b) Books published by the Institute

The Annals of Ulster Part 1 Ed. Seán Mac Airt and Gearóid Mac Niocaill	xv + 579	£40.00

Catalogue of Irish MSS. in NLI fasc. VIII		
Nessa Ní Shéaghdha.	98pp.	£9.00
Celtica xvi		
Ed. Brian Ó Cuív.	220pp.	£12.00
Translations and Adaptations into Irish		
Nessa Ní Sheaghdha.	ii + 18pp.	£1.00

(c) Reprints of Institute publications

1. Adamnan's De Locis Sanctis.
2. Mesca Ulad.
3. Periphyseon II
4. Annals of Connacht
5. Eachtra Uilliam
6. Apocrypha in the Irish Church.
7. Irish Bardic Poetry.
8. Brut y Brenhinedd.
9. Dhá Sgéal Artúraíochta.
10. Seana-chaint na nDéise.
11. Stories from the Acallam.
12. Learning Irish.

(d) Reprint editions of works originally published elsewhere

Félire Óengusso Céli Dé : The Martyrology of Oengus the Culdee

(e) Contributions to periodicals and other publications:

D.A. Binchy:

The Original Meaning of co nómad náu (nó); Linguists V. Historians? Celtica xvi. 1 - 12

Brian Ó Cuív:

An Elegy on Donnchadh Ó Brian, Fourth Earl of Thomond. Celtica xvi. 87 - 105.

Some Irish items relating to the McDonnells of Antrim ibid. 139 - 156.

Reviews of publications ibid. 190 - 196, 207 - 216.

The family of Ó Gnímh in Ireland and Scotland: a look at the sources.
Nomina 8 57 - 71

Review of Gaelic Personal Names (Ó Corráin/Maguire)
ibid. 18 - 20

An raibh adharca ar do mhinistir?
Béaloideas 52.7014

Ireland in the eleventh and twelfth centuries. The Course of Irish History (revised edition).

Heinrich Wagner:

Oral Literature from Dunquin, Co. Kerry (with Nollaig Mac Congail) Institute of Irish Studies, Belfast.

Pádraig de Brún:

An Teagasc Críostaí i gConamara roimh 1800 Celtica xvi.138.

The Irish Society's Bible Teachers, 1818 - 27 : II. Éigse 20 34 - 92

Further additions to the Franciscan collection. ibid. 157 - 63

Some impressions of Kildare in 1801. Kildare Archaelogical Society Journal. 16/4. 340 - 41.

Fergus Kelly:

Reviews of publications. Celtica xvi. 197 - 201.

Míchéal Ó Siadhail:

Agus (Is) / And: A Shared Syntactic Feature. Celtica xvi 125 - 137.

Review of Progress in Language Planning: International perspectives. ibid. 189 - 190.

Malachy McKenna:

The Breton Literary Tradition. Celtica xvi. 35 - 51.
A note on E. Ulster nar and Old Irish náthar, nár, ibid. 52.

Nessa Ní Shéaghdha:

Ovid's Remedia Amoris. Celtica xvi 106.

Translations and Adaptations into Irish. ibid. 107 - 124

Aoife Nic Ghiollamhaith:

The Uí Bhriain and the King of England, 1248 - 1276. Dal gCais 94 - 99.

Review of James III: a political study (Macdougall). Cambridge Medieval Celtic Studies 8. 107.

David Johnston:

Reviews of publications. Celtica xvi. 203 - 206, 219 - 220.

Anthony Harvey:

Aspects of Lenition and Spirantization. Cambridge Medieval Celtic Studies. 8. 87 - 100

Neil McLeod:

Ronayne's 'Seandlithe na nGael': A Supplement. Irish Jurist 18. 360 - 363.

III - Annual Report of the Governing Board of the School of Theoretical Physics for the year 1984, adopted at its meeting on 1 October 1985.

1. STAFF, SCHOLARS, RESEARCH ASSOCIATES, VISITING SCIENTISTS and EMERITUS PROFESSOR.

Senior Professors:

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

Assistant Professors:

M. van den Berg to 30 September; J. Burzlaff from 1 October.

Librarian-Executive:

Evelyn R. Wills

Secretary:

Margaret Matthews.

Scholars:

T. Murphy (USA) to 31 August; J. Burzlaff (Fed. German Rep.) to 30 September; F. Marchesoni (Italy) to 31 August; E. Buffet (France) 1 February to 30 September; E. Müller (Fed. German Rep.) from 1 October; P. Horvàthy (Hungary) from 1 October; H. Yoneyama (Japan) from 1 October; A. Wipf (Fed. German Rep.) from 1 November.

Research Associates (all appointments to 31 December 1984):

TCD: D. J. Bradley, R.K.Dodd, P.S. Florides, H.C. Morris, B.K.P. Scaife, R.S. Ward, A.E. Raftery from 6 April

UCD S. Dineen, P.A. Hogan, D.J. Judge, J.D. McCrea, J.V. Pulè, W. Sullivan; D. Weaire (transferred to TCD from 1 October)

St. Patrick's College, Maynooth: C. Nash, A. O'Farrell, J. Spelman, D. H. Tchrakian.

UCG: M.J. Conneely, T.N. Sherry

DIT Kevin St.: T. Garavaglia, B. Goldsmith; D. Heffernan from 3 July.

DIT Rathmines: M. Tuite

NIHED: R.C. Flood

NIHEL: J. Kinsella

An Foras Forbartha: J. M. Golden

~~NUU: P. McGill~~

Open University: A.I. Solomon.

Visiting Scientists:

F. Ando (Shinshu Univ) 16 - 18 July; M. van den Berg (Heriot-Watt, Edinburgh) 13-31 December; A. Chakrabarti (Ecole Polytech., Paris) 3 July - 5 August; J. Conlon (Missouri) 2 - 31 July; P. Dolan (Imperial Coll., London) 11 - 18 April, 1 - 14 August; D.E. Evans (Warwick) 2 - 12 February, 30 December - 13 January 1985; M. Fannes (Leuven) 26 March - 19 April; G.W. Ford (Michigan, Ann Arbor) 2 - 31 July; D.G. Frood (Lakehead Univ., Ont.) one year from 28 August; C.A. Hurst (Adelaide) 15 - 28 September; M. Lunn (Oxford) 24 - 28 September; V. Mizel (Carnegie-Mellon, Pittsburgh) 23 - 25 July; A. Morita (Tokyo) 13 - 20 August; W. Nahm (Bonn) 16 - 18 April; G.B. Parravicini (Pavia) 9 - 14 May; D. Pottinger (Bonn) 3 - 6 January; G. Prince (Roy. Melbourne Inst. Tech.) 28 December - 6 January 1985; A. Savini (Pavia) 8 - 16 August; D. Speiser (Louvain) 17 - 21 November; M. Toller (Trento) 4 - 11 August; M. Yor (Paris VI) 8 February.

Emeritus Professor:

John L. Synge.

2 GENERAL

The Chairman and Professor O'Raifeartaigh met the Delegation to Ireland from the Academy of Sciences of the USSR when it came to the School; the possibility of future exchange visits was discussed.

In continuing fulfilment of the School's statutory function "to train advanced students in the methods of original research", postdoctoral scholarships (up to six at any one time) were awarded to E. Buffet, E. Müller, P. Horvàthy, H. Yoneyama, and A. Wipf; the scholarships already held by T. Murphy and F. Marchesoni ended on 31 August, and that of J. Burzlaff on 30 September.

J. Alberty (Portugal), P. Horváthy (Hung E. Müller (Fed Ge A. Wipf R D Ó Sé (Ireland) M. Vandyck (Bel

In addition to the use made by Staff, Scholars, and Research Associates of the School in their primary research activities, much use was made also by visitors, particularly during the summer months, of the School's facilities for research - especially of the opportunities for informal discussions, and the library resources. Twenty-~~nine~~ research workers from universities and other institutes of research or higher education were admitted as research associates of the School. For details of Visitors to the School see §10.

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3. RESEARCH AND STUDY

Primary areas -

(a) Theoretical Particle Physics

Professor O'Raifeartaigh spent the first eight months of the year completing the manuscript of his book "Group Structure of Gauge Theories" and sent it to the Cambridge University Press on 1 September. He continued his work on gauge theories, particularly on colour-breaking by monopoles and on the structure of Higgs potentials, the latter work being in collaboration with Dr. Murphy and Professor Burzlaff. He re-commenced work on effective potentials, collaborating with Drs. Wipf and Yoneyama. Dr. Murphy worked also on functional integrals and the WKB approximation. Professor Burzlaff studied both static and time-dependent solutions to Yang-Mills-Higgs systems. These static solutions do not minimize the energy in a topological sector. In collaboration with Dr. Tchrakian and Dr. Sherry he analysed Yang-Mills-Higgs systems resulting from the dimensional reduction of higher-dimensional pure Yang-Mills systems. Dr. Tchrakian continued his investigations in classical gauge field theories, including gravity, from the special

viewpoint of imposing symmetries on higher dimensional theory, paying special attention to a theory in eight dimensions which he himself introduced some years before; he found an exact solution. He continued his collaboration with Drs. Sherry, Ma, and O'Brien on the dimensional reduction of Chern-classes on arbitrary dimensions. He was assisted in some of this work by Mr. O'Sé (Maynooth) and Mr. J. O'Donoghue (Maynooth); he also studied, together with Dr. Sherry and Mr. O' Sé, axial two-dimensional solutions to gauge field systems. Dr. Wipf studied general properties of the tunnel determinant (analyticity, convergence, etc.) in phase transitions. Dr. Yoneyama studied the phase structure of the gauge system and scalar field system, based mainly on the lattice formulation.

Dr. Horváthy studied internal symmetries in non-Abelian gauge theories, in collaboration with Dr. J. Rawnsley (Warwick), and the non-Abelian Aharonov-Bohm effect, in collaboration with Professor O'Raifeartaigh.

Dr. Tuite continued his studies of supersymmetry breaking and N=1 supergravity, non-linear realisations of supersymmetry, and Yang-Mills theories coupled to N=2 supergravity; he began a study programme on applications of finite-temperature effective potentials in gauge theories, with emphasis on the approach of "thermo-field dynamics" to quantum field theory at finite temperatures.

Dr. Garavaglia studied polarization phenomena in lepton-nucleon scattering, neutrino-electron scattering with polarized electrons and Majorana or Dirac neutrinos, and nucleon structure with polarized leptons.

(b) Classical Statistical Mechanics

(i) Brownian Motion and Relaxation Phenomena

Professor McConnell continued to work on the theory of nuclear magnetic relaxation processes, with special reference to molecular liquids. He studied the literature on intermolecular dipolar interaction and on NMR relaxation experiments. He began to prepare material for a book dealing with the theory of nuclear magnetic relaxation.

(ii) Phase Transitions in Lattice Systems

Professor Lewis continued his collaboration with Dr. D.E. Evans (Warwick) on a C*-algebra formulation of the two-dimensional Ising model. Using Kramers-Wannier duality, they obtained a simple proof of the Araki-Evans theorem on the Ising representation of the Pauli algebra.

Dr. Sullivan continued his work on the study of spectral properties of stochastic processes, in collaboration with Dr. Flood; he also studied L^2 convergence of certain random walks on W^2 and related diffusions.

(c) Quantum Statistical Mechanics

(i) Asymptotic Evolution of Open Systems

Dr. Müller began an investigation of a spin system coupled to the quantized electromagnetic field, using an unconventional approach which involved Debye potentials for the electromagnetic field. In this way some notorious problems in quantum electrodynamics were circumvented.

(ii) Boson Condensation

Professor Lewis continued his collaboration with Dr. Lunn (Oxford) and Professor van den Berg on the states of the free Boson gas.

Dr. Buffet worked on a rigorous approach to the critical slowing down and on condensation in a hard core Bose gas.

(iii) Quantum stochastic processes

Professor Lewis continued his collaboration with Dr. Maassen (Delft) on the quantum Langevin equation, and with Professor Ford (Ann Arbor) and Professor O'Connell (Baton Rouge) on the application of the quantum Langevin equation to Stark shifts due to black body radiation.

Dr. Garavaglia studied finite temperature field theory and quantum noise in electrical circuits, and finite temperature field theory and phase diagrams in scalar quantum electrodynamics.

(d) Quantum Electronics

Dr. Heffernan's research interests included semiconductor lasers, non-linear optical effects in fibres, polymers and organic materials, ultrafast optical processes, bistability and dynamical processes in optical systems. In some of his work on multistability, ultrafast switching and chaos in semiconductor lasers he had collaboration from B. Hawdon, L. Reekie, J. McInerney, and D. J. Bradley (all of TCD).

Secondary areas -

(e) General Relativity and Gravitation

In continuation of recent work in which he found a stationary spherically symmetric solution of the quadratic Poincaré gauge field equations of gravitation, Dr. McCrea undertook a search for a stationary axially symmetric solution which would be the analogue of the Kerr solution in general relativity, which is not yet completed. He worked also on a review article, in collaboration with Professor F. W. Hehl (Cologne).

Dr. Hogan collaborated with Professor A. Trautman (Warsaw) in a study of the asymptotic field in gravitational radiation from bounded sources. He collaborated also with Professor I. Robinson (Texas) in a study of the electromagnetic and gravitational radiation reaction on the motion of charged and uncharged particles, and its relationship with the geodesic hypothesis in general relativity.

(f) Pure Mathematics

Professor van den Berg studied the heat equation for regions in R^n with a smooth boundary, and for horn-shaped regions in R^2 with a regular boundary, and obtained best possible bounds for traces associated with the Dirichlet Laplacian. He collaborated with Professor Lewis in obtaining a martingale characterization of Brownian motion on a hypersurface.

Dr. Goldsmith continued his studies of endomorphism algebras of modules and Abelian groups including combinatorial set theoretic techniques.

(g) Applied Mathematics

Professor Synge continued his collaboration with Professor Lewis on problems in wave-propagation.

Dr. Marchesoni studied adiabatic elimination procedures for a number of stochastic systems, and relaxational dynamics of a planar rotator in an M-fold periodic potential subject to a random torque, which he applied to dielectric spectroscopy.

Research Reports

Research work during the year was written up in the first instance in research reports. Three lists of titles of these reports (preprints) were prepared and circulated to a mailing list of approximately 300 research institutes and university departments throughout the world. As far as available, copies of the preprints were supplied to research workers in response to requests. Many of the reports appeared later as publications, or were in press at the end of the year (See Section 11)

DIAS-STP-84-01: E. GUARDIA, F. MARCHESONI & M. San MIGUEL: Escape times with memory effects.

-02: F. MARCHESONI : Use and misuse of adiabatic elimination procedures for stochastic processes.

-03 C. FESTA, L. FRONZONI, P. GRIGOLINI, & F. MARCHESONI: The range of validity of the current procedures of adiabatic elimination: Experimental and theoretic evidence.

-04: F. MARCHESONI: Stability of nonlinear overdamped systems in the presence of multiplicative fluctuations.

-05: F. MARCHESONI & P. GRIGOLINI: On the contraction of fast variables in stochastic processes: The influence of pumping on relaxation.

-06: P. HANGGI, F. MARCHESONI, & P. GRIGOLINI: Bistable flow driven by coloured Gaussian noise: A critical case study.

-07: P. GRIGOLINI & F. MARCHESONI: Our adiabatic elimination procedure: A basic description.

-08: F. MARCHESONI: Non-linear and non-Markovian effects in relaxation processes: Application to molecular physics.

-09: J. BURZLAFF & V. MONCRIEF: The global existence of time-dependent vortex solutions.

-10: P. A. HOGAN: Yang-Mills fields on 2-surfaces of constant curvature.

-11: J. BURZLAFF: Noncontractible hyperloops in gauge models with Higgs fields in the fundamental representation.

-12: T. MURPHY, L. O'RAIFEARTAIGH & M. YAMADA: Symmetry breaking and renormalization effects for an SU (n) model with two scalar fields.

-14: * J. R. McCONNELL: Relaxation theory for molecular liquids.

-15: M. van den BERG & J. T. LEWIS: On the heat equation and the spectrum of the Dirichlet Laplacian for spiral regions in R^2.

-16: T. MURPHY: Symmetry breaking patterns in SU(n) and symmetric theories.

-17: M. van den BERG & J. T. LEWIS: Brownian motion on a hypersurface in $\mathbb{R}^d$.

-18: F. FERRINI, F. MARCHESONI & S. N. SHORE: Stochastic processes in astrophysics: Stellar formation and galactic evolution.

-19: F. MARCHESONI: Thermally activated chemical reactions in the presence of internal multiplicative noise.

-20: E. BUFFET, Ph. de SMEDT & J. V. PULÈ: On the dynamics of Bose-Einstein condensation.

-21: F. MARCHESONI: On the breakdown of the Kramers theory as a problem of correct modelling.

-22: J. BURZLAFF, T.N. SHERRY, & D. H. TCHRAKIAN: Dimensional reduction, vortices and saddle points.

-23: T. FONSECA, J. A. GOMES, P. GRIGOLINI, & F. MARCHESONI: The theory of chemical reaction rates.

-24: D. O'SÉ, T. N. SHERRY, & D.H. TCHRAKIAN: Surface integrals in lower dimensions from higher order Chern classes and a class of solutions in three dimensions.

-25: P. A. HOGAN: Bateman's electromagnetic waves.

-26: G. W. FORD & J. T. LEWIS: Quantum stochastic processes.

-27: P. GRIGOLINI, F. MARCHESONI, & S. PRESCIUTTINI: Population genetics: time properties of a model of random fluctuating selection.

-28: F. MARCHESONI & J.K.VIJ: Brownian motion in a periodic potential: application to dielectric relaxation.

-29: F. MARCHESONI: Numerical solutions in periodic potentials: A comparison with the theory of activated processes.

-30: M.W.EVANS & F. MARCHESONI: Limitations of the one-body approach to dielectric relaxation: comparison with rise transients from computer simulation.

-31: L. PAPIEZ: Microscopic open systems.

-32: D. HEFFERNAN: Transient resonant spiking in degenerate four wave mixing in saturable absorbers.

-33: L. O'RAIFEARTAIGH: Group structure of gauge theories.

-34: D. H. TCHRAKIAN: Spherically symmetric gauge field configurations with finite action in 4p - dimensions (p= integer).

-35: A. I. SOLOMON: A Lie algebraic approach to order parameters.

-36: A. I. SOLOMON & J. L. BIRMAN: Dynamical group model of a spin density wave system.

-37: J. L. BIRMAN & A. I. SOLOMON: State labels, and selection rules in superconductors and charge density wave superconductors in the dynamical algebra.

-38: J. L. BIRMAN & A. I. SOLOMON: Lie algebraic methods applied to systems of coexisting phases.

-39: D. M. HEFFERNAN: Multistability, intermittency and remerging Feigenbaum trees in an externally pumped ring cavity laser system.

-40: H. YONEYAMA: The Martinelli-Parisi systematic expansion in lattice gauge theory - Z(2) model on a cubic lattice.

-41: S. CARACCIOLO & H. YONEYAMA: Optimization of the potential shifting in the Martinelli-Parisi expansion of the Z(2) gauge theory on a cubic lattice.

-42: G. W. FORD, J.T. LEWIS & R.F.O'CONNELL: Stark shifts due to blackbody radiation.

-43: E. MÜLLER: Note on relative entropy and thermodynamical limit.

-44: M. van den BERG: On the asymptotics of the heat equation.

-45: E. BUFFET & J. V. PULÈ: A hard core Bose gas.

-46: W. G. SULLIVAN: L^2 convergence of certain random walks on W^2 and related diffusions.

-47: J. BURZLAFF, T. MURPHY, & L. O' RAIFEARTAIGH: Non-maximal and disconnected stability groups: SU(3) counter-example to Michel conjecture.

-48: J. T. LEWIS: Brownian motion on a submanifold of Euclidean space.

-49: M. van den BERG, J.T.LEWIS, & M. LUNN: On the general theory of Bose-Einstein condensation and the state of the free boson gas.

-50: J. T. LEWIS: An elementary approach to Brownian motion on manifold.

-51: A. TRUMAN & J. T. LEWIS: The stochastic mechanics of the ground state of the hydrogen atom.

-52: H. BLOCK, E. KLUK, J. McCONNELL, & B. K. SCAIFE: Polarization in rotating dielectrics.

4. SEMINARS, REVIEW LECTURES, SERIES, COURSES.

Seminar and review lectures, series and courses in specialized areas of physics and/or mathematics were held throughout the year, and as in previous years were attended by members of staff and students from the universities and other third level and research institutes in the Dublin area, and by members of the scientific schools of DIAS.

(a) Seminar and review lectures given at DIAS-STP:

Prof. J. CONLON (Missouri):	The ground state energy of a boson gas.
Prof. G.W. FORD (Ann Arbor):	Quantum Langevin equation.
Prof. C.A. HURST (Adelaide):	Dirac's method of quantization: A rigorous approach.
Prof. J.T. LEWIS:	Donsker-Varadhan theory.
	An elementary approach to Brownian motion on manifolds.
Prof. V. MIZEL (Carnegie-Mellon):	Singular solution of regular variational problems.
Dr. T. MURPHY :	On the triviality of ϕ^4 theory - a variational approach.
Dr. W. NAHM (Bonn):	The Rubakov effect.
Dr. P. RYAN (AFT) :	Opportunities for EEC funding towards science and technology in Ireland.
Prof. A. SAVINI (Pavia):	Dielectrophoresis of weakly-conducting dielectrics.
Prof. M. TOLLER (Trento):	Field theory on a space of reference frames.
Prof. M. YOR (Paris VI) :	Applications of local time to storage processes and other problems.

Informal seminars:

Dr. A. CHAKRABARTI (Ecole Poly.Paris):	Instanton chains with monopole limits.
	Topological aspects of Yang-Mills fields in curved spaces (Exact solutions).
	Fermions in monopole-type backgrounds (Rubakov-Callan effect and related considerations).
Dr. P. HORVÀTHY:	Non-Abelian BA effect.
Dr. J. V. PULÈ :	Some one-dimensional models of interacting boson equations.
Dr. H. YONEYAMA:	Introduction to lattice theory (3 seminars).

(b) Series and Courses:

A series of informal seminars in STATISTICAL PHYSICS was given from October onward by Professor LEWIS and others working with him. A series of informal seminars on THE THEORY OF LARGE DEVIATIONS was given in October and November by Professor LEWIS' group.

Professor LEWIS completed his course on STATISTICAL MECHANICS for graduate or final year undergraduate students, begun the previous year; he began a new course on the same subject in October.

Professor O'RAIFEARTAIGH commenced a course of lectures on GROUP THEORY AND ITS APPLICATIONS TO PHYSICS, forming part of the M.Sc. course for universities in the Dublin area, in October.

(c) Contributions to the Journals' Club (Joint TCD-UCD-Maynooth-DIAS Particle Group, meeting in TCD);

Prof. M. van den BERG:	Can you hear the shape of a drum?
Dr. J. BURZLAFF:	The global existence of time-dependent vortex solution.
	SU(13) counter-example to Michel conjecture JC.

Dr. T. MURPHY:	New inflationary universe.
Prof. L. O'RAIFEARTAIGH:	On colour-breaking by monopoles.
Dr. J. V. PULÈ:	Stability of matter and Thomas-Fermi theory.
Dr. D.H. TCHRAKIAN:	Dimensional reduction and higher order topological invariants in gauge theories.
Dr. H. YONEYAMA:	Lattice gauge theory and real space normalization group.

(d) Other lectures or seminars given in Ireland by members of DIAS-STP:

Dr. D. HEFFERNAN:	Rapid switching in multistable systems - the road to chaos? Given at TCD.

5. ACTIVITIES ABROAD

Professor McConnell visited the University of Bielefeld, the Johannes Gutenberg University (Mainz), and the Otto-Hahn Institut für Chemie (Mainz) during March to lecture and have discussions, and to promote European collaboration in the field of molecular liquids. He attended the conference of the Condensed Matter Division of the European Physical Society at The Hague, 18 - 22 March, and presented a poster. On 10 July he attended, at University of Paris VI, a meeting of the organizing committee for the 2nd European Molecular Liquids Group Conference. In September he visited Nice to act as chairman of committees of the EMLG, and to attend and lecture at the 2nd EMLG Conference, at the University of Nice, 3 - 8 September. He visited the University of Pavia in September, to give a lecture, and to have discussions with experimentalists.

Professor Lewis visited the University of Warwick (20 - 24 February and 30 April - 4 May), the University of Nottingham (19 - 20 March), the University of Swansea (21 - 27 March and 14 - 24 May), the Universities of Oxford and Swansea (18 - 22 June), and King's College, London (15 - 16 November), for discussions. He attended the 1984 Pugwash Conference on Science and World Affairs at Bjorklinden (Sweden), 9 - 15 July; he attended and lectured at the Conference on Stochastic Processes, and Quantum Physics, Swansea, 13 - 20 August, the Colloquium on Random Fields at Kőszeg (Hungary), 26 August - 1 September, the Symposium on Stochastic Processes, Bielefeld, 10 - 14 September, and the Second Workshop on Quantum Probability and Applications,

Heidelberg, 1 - 4 October. From 26 November - 14 December he visited and lectured at Missouri - Columbia University, Louisiana State University, Carnegie-Mellon University, MIT and the Courant Institute (NYU); he attended and lectured at the 52nd Statistical Mechanics Meeting, at Rutgers University 13 - 14 December.

Professor O'Raifeartaigh was at IHES (Bures-sur-Yvette) on continuing leave of absence from the School until 30 April. During that time he visited Bonn University in January and University of Bern in April to give seminars. In June he visited Oxford University for two days, and gave a seminar. He gave a series of four lectures on Unified Gauge Theory at the International Seminar on Mathematical Physics at Qukuroa University, Ankara, from 23 November to 2 December.

Between 25 May and 4 June Professor van den Berg visited King's College, London, for discussions with E.B. Davies, University of Groningen for discussions with L. Pietronero, and Univ. Cat. Nijmegen for discussions with W. Vervaat. He attended and lectured at the Workshop on Functional Integration, Stochastic Processes, Quantum Mechanics, Swansea, 13 - 20 August.

Professor Burzlaff visited University of Freiburg (discussions), 4 - 5 January, University of Kaiserslautern (discussions and seminar), 9 - 11 January, and IHES (Bures-sur-Yvette) (discussions), 11 - 13 January. He visited University of Clausthal (for a talk), 12 - 13 June, the Max- Planck Institute at Bonn (collaboration with V. Moncrief), 18 June, the University of Heidelberg (talk) 19 - 20 June; the University of Kaiserslautern (talk), 22 June, and University of Hamburg (talk), 25 - 26 June. He attended the Royal Society Meeting on New Developments in the Theory and Application of Solitons, 1 - 2 November.

Dr. Marchesoni visited the University of Aachen 4 - 8 January, for discussions and a seminar.

Dr. Müller attended and lectured at the Second Workshop on Quantum Probability and Applications, Heidelberg, 1 - 5 October.

Dr. Horvàthy went to Marseilles-Luminy on leave of absence from 1 December.

Drs. Wipf and Yoneyama attended the Annual Rochester High Energy Physics Meeting, 17 - 19 December.

Dr. McCrea visited the Institut für theoretische Kernphysik, University of Cologne for one week in July, to collaborate with F.W. Hehl, and to give a seminar.

Dr. Hogan visited the University of Louvain from 15 June to 15 July, to give a course.

Dr. Tchrakian visited University of Texas, Austin, Oct. - Nov. for discussions with S. Weinberg and his group. He spent December at the State University of New York at Stony Brook, visiting C. N. Yang and his group. During these visits he gave a number of seminars.

Dr. Garavaglia visited the Centre for Theoretical Physics, Marseille, in September, for collaborative work and to attend a conference on High Energy Spin Physics.

Dr. Goldsmith attended and lectured at the Conference on Abelian Groups and Modules, at Udine (Italy) in April.

Dr. Sullivan attended and lectured at the Conference on Spatial Processes, at Heidelberg in September.

Dr. Heffernan attended the Royal Society Discussion Meeting on Optical Bi-stability, Dynamical Nonlinearity, and Photonic Logic, 21 - 22 March.

Dr. Murphy attended the Spring Meeting of the American Physical Society, Washington, 14 - 22 April.

Seminars, Lectures, and Courses given Abroad:

Professor McCONNELL:

Lecture on "Theory of Nuclear Magnetic Relaxation",given at Bielefeld, and at Johannes Gutenberg University.

Poster on "Relaxation Theory of Molecular Liquids", given at Conference at The Hague.

Lecture on "Debye Approximation of Inertial Relaxation Theory", given at Nice Conference.

Lecture on "Debye Limit of the Stochastic Rotation Operator", given at Pavia.

Professor LEWIS:

Lecture on "An Elementary Approach to Brownian Motion on Manifolds", given at Swansea, at King's Coll., London, at Bielefeld, at the Courant Institute, and at MIT.

Lecture on "Equivalence of Ensembles in Statistical Mechanics", given at Köszeg, at the Carnegie-Mellon University, and at University of Missouri-Columbia.

Lecture on "Stark Shifts due to Black Body Radiation", given at Oxford, LSU (Baton Rouge), and at the Rutgers Conference.

Seminar on "Asymptotic Methods for Relaxation Processes", given at LSU.

Lecture on "Quantum Probability in Physics", given at Heidelberg.

Professor O'RAIFEARTAIGH

Seminar on "Effective Potential", given at Bonn.

Seminar on "Colour Breaking by Monopoles", given at Bern and at Oxford.

Series of four lectures on Unified Gauge Theories given at ANKARA

Professor van den BERG:

Lecture on "Asymptotics of the Heat Equation", given at Swansea.

Professor BURZLAFF:

Lecture on "Globale Existenz Zeitabhängiger Vortex lösungen", given at Kaiserslautern.

Lecture on "Sattelpuntke in Eichtheorien", given at Clausthal, Heidelberg, Kaiserslautern, and Hamburg.

Dr. MÜLLER:

Lecture on "Note on Relative Entropy and Thermodynamical Limit" given at Heidelberg.

Dr. McCREA:

Lecture on "Algebraic Computing in the QPG Theory of Gravitation" given at Cologne.

Dr. HOGAN:

One month course on "Gravitational Radiation", given at Louvain.

Dr. TCHRAKIAN:

Seminars as follows:

"Classical Field Configurations, with topologically Interesting Properties, in Higher Dimensions", given at Austin, UCLA and MIT.

"Gauge Field Theories on Euclidean Manifolds, Maxwell, Yang-Mills and Beyond", given at Baton Rouge, and at Texas A & M (Galveston).

"Symmetries on Gauge Fields", given at UC Berkeley.

Dr. GARAVAGLIA:

Seminar on "Towards a Composite Field Theory", given at Marseille.

Dr. GOLDSMITH:

Lecture on "Endomorphism Algebras in the Category Walk", given at Udine.

Dr. SULLIVAN:

Lecture on "L^2 Convergence of Certain Random Walks on W^2 and Related Diffusions", given at Heidelberg.

6. STATUTORY PUBLIC LECTURE

A Statutory Public Lecture under the auspices of the School was delivered by Professor D. SPEISER (Univ. Cath., Louvain) on 20 November in Trinity College Dublin. The title was 'The development of continuum mechanics in the 18th century'.

7. SYMPOSIA

Two mathematical Symposia were held during the year, 17 - 18 April, and 20 - 21 December. The attendances (44 in April, 51 in December) included professors, lecturers, and graduate students from the Irish universities and other third-level and research institutions, and from institutions abroad, and members of the Scientific Schools of DIAS.

Lectures were given as follows:

APRIL:

Review Lectures:

Prof. J.L. ERICKSEN (Minnesota):	Thermoelastic theory of twinning.
Dr. G.R. ALLAN (Cambridge):	Subharmonic functions in spectral theory.

Lectures:

Dr. T. MURPHY (TCD):	Mathematical tools in theoretical computing: 1. The topology of data types.
Dr. J. BURZLAFF (DIAS):	Saddle points in gauge field theories.
Dr. D. H. TCHRAKIAN (Maynooth & DIAS):	Dimensional reduction and topological invariants in gauge theories.
Dr. D. HURLEY (UCC):	Hyperbolic behaviour of geodesic flows.

Short talks:

Dr. P. LYNCH (Met. Office):	A new initialization method for NWP (Numerical Weather Prediction).

Dr. M. FANNES (Leuven):	Correlation inequalities for classical statistical mechanics.
Prof. J. T. LEWIS (DIAS):	Fourier series on finite groups and statistical mechanics.
Dr. P. DOLAN (Imperial Coll.):	Extended and graded symmetries in general relativity.
Dr. P. HOGAN (UCD):	Every plane EM wave is a Synge wave.

DECEMBER:

Review Lectures:

Dr. A. B. TAYLER (Oxford):	The application of weak solutions to problems in applied mechanics.
Dr. M. van den BERG (Heriot-Watt):	On the asymptotics of the heat equation and the eigenvalues of the Dirichlet Laplacian.

Lectures:

Prof. B. TWOMEY (UCC):	Boundary behaviour of univalent functions.
Dr. I. A. KINSELLA (DIT):	Statistical aspects of radio-biological models.
Prof. S. DINEEN (UCD):	Symmetric domains and JB*-systems in Banach spaces.
Dr. B. GOLDSMITH (DIT):	Subgroups of the Baer-Specker group.

Short talks:

Dr. D. REYNOLDS (NIHED):	An application of bifurcation theory to resonant surface waves in an oscillating shallow tank.
Dr. N. Ó MURCHADHA (UCC):	Logarithmic terms in solutions to the Poisson equation.

Dr. P. MULDOWNEY (Londonderry):	Richard Feynman's path integral method.
Dr. D. HURLEY (UCC):	Visibility manifolds.
Prof. F. HOLLAND (UCC):	Shannon's sampling theorem applied to rational signals.
Prof. P. M. QUINLAN (UCC):	The edge function method for multiply-connected regions.

8. IRISH MECHANICS GROUP

Two meetings, Reports on 'Modern Developments in Mechanics', were organized by the Irish Mechanics Group, in association with DIAS, during the year. The meetings were held at the Institute on 17 April (attendance 16), and 19 December (attendance 30). The December meeting was to honour Professor QUINLAN, on the occasion of his 65th birthday.

Speakers and Lecture Topics were as follows:

APRIL:

Drs. R. K. LI & D.W.A. REES (TCD):	Scalar polynomial tensor flow potentials.
Dr. D. W. REYNOLDS (NIHED):	The buckling of viscoelastic rods.
Prof. J. N. FLAVIN (UCG):	Some asymptotic bounds for end-bonded elastic cylinders.
Dr. J. N. DUNWOODY (QUB):	Slow perturbations of fast plane shear flow of a simple fluid.
Prof. M. A. HAYES (UCD):	Inhomogeneous plane waves.
Prof. P. M. QUINLAN (UCC):	The complex displacement method in elasticity.

DECEMBER:

Dr. A. D. NORRIS (Exxon Res. NJ):	A differential scheme for the effective moduli of composites.
Dr. A. B. TAYLER (Oxford)	Resonance in a gear box.

Prof. M. F. McCARTHY (UCG):	Scattering by circular disks.
Dr. P. F. HODNETT (NIHEL):	Computer aided design of air-journal bearings.
Prof. J. N. FLAVIN (UCG):	Some remarks concerning St. Venant's principle.
Dr. A. P. PARKER (Nth. Staffordshire Polytech.):	Numerical methods applied to some current problems.
Dr. J. J. GRANNELL (UCC):	Progress in the edge function method.

9. DUBLIN SUMMER SCHOOL IN PHYSICS.

The third Dublin Summer School in Physics, organized by the School of Theoretical Physics in association with Trinity College Dublin, University College Dublin, and St. Patrick's College Maynooth, was held at DIAS from 25 June to 6 July. Assistance was given by the NBST, the IOP, and NIHED. The subject for the School was "Surfaces and Semiconductors", and the attendance was 50. There were 15 speakers, a manufacturer's display, visits to research laboratories (including one to the National Microelectronic Lab., Cork), and an Open Seminar on Industry and Higher Education - Cooperation.

The speakers and lecture topics were as follows.

Dr. M. BRIDGE (TCD):	Surface structure determination.
Dr. D. BULLETT (Bath):	Surface electronic structure.
Dr. H. GAMBLE (QUB):	Silicon device fabrication.
Dr. R. HECKINGBOTTOM (Brit. Telecom Res. Labs.):	Molecular beam epitaxy
Dr. L. KELLY (Nat. Micro Electronics Res. Centre,UCC):	Competing III - V integrated circuit technologies.
Dr. M. KELLY (GEC Res. Labs, Wembley, UK):	The physics and applications of the two-dimensional electron gas.
	The physics of fine geometry semiconductors structures.
Prof. D. R. LLOYD (TCD):	Angle-resolved photoemission.

Dr. J. McGILP (TCD):	Introduction to surface physics.
	Ion beams as surface probes.
Dr. I. McGOVERN (TCD):	Surface composition.
	Synchrotron radiation studies.
Dr. D. NORMAN (SERC, Daresbury, UK):	Some new methods of surface structure determination.
Dr. E. O'REILLY (NIHED):	Electrons and holes in semiconductors.
Prof. D. WEAIRE (UCD):	Periodicity and non-periodicity in solids.
Dr. D. WILLIAMS (VG Semicon, UK):	UHV technology.
	Molecular beam epitaxial growth technology.
Prof. R. H. WILLIAMS (Cardiff):	Angle-resolved photoemission of semi-conductors.
	Metals on semiconductors.
Prof. F. WOOTEN (UC, Davis):	Optical properties of semiconductors.
	Angle-integrated photoemission.

10 VISITORS

For lectures given by Visitors see §§ 4, 6, 7, 8, 9.

As in previous years, visitors, mainly from abroad, came to the School for short or long periods, for discussions with School members, to give seminars, and to avail of the School's library resources for their research work.

Short visits (up to one week) were made by

D. Pottinger (Bonn), 3 - 6 January

M. Yor (Paris VI), 8 February

W. Nahm (Bonn), 16 - 18 April

G. L. Allan (Cambridge), 17 - 18 April

J. L. Ericksen (Minnesota), 17 - 18 April

D. Hurley (UCC), 17 - 18 April

G. B. Parravicini (Pavia), 9 - 14 May

F. Ando (Shinshu Univ.) 16 - 18 July

V. Mizel (Carnegie-Mellon, Pittsburgh), 23 - 25 July

P. Ryan (AFT), 14 August

M. Lunn (Oxford), 24 - 28 September

D. Speiser (Louvain), 17 - 21 November

A. P. Parker (Nth. Staff. Polytech.), 19 - 21 December

A. B. Tayler (Oxford), 19 - 21 December

J. J. Grannell (UCC), 20 - 21 December

B. Twomey (UCC), 20 - 21 December.

Longer visits were made by:

D. E. Evans (Warwick), 2 - 12 February, 30 December - 13 January '85.

M. Fannes (Leuven), 26 March - 19 April

P. Dolan (Imperial Coll., London), 11 - 18 April, 1 - 14 August

G. W. Ford (Michigan, Ann Arbor), 2 - 31 July

J. Conlon (Missouri), 2 - 31 July

A. Chakrabarti (Ecole Poly., Paris), 3 July - 5 August

M. Toller (Trento), 4 - 11 August

A. Morita (Tokyo), 13 - 20 August

A. Savini (Pavia), 8 - 16 August

D. G. Frood (Lakehead Univ., Ontario), one year from 28 August

C. A. Hurst (Adelaide), 15 - 28 September

M. van den Berg (Heriot-Watt, Edinburgh), 13 - 31 December

G. Prince (Roy. Melbourne Inst. Tech.), 28 December - 6 January '85

Visits to the School in connection with the Third Dublin Summer School in Physics (see § 9) were made by

D. Bullett (Bath), H. Gamble (QUB), R. Heckingbottom (Brit. Telecom), L. Kelly (Nat. Micro Electron. Centre, Cork), M. Kelly (GEC Wembley), D. Norman (Daresbury), D. Williams (VG Semicon. UK), R.H. Williams (Cardiff), and F. Wooten (UC, Davis).

11 PUBLICATIONS

Note: Items marked with an asterisk have been recorded as in press in previous reports.

(1) Book:

In the press:

L. O'Raifeartaigh. Group structure of gauge theories. Cambridge University Press.

(2) Communications of the Dublin Institute for Advanced Studies, Series A (Theoretical Physics):

No. 28: Mechanics, boundary layers and function spaces. By. D. Ó Mathuna. Price £9.00 pp. 216 ISSN 0070 - 7414. Published 31 March.

(3) Contributions to periodical and other publications:

J. McConnell:

* Analytical approach to the study of molecular rotation in liquids. J. molec. Liq. 28 (1984), 61 - 70,

* Series expansion of the stochastic rotation operator. Proc. R.I.A. 84A (1984), 9 - 26.

Theory of nuclear magnetic relaxation by anisotropic chemical shift. Physica 127 A (1984), 152 - 172.

Relaxation theory for molecular liquids. Abstracts, 4th Gen. Conf. of Condensed Matter Div. of EPS, The Hague, 1984, eds. R. de Groot & F. M. Miller. EPS print, pp. 1 - 10.

Debye limit of the stochastic rotation operator. Physica 128 A (1984), 611 - 630.

H. Block, E. Kluk, J. McConnell, & B.K.P. Scaife:

Polarization in rotating dielectrics. J. Colloid. Interface Sci. 101 (1984), 320 - 329.

J. T. Lewis & M. Schreiber:

* On a theorem of Weyl. Integ. Eqns. Op. Th. 7 (1984), 431 - 435.

J. T. Lewis, J. V. Pulè, & P. de Smedt:

* The superstability of pair-potentials of positive type. J. statist. Phys. 35 (1984), 381 - 385.

M. van den Berg, J. T. Lewis, & P. de Smedt:

Condensation in the imperfect boson gas. J. statist. Phys. 37 (1984), 697 - 707.

D. E. Evans & J. T. Lewis

* The spectrum of the transfer matrix in the C^* algebra of the Ising model at high temperatures. Commum. math. Phys. 92 (1984), 309 - 327.

M. van den Berg:

On the spectrum of the Dirichlet Laplacian for horn-shaped regions in R^n with infinite volume. J. funct. Anal. 58 (1984) 150 - 156.

* A uniform bound on trace $(e^{t\Delta})$ for convex regions in R^n with smooth boundaries. Commun. math. Phys. 92 (1984), 525 - 530 .

M. van den Berg & J. L. van Hemmen:

* On a neutral plasma with quadratic interactions. J. Phys. A: Math. Gen. 17 (1984), 169 - 174.

H. Maassen:

* Return to thermal equilibrium by the solution of a quantum Langevin equation. J. statist. Phys. 34 (1984), 239 - 261.

E. Buffet, Ph. de Smedt, & J. V. Pulè:

The dynamics of the open Bose gas. Ann. of Phys. 155 (1984), 269 - 304.

On the dynamics of Bose-Einstein condensation. Ann. Inst. H. Poincaré, Analyse non linéaire 1 (1984), 413 - 451.

J. V. Pulè:

* A unified approach to classical and quantum KMS theory. Rep. math. Phys. 20 (1984), 75 - 81.

L. Papiez:

Stochastic formulation of Feynman path integrals from the least action point of view. J. math Phys. 25 (1984), 564 - 569.

W. G. Sullivan:

The L^2 spectral gap of certain positive recurrent Markov chains and jump processes. Z. Wahrscheinlichkeitstheorie verw. Gebiete 67 (1984), 387 - 398.

T. Murphy, L. O'Raifeartaigh, & M. Yamada:

Symmetry breaking and renormalization effects for an SU(n) model with two scalar fields. Nucl. Phys. 248B (1984), 365 - 380.

J. Burzlaff:

* A classical lump in SU(2) gauge theory with a Higgs doublet. Nuclear Phys. 233B (1984), 262 - 268.

Noncontractible hyperloops in gauge models with Higgs fields in the fundamental representation. LMP 8 (1984), 459-465.

J. Burzlaff & J. E. M. Hornos:

* On the relation between complex manifolds and soliton theoretic constructions for self-dual fields. J. math. Phys. 25 (1984), 1524 - 1527.

J. Burzlaff & D. H. Tchrakian:

Vortex solutions in the Yang R-gauge. Nuovo Cim. Lett. 40 (1984), 129 - 134.

D. H. Tchrakian:

* A formulation of massless fields with half-integer spin. Class. Q. Grav. 1 (1984). L13 - L16.

T. N. Sherry & D. H. Tchrakian:

Dimensional reduction and higher order topological invariants. Phys. Lett. 147B (1984), 121 - 126.

D. M. Heffernan:

Transient degenerate four wave mixing in saturable absorbers. Phys. Lett. 103A (1984), 286 - 288.

Long switching times in absorptive bistable systems. Phys. Lett. 104A (1984), 169 - 172.

D. M. Heffernan & R. L. Liboff:

A model for the diffuse γ - ray spectrum. Phys. Lett. 101A (1984), 305 - 307.

T. Garavaglia:

* Dirac- and Majorana-neutrino-mass effects in neutrino-electron elastic scattering. Phys. Rev. 29D (1984), 387 - 392.

* Polarized electron scattering on spin zero and polarized spin-$\frac{1}{2}$ targets: deep inelastic scattering, elastic electron-muon scattering, and elastic electron-nucleon scattering. Inter. J. theor. Phys. 23 (1984) 251 - 294.

Y. Fujimoto & T. Garavaglia:

Phase diagrams in scalar QED. Phys. Lett. 148B (1984), 220 - 224.

M. Crampin & G. E. Prince:

* The geodesic spray, the vertical projection, and Raychaudhuri's equation. Gen. Rel. Grav. 16 (1984), 675 - 689.

Projective differential geometry and geodesic conservation laws in general relativity. I. Projective actions. Gen. Rel. Grav. 16 (1984) 921 - 942.

Projective differential geometry and geodesic conservation laws in general relativity. II. Conservation laws. Gen. Rel. Grav. 16, (1984) 1063-1075.

M. Crampin, G. E. Prince, and G. Thompson.

A geometrical version of the Helmholtz conditions in time-dependent Lagrangian dynamics. J. Phys. A: Math. Gen. 17 (1984), 1437 - 1447.

P. A. Hogan:

* Kaluza-Klein theory derived from a Riemannian submersion. J. math. Phys. 25 (1984), 2301 - 2305.

Bateman electromagnetic waves. Proc. Roy. Soc. 396 A (1984), 199 - 204.

Yang-Mills fields on two surfaces of constant curvature. Class. Q. Grav. 1 (1984), 325 - 330.

J. D. McCrea.

A NUT-like solution of the quadratic Poincaré gauge field equations. Phys. Lett. 100A (1984), 397 - 399.

F. Marchesoni:

* Use and misuse of adiabatic elimination procedures for stochastic processes. Phys. Lett. 101A (1984), 11 - 14.

Non-linear and non-Markovian effects in relaxation processes: application to molecular dynamics. Phys. Scripta 30 (1984), 19 - 24.

The itinerant oscillator model: dielectric relaxation in the presence of non-linear dipole-dipole coupling. Chem. Phys. Lett. 112 (1984), 315 - 318.

Thermally activated chemical reactions in the presence of internal multiplicative noise. Chem. Phys. Lett. 110 (1984), 20 - 24.

E. Guardia, F. Marchesoni, & M. San Miguel:

* Escape times in systems with memory effects. Phys. Lett. 100A (1984), 15 - 18.

C. Festa, L. Fronzoni, P. Grigolini, & F. Marchesoni:

* The range of validity of the current procedures of adiabatic elimination: Experimental and theoretical evidence. Phys. Lett. 102A (1984), 95 - 98.

F. Marchesoni & P. Grigolini:

On the contraction of fast variables in stochastic processes: The influence of pumping on relaxation. Z. Phys. 55B(1984) 257 - 262.

P. Hänggi, F. Marchesoni, & P. Grigolini:

Bistable flow driven by coloured Gaussian noise - A critical case study. Z. Phys. 56B (1984), 333 - 369.

A. I. Solomon:

A Lie-algebraic approach to order parameters. Differential Geometric Methods in Mathematical Physics, Ed. S. Sternberg, Reidel 1984, pp. 279 - 285.

A. I. Solomon & J. L. Birman:

Dynamical group model of a spin density wave system. Phys. Lett. 104A (1984), 235 - 238.

B. Goldsmith:

An essentially semi-rigid class of modules. J. Lond. Math. Soc. (2) 29 (1984), 415 - 417.

M. Dugas, R. Godel, & B. Goldsmith:

* Representation of algebras over a complete valuation ring. Q. Jl Math. (Oxford) (2) 35 (1984), 131 - 146.

In the press:

J. McConnell:

*999.83-44 Theory of nuclear magnetic relaxation. Polymer.

M. van den Berg, J. T. Lewis, & M. Lunn:

On the general theory of Bose-Einstein condensation and the state of the free boson gas. Helvetica Phys. Acta.

M. van den Berg & J. T. Lewis:

On the heat equation and the spectrum of the Dirichlet Laplacian for spiral regions in R^2. Commun. math. Phys.

Brownian motion on a hypersurface in $\mathbb{R}^d$. Bull. Lond. Math. Soc.

G. W. Ford & J. T. Lewis:

Quantum stochastic processes. Invited contribution: Festschrift for M. Kac, Ed. G. -C. Rota.

J. T. Lewis:

An elementary approach to Brownian motion on manifolds. BiBos Symposium on Stochastic Processes - Mathematics and Physics, Zif-Bielefeld, 1984. Springer, Lecture Notes in Math.

A. Truman & J. T. Lewis:

The stochastic mechanics of the ground-state of the hydrogen atom. BiBos Symposium on Stochastic Processes - Mathematics and Physics, Zif-Bielefeld, 1984. Springer, Lecture Notes in Math.

L.Papiez:

Microscopic open systems. Ann. of Phys.

E. E. Mueller:

Note on relative entropy and thermodynamical limit. Helvetica Phys. Acta.

J. Burzlaff, T. Murphy, & L. O'Raifeartaigh:

Non-maximal and disconnected stability groups: SU (3) counter-example to Michel conjecture. Phys. Lett. B.

J. Burzlaff:

Radially separated classical lumps in non-Abelian gauge models. J. math. Phys.

J. Burzlaff & V. Moncrief:

*1046 84-09 The global existence of time-dependent vortex solutions, J. math. Phys.

J. Burzlaff, T. N. Sherry, & D. H. Tchrakian:

*1012/82-2 Dimensional reduction, vortices and saddle points. Nuovo Cim. A

D. H. Tchrakian:

A candidate for a classical lump in 4 Euclidean dimensions. Phys. Lett. B.

*995/84-34 Spherically symmetric gauge field configurations with finite action in 4p-dimensions (p=integer). Phys. Lett. B.

G. M. O'Brien & D. H. Tchrakian:

*1001/82-57 Self-duality in Euclidean supergravity. Gen. Rel. Grav.

P. S. Florides:

*1005/— Generalized Robertson-Walker metrics and some of their properties. II. Gen Rel. Grav.

P. Hogan & A. Trautman:

On gravitational radiation from bounded sources. Gravitation and Geometry, Eds. W. Rindler & A. Trautman, Bibliopolis (Naples).

D. J. McCrea:

The use of REDUCE in finding exact solutions of the quadratic Poincaré gauge field equations. Classical General Relativity, Eds. W. B. Bonnor, J. N. Isham, & M. A. MacCallum, Cambridge Univ. Pr.

D. Heffernan:

*1006/84-39 Multistability, intermittency and remerging Feigenbaum trees in an externally pumped ring cavity laser system. Phys. Lett.A.

~~1032 84-37~~ 56 Transient resonant spiking in degenerate four wave mixing in saturable absorbers. Electron. Lett.

M. W. Evans & F. Marchesoni:

Limitations of the one-body approach to dielectric relaxation: comparison with rise transients from computer simulation. J. Phys. D; Appl. Phys.

F. Marchesoni & J. K. Vij:

Brownian motion in a periodic potential application to dielectric relaxation. Z. Phys. B.

P. Grigolini & F. Marchesoni:

Our adiabatic elimination procedure: A basic description. Adv. Chem. Phys. Wiley.

P. Grigolini, F. Marchesoni, & S. Presciuttini:

Population genetics: time properties of a model of random fluctuating selection. Adv. Chem. Phys. Wiley.

T. Fonseca, J. Gomes, P. Grigolini, & F. Marchesoni:

The theory of chemical reaction rates. Adv. Chem. Phys. Wiley.

F. Ferrini, F. Marchesoni, & S. N. Shore:

Stochastic processes in astrophysics: Stellar formation and galactic evolution. Adv. Chem. Phys. Wiley.

F. Marchesoni:

On the breakdown of the Kramers theory as a problem of correct modelling. Adv. Chem. Phys. Wiley.

Numerical solution for diffusion in periodic potentials: A comparison with the theory of activated processes. Phys. Rev. B, Brief Reports.

B. Franzen & B. Goldsmith:

On endomorphism algebras of mixed modules. J. Lond. Math. Soc.

12 LIBRARY

Approximately 220 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 RIA 'permanent loan' scheme was continued, as were other forms of cooperation with research libraries at home and abroad.

Offprints and preprints were received from many scientific institutes and university departments at home and abroad, either directly or in response to requests.

Other gifts of books and journals, in addition to material received under exchange arrangements, were received from: Professor McConnell, Professor Burzlaff, Dr. McCrea, Prof. L. Castell(Starnberg),Profs. F. Güttner et al. (Heidelberg) Prof J. Rayski (Krakow), Prof. A. Savini (Pavia), Math. Centrum (Amsterdam), CERN, ICTP (Trieste), Inst. Nat. Phys. Nucl. & Phys. de Part. (Paris), and NORDITA (Copenhagen)

The Delegation to Ireland from the Academy of Sciences of the USSR visited the library and observed the holdings of Russian books and journals (in original and in translation).

IV - Annual Report of the Governing Board of the School of Cosmic Physics for the year 1984, adopted at its meeting on 11th April, 1984.

A ASTRONOMY SECTION

1. STAFF, SCHOLARS and EMERITUS PROFESSOR

Senior Professor:

P. A. Wayman

Professor:

T. Kiang

Research Assistant:

I. Elliott

Experimental Officer:

B. D. Jordan

Research Associates:

P. B. Byrne, (Armagh), B. McBreen (UCD)
T. P. Ray (UCD), R. M. Redfern (UCG)

Technical and Clerical Staff:

A. M. Callanan, W. H. Dumpleton.

Scholars

H. P. Deasy, P. J. Callanan

Emeritus Professor:

H. A. Brück

With the consent of the Council of the Institute, P. A. Wayman was appointed by the Provost and Council of Trinity College as tenth Andrews' Professor of Astronomy in the University of Dublin, in an honorary capacity, from 1st October 1984. The previous holder was H. C. Plummer from 1912 to 1921. All Andrews Professors from the foundation in 1783 have held responsibility for the work of Dunsink Observatory.

P. A. Wayman continued as Adviser to the Executive Committee of the International Astronomical Union, on the Board of Governors of Armagh Observatory, as a member of the ESA Working Group for Hipparcos satellite, and on the SERC La Palma Working Group of the UK. I. Elliott became Chairman of the Irish National Committee for Astronomy in March and continued as Secretary/Treasurer of the Irish Astronomical Science Group. P. A. Wayman was appointed to the Irish National Committee for the History and Philosophy of Science in March.

R. Hanbury Brown (University of Sydney, Australia), President of the International Astronomical Union, visited the Astronomy Section 3 - 6 and 14 - 16 June.

F. Z. Cheng (University of Science & Technology, Hefei, China) worked in the Astronomy Section 18 - 25 November.

P. Callanan, Scholar worked at the Institute of Astronomy, Cambridge University, 10 July - 24 August.

H. P. Deasy, Scholar, worked at the Joint Institute for Laboratory Astrophysics, Boulder, Colorado, USA, 19 November - 22 December.

2 RESEARCH WORK

Cepheid Variable Stars: P. A. Wayman, H. P. Deasy, with C. J. Butler (Armagh)

Work by Deasy and Wayman on period-change in cepheid variable stars in the Magellanic Clouds was embodied in a paper published during the year. A statistical test suggested by a referee indicated that the error estimates for the periods used were correctly estimated. Interpretation of the period changes in terms of mass-loss was discussed by Deasy at the IAU Colloquium at Toronto in May and was the basis for two joint proposals by H. Deasy and C.J. Butler for observations at the European Space Agency, Madrid station, with the International Ultraviolet Explorer. One observing run was executed during July and other is scheduled for 1985. In April (one IUE shift) four classical cepheid variable spectra at high dispersion were obtained, the stars being V810 Cen, S Mus, and l Car. The spectra were reduced to intensity plots by ESA software at Villafranca, Spain, for the preliminary stages and then with 'Starlink" software at Rutherford Laboratory and UCD, using network links. Archive material of a similar nature from the Rutherford IUE World Data Centre was also used. The Mg ll h & k lines at c.2800A have been analysed for possible absorption components in order to estimate evidence for mass-loss from cepheids. To enable interpretation to be quantitative, H. P. Deasy visited the Joint Institute for Laboratory Astrophysics, Boulder,

Colorado, USA from 19 November to 22 December. The computer code of P. Kunasz to solve the Radiation Transfer Equation in spherical geometry, adapted to the co-moving frame and partial redistribution in frequency by S. Drake, was used at Boulder and has since been transferred by Deasy to the CRAY computer at University College, London.

Photometry of Ap Stars: I Elliott, P. A. Wayman

High-speed photometry of peculiar A stars was carried out on the 1-m Jacobus Kapteyn Telescope, La Palma, 19 - 25 June. The People's Photometer was used for simultaneous B, V data at 5-sec. sampling. 26 runs each of 43 minutes were secured on eight stars, plus calibration runs. Stars chosen included β CrB and χEqu. Preliminary results indicate luminosity variations. Data were read into the VAX 11/780 computer of University College, Dublin for use with the Starlink ASPIC package.

A further proposal for a collaborative observing programme, with T. J. Kreidl, Lowell Observatory, Arizona, USA, to gain data adequate for identifying oscillation modes has been prepared. The star 21 Com is included in this programme.

Asteroid Dynamics: T. Kiang

A purely gravitational origin for peculiarities (gaps and concentrations) in the distribution of asteroid orbits has been sought. The planar circular-orbit Sun-Jupiter-asteroid model has been put into Hamiltonian form with two pairs of conjugate variables where three of these variables are slowly varying. Solutions of the Hill's equation obtained from a second-order differential equation with a large number of partial derivatives have been used to indicate whether the 'Kirkwood gaps' (etc.) can be explained gravitationally.

Cerenkov Line-radiation: T. Kiang

In continuing study of Cerenkov Line-radiation, two points have emerged. (i) The nature of J. H. You's "internal absorption" was elucidated as classical radiation damping, which causes natural broadening of spectral lines. Further development of the theory should include pressure broadening and Doppler broadening. (ii) The long 'tail' in the emission line predicted by the original theory has been recognized as a mathematical artefact, arising from approximations made in the formula for refractive index.

X-Ray Sources: P. Callanan, with R. M. Redfern (UCG)

During the year two allocations of 4 'units' (= 10^4 secs) of EXOSAT time were received for a proposal to observe the X-ray source in the globular cluster M15. The observation on 1st July was satisfactory and a preliminary analysis by EXOSAT software made available by the Institute of Astronomy has been carried out. Tests for periodicity in X-ray brightness and variation in spectral temperature, absorption, etc. have been made. So far definite optical indentification has not been made. An attempt in October with the second allocation, to make an identification in conjunction with a group using the Canada-France-Hawaii telescope on Mauna Kea, Hawaii, was unsuccessful. The variability of the X-ray spectrum has since been made clearly apparent, involving temperature change. Autocorrelation tests show no clear limits to the time-scale of variations; it is similar in behaviour to Cygnus X - 1.

A comparison of M15 with published results for NGC 6624 has been made and new proposals have been prepared for making observations of other low-mass X-ray binaries.

RS CVn Stars: P. A. Wayman, with P. B. Byrne (Armagh) and J. G. Doyle (Armagh),

During a week in July parallel observations with the International Ultraviolet Satellite (2 shifts) and with the 2.5-m Isaac Newton Telescope, La Palma (part nights), were secured. Spectra in four optical regions and some IUE high dispersion spectra at long and short wavelength were obtained at various times in the one week. An optical light-curve was also obtained by co-operation of the South African Astronomical Observatory. From a preliminary analysis made at Armagh Observatory, changes in the H-alpha profiles have been detected and resolved lines in the IUE spectra are found to have broad profiles that appear to exceed thermal or rotational width.

CCD Observations of Galaxies: T. P. Ray (UCD) and B. McBreen (UCD)

Preparation has been made towards use of the 1-m Kapteyn telescope in February 1985 with the UCD-DIAS Charge-coupled device camera for a programme of observations of jets and extensions from blue compact galaxies (e.g. Haro galaxies).

3 ELECTRONICS LABORATORY AND WORKSHOP: B. D. Jordan with B. McBreen (UCD) and L. Metcalfe (UCD).

Development of the charge-coupled device camera jointly with the Physics Department, UCD, continued during the year. Production of a special-purpose silicon-chip to provide clock pulses at Queen's University, Belfast, was not successful during 1984. A new housing for existing boards was therefore needed. Improvements to the driving circuits were made and a diagnostic board was constructed to test the A/D converter and computer (LSI-11) interface. Filter wheel, photoelectric sensors and camera-shutter circuits were built and the motor drive for the filter wheel, operated through a mechanical 'Geneva mechanism', was installed, the mechanical work being done in the UCD Physics workshop. Three liquid-nitrogen Dewar units were wired for the three available CCD 'chips' and auxiliary items such as temperature control were installed.

The original LSI-11 computer was replaced by the incorporation of an LSI-11 computer with 22-bit addressing and a 10MB Winchester disc drive. A 'Matrox' monitor system for Video display was installed, and the required software developed or adapted. Tests showed some abnormal electrical noise interference and work to eliminate this was put in hand.

4. COMPUTER INSTALLATION: I. Elliott, B. D. Jordan.

During the year most of the computing needs of the Astronomy Section were met by the use of the Starlink application programs on the VAX 11/780 at the UCD Computer Centre and by access to the Starlink network in the U.K. via the Irish Universities Network and Euronet.

The data link between Dunsink and UCD was upgraded by replacing the 300 baud modem with a modem working at 1200 baud. Despite a thorough investigation,noise on the data link restricted the type of work possible from Dunsink. For fast and reliable operation it was necessary to use the Sigma monochrome graphics terminal and the Anadex printer situated temporarily in the UCD Physics Department. At Dunsink, the Teletype 43 matrix printer was replaced by a Canon PW-1080A matrix printer which provides high quality output for both printed matter and graphics.

During the year close liaison was maintained with the staff of the UCD Computer Centre and the Starlink Software Collection was updated twice. A version of the Graphics Kernal Software was obtained from RAL for use with the Starlink software. During December, Dr. David Terrett from Rutherford Appleton Laboratory spent one week at the UCD Computer Centre assisting with Starlink software.

Consideration was given to improvement of computing facilities in the School. For the Astronomy Section essential access to Starlink software could be met through joint use with UCD Physics Department of the VAX 11/780 at the UCD Computer Centre; for fully effective use, more on-line storage was needed. It was decided to purchase two large Winchester disk drives (System Industries Type 9751, 474MB unformatted), one for use with the Eclipse computer and the other for use on astronomy programs at UCD; also a disk controller was required for the Eclipse system.

Software for EXOSAT observations,originating from several institutions but made available by Professor A. Fabian, Cambridge University, Institute of Astronomy, was adapted to the VAX 11/780 computer installation of University College, Galway, by R.M. Redfern and P. J. Callanan.

5. OBSERVATORY DEL ROQUE DE LOS MUCHACHOS

Scheduled periods of observation with the 1-m Jacobus Kapteyn Telescope (JKT) and the 2.5-m Isaac Newton Telescope (INT) on La Palma began in May 1984. Commissioning continued at intervals through the year; P.A. Wayman contributed to the work of testing the astigmatism of the main mirror of the 1-m telescope in May and B. McBreen made a visit to La Palma in late May to appraise the conditions for mounting the CCD camera on the 1-m telescope.

A representative of the Advisory Committee for the La Palma Project attended each of two meetings of the SERC Panel for Allocation of Telescope Time held during the year. The work of the La Palma Working Group was terminated in July, to be replaced by a 'La Palma Users Group'.

Design problems with the mirror-support system, producing an unacceptable and variable (but small) amount of on-axis astigmatism, in the 1-m JKT were encountered during the year. Corrective measures were put in hand by the Royal Greenwich Observatory in order to make astrometric work feasible.

The Advisory Committee produced Information Sheets Nos. 8, & 9 during the year, copies being circulated to over fifty interested individuals, university departments, etc.

6. HISTORICAL ASTRONOMY: P. A. Wayman

A chapter was completed on Rev. John Brinkley, first Royal Astronomer of Ireland and second Andrews' Professor of Astronomy in the University of Dublin, 1791 - 1827, for a volume commemorating 19th Century scientists of Trinity College Dublin (ed. Prof. G. L. Herries-Davies, TCD). During this work a possible explanation of the spurious stellar parallaxes found by Brinkley in the years 1810 - 1825 was suggested.

The diary entries of Robert Stawell Ball, written during a visit to Canada and the United States in 1884, were the subject of a paper communicated to the Irish Astronomical Journal. Principal interests emerging from this work were the high regard that the diaries showed for technology in the United States at that time and the emergence of Robert Ball's lecturing style and success.

Recognizing the bicentenary, on 25th August 1985, of the commencement of astronomical work at Dunsink Observatory, a programme of events for 1985 is in preparation and a start was made during 1984 on a History of Dunsink Observatory,1785 - 1985.

7. LECTURES, CONFERENCES, ETC.,

P. A. Wayman presented eight lectures on 'Introduction to Nuclear Astrophysics' in the Department of Pure & Applied Physics, TCD, in the period January-March, and eight double-session lectures on 'Stellar physics and positional astronomy' in the Department of Mathematics, TCD, in October - December.

I. Elliott gave a course of sixteen lectures on Introductory Astrophysics to Junior Sophister honours students in physics in TCD during January and February.

Colloquium lectures in the Astronomy Section were held as follows:

29 March:	P. Callanan -	"X-ray Binaries"
14 June:	H. P. Deasy -	"Cepheid Variables, Theory and Observation, Toronto 1984, and current work".
23 November:	F. Z. Cheng -	"Internal Absorption and Luminosity Function of Seyfert I Galaxies."

H. P. Deasy spoke on 'Mass-Loss from Cepheids' in JILA Boulder, Colorado on 19 December. T. Kiang visited China in September and October as a guest of the People's Republic of China and addressed groups at several university locations and elsewhere during the visit. P. A. Wayman attended the 52nd Meeting of the Executive Committee of the International Astronomical Union held in Paris and on Ile d'Yeu, France, 10-14 September. As chairman of a subcommittee on the structure and functions of IAU Commissions he prepared a report to the Executive Committee at its meeting.

T. Kiang paid a visit to the University of Durham, Department of Physics, 6 - 8 November, to present material on traditional Chinese astronomy.

I. Elliott attended the 25th Liège Colloquium in Astrophysics, 'Theoretical Problems in Stellar Stability and Oscillations', in connection with his co-operative programme on Ap stars. He arranged the programme of the meetings of the Astronomical Science Group of Ireland in University College, Galway, on 6th April and in University College, Dublin, on 21st September.

P. A. Wayman visited the Royal Greenwich Observatory on 19 - 20 July and contributed to an internal colloquium on the Kapteyn Telescope testing and instrumentation.

Public Open Nights were held on fourteen nights during the year, lectures were given by P. A. Wayman and I. Elliott to the Dublin Centre, Irish Astronomical Society, visiting groups to Dunsink included parties from the Irish Astronomical Association (N. Ireland) and the Dublin Centre of the I.A.S., the Royal Aeronautical Society, and from the Institute itself. Other visitors included R. Hide, President Royal Astronomical Society, R. Hunbury Brown, President International Astronomical Union, and Mrs. Hanbury Brown, Robert Ballagh, and A. Somogyi (Budapest).

8. PUBLICATIONS

The publication arrangements for the Irish Astronomical Journal, jointly with Armagh Observatory, continued as in 1983, as did the contribution to the Chinese Journal of Astronomy and Astrophysics.

Published, 1984:

Irish Astronomical Journal, Vol. 16, Nos. 1 to 4
(March 1983 - September 1984)

(The backlog of publication-date delay for the Journal is now fully eliminated.)

Chinese Astronomy and Astrophysics (Chief Translation Editor, T. Kiang): Vol. 8.

Journals, etc.:

H. P. Murphy:

"CCD Camera Observations of Nearby Rich Galaxies, 11 - Techniques and Results for A85", Mon. Not. R. Astr. Soc., 211: 637 - 658, 1984.

J. H. You, T. Kiang, F. H. Cheng and F. Z. Cheng:

"Cerenkov Line Emission: Basis Theory", Mon. Not. R. Astr. Soc., 211: 667 - 677, 1984.

H. P. Deasy and P. A. Wayman:

"Period change in Magellanic Cloud Cepheids", Mon. Not. R. Astr. Soc., 212: 395 - 411, 1985.

T. Kiang:

"Statistical Problems in the Determination of the Cosmological Deceleration Parameter qo". ESA Special Report 201, pp. 209 - 214, 1984.

Notes, Abstracts, etc., in the Irish Astronomical Journal:

P. A. Wayman:

"Dunsink Observatory in 1983", 17: 1985

"The Period-Luminosity Relation in the Magellanic Clouds". 16: 188. 1984.

I. Elliott:

"Stellar Seismology" 17: 1985
"Progress towards LEST", 17: 1985

B COSMIC RAY SECTION

1 STAFF, SCHOLARS and EMERITUS PROFESSOR

Senior Professor:

C. Ó Ceallaigh (to 29 July)

Professor:

Vacant

Assistant Professor:

D. O'Sullivan, A. Thompson

Research Assistant:

Vacant

Experimental Officer:

J. Daly

Technical and Clerical Staff:

E. Clifton, H. Sullivan, A. Grace-Casey,
G. Broderick, A. Larkin, E. Ryan, S. Ledwidge.

Emeritus Professor:

C. Ó Ceallaigh

Professor Cormac Ó Ceallaigh, Senior Professor and Head of the Cosmic Ray Section since 1953, retired on 29th July 1984. Professor Ó Ceallaigh's work in the physics of cosmic rays and of the detection of cosmic rays, in Ireland and in the United Kingdom, with collaborators from many countries, represents a very major contribution to world science from Ireland that has stood for many years as a continuous and important part of the research programme of the Dublin Institute for Advanced Studies. Professor Ó Ceallaigh was director of the School of Cosmic Physics at the time of his retirement.

Professor P. A. Wayman (Senior Professor, Astronomy Section) assumed responsibility as Acting Head of the Cosmic Ray Section from 1st August 1984.

A. Thompson continued as secretary of the National Committee for Physics and as a member of the Royal Irish Academy Committee for Space Research. D. O'Sullivan continued as a member of the Editorial Board of the Nuclear Tracks and Radiation Measurements Journal.

A. Thompson represented Ireland on the Council of the European Physical Society during the year. He also represented the Royal Irish Academy at the 6th General Conference of the European Physical Society held in Prague, Czechoslovakia during August, including a Council Meeting on 26th August.

D. O'Sullivan and A. Thompson were selected along with five U.S. scientists for membership of the LDEF-2 Science Steering Committee which met for the first time in May under the chairmanship of Jonathan Ormes, Acting Chief, High Energy Astrophysics, NASA. Selection was based on proposals invited by NASA from the international cosmic ray community.

2. RESEARCH WORK

(a) The Ultra-Heavy Cosmic Ray Experiment and Associated Work.

D. O'Sullivan , A. Thompson, J. Daly.

The First Long Duration Exposure Facility(LDEF-1) Mission

During January, the sixteen flight experiment trays of the DIAS-ESTEC Ultra Heavy Cosmic Ray Experiment (UHCRE) were integrated with the LDEF spacecraft at the Kennedy Space Center. The experiment team's obligations were carried out by A. Thompson , D. O'Sullivan and two technicians from ESTEC (A. Smit and P. van Meygaerden). Minor last minute modifications required by NASA were carried out in situ.

The LDEF-1 was launched on 6 April 1984 at 15.00 G.M.T. by means of the Space Shuttle Challenger (Space Shuttle Mission 41-C). On 7 April 1984, at about 18.00 G.M.T. the LDEF spacecraft was deployed, by means of the Remote Manipulator System, into circular earth orbit having an altitude of 250 nautical miles and an inclination to the equatorial plane of 28.5 degrees. Both launch and deployment were remarkably successful and free of complications. In particular, all the UHCRE thermal control covers appear to have survived undamged.

The LDEF has remained in orbit for the remainder of the year; recovery by another Space Shuttle Mission is provisionally planned for March 1985.

The Abundance of Actinide Elements in the Galactic Cosmic Radiation

Recent investigations of the charge spectrum of ultra heavy cosmic ray nuclei by the HEAO-3 and UK6 satellites resulted in a lower actinide abundance than that reported by either the Bristol-Dublin balloon flight experiments or the Berkeley Skylab study. The balloon flight data, covering a total of eleven flights between 1972 and 1977, were re-examined in the light of recent DIAS

results on the effect of temperature on track response in nuclear track detectors. Using temperature profiles recorded during detector exposure at altitude, the average charge shift was estimated for the total sample of nuclei with charge greater than Z = 74. Assuming a charge distribution similar to that published by the HEAO - 3 experimenters and a normal energy spectrum for ultra heavy cosmic ray nuclei, it was found that the relative abundance of actinides could be less than half than reported earlier. The results of this investigation are being prepared for publication.

LDEF-2 Related Research

Studies of particle velocity degraders for use in the LDEF-2 mission due to be launched in 1987 were undertaken during the year. This mission, unlike LDEF-1, will encompass a wide spectrum of particle energies where electron capture and loss cross-sections for ultra heavy nuclei in matter are not well known. Initial measurements carried out on composite detector stacks containing lead and copper degraders exposed to ultra heavy nuclei at the Bevalac indicated that electron stripping was enhanced by these metals.

Following the decision by the LDEF-2 Science Steering Committee to employ Tuffak polycarbonate (discovered and first utilised by D. O'Sullivan and A. Thompson) as the main detector component on the LDEF-2 ultra heavy cosmic ray experiment, NASA requested the DIAS group to undertake a study of the long term stability of this material for charged particle studies, prior to committing itself to the purchase of ≈ 1500 kg of the detector for the mission. By employing a Tuffak stack which had been exposed to medium energy iron nuclei in 1979, part of which was stored in laboratory conditions for five years, it was ascertained that the material was stable, exhibited no significant change in the latent image of the particles and was suitable for long-term space exposure.

Registration Temperature Effect

Work on the Registration Temperature Effect in solid state nuclear track detectors continued during the year using several types of custom made allyl diglycol carbonate polymer and two commercial polycarbonate polymers irradiated with 960 MeV/N Uranium ions and 300 MeV/N Iron ions at different temperatures. Extensive processing and track analysis have confirmed the discovery, reported last year, that the rate of increase of relative signal strength (with decrease in registration temperature) is itself a strongly increasing function of ionisation. These results were presented (in advanced of publication) to the NASA LDEF-2 Science Steering Committee because of their direct relevance to the design philosophy of the Heavy Nuclear Collector Experiment for the LDEF-2 Mission.

Interaction of Ultra Heavy Nuclei with Matter

The study of the processes by which energetic particles lose energy when traversing matter was extended into the ultra heavy region for the first time. This was made possible by the Bevalac Nuclear Science Committee accepting a proposal by D. O'Sullivan and A. Thompson to expose polymer detectors to a wide range of ultra heavy nuclei. The exposures were successfully executed in August by the DIAS investigators and resulted in the first ever nuclear experiment to include high energy iron, xenon, holmium, gold and uranium ions in one detector medium. Initial processing and measuring were started before the end of the year and preliminary analysis in already underway.

(b) The EPONA Experiment on the Giotto Mission to Comet Halley:

A. Thompson, D. O'Sullivan, with S. McKenna-Lawlor (Maynooth)

Further development of the EPONA ground support hardware and software necessary for monitoring and for analysis of the cruise and encounter phases of the mission took place at the Institute of Data Analysis, Braunschweig in consultation with A. Thompson and D. O'Sullivan.

The EPONA particle telescope was delivered to the INTERSPACE facility of CNES at Toulouse during 1984 and integrated with the Giotto spacecraft. A high level of noise in the detectors was found to be due to high frequency ($\simeq$ 1 MHz) emission from an on-board spacecraft power control unit and was eliminated by enclosing the experiment in a Faraday cage. Testing procedures under integration at Toulouse included solar simulation, thermal-vacuum, acoustic and vibration tests, all of which were successful. The flight model, flight spare and ground support equipment will be shipped to Kourou before 9 April 1985 and the launch is scheduled for early July 1985.

(c) Laboratory and Workshop: J. Daly

Some maintenance of the equipment was carried out which included principally the dismantling and reassembling of the measuring stations (microcopes and measuring apparatus) in all the laboratories and also the etching equipment during the rewiring of No. 5 Merrion Square and again during the subsequent redecoration.

Towards the end of the year a start was made on refurbishing the existing etching equipment and on building a new etching tank.

4 LECTURES, CONFERENCES, ETC.,

The statutory Public Lecture for the School was given by Prof. P. B. Price (University of California at Berkeley) who delivered a talk titled"The Grand Search for Supermassive Magnetic Monopoles" in the Walton Theatre, Trinity College on April 18th.

D. O'Sullivan delivered a lecture on cosmic ray astrophysics in the Physics Department, UCD on February 13th and addressed the Irish Astronomical Science Group during its meeting at UCD on September 21st. He also delivered an invited talk on October 18th at the Workshop on Cosmic Ray and High Energy Gamma Ray Experiments for the Space Station Era held in Baton Rouge.

Working visits were made to the following centres by D. O'Sullivan and A. Thompson in furtherance of the LDEF-1, LDEF-2 and Giotto space missions: Kennedy Space Center, USA (Jan 12th - Feb 3rd and April 2nd - 11th, the latter period including the launch of LDEF-1 by the Space Shuttle); NASA Headquarters, Washington, USA (May 8th - 13th); Berkeley, USA (July 29th - Aug 12th); Max Planck Institute for Aeronomy, IDA, Braunschweig and ESTEC (Dec 10th - 15th).

The private guests attending the LDEF launch ceremonies included Professor P. A. Wayman (Senior Professor Astronomy Section), Dr. G. A. Baird (UCD), Dr. B. O'Donnell (NBST) and Dr. S.M.P. McKenna-Lawlor (Maynooth).

A. Thompson and D.O'Sullivan attended the NASA workshop on Cosmic Ray and High Energy Gamma-Ray Experiments for the Space Station Era, held at Baton Rouge, USA in October and the LDEF-2 Science Steering Committee meeting which was held during the same period.

Visitors to the Section included Prof. P.B. Price (Berkeley), Dr. J. Palfalvi (Budapest), Dr. A. Vidal-Quadras (Barcelona) and Prof. A. J. Somogyi (Budapest).

5 PUBLICATIONS

D. O' Sullivan and A. Thompson

The Ultra Heavy Nuclei of the Galactic Cosmic Radiation. Invited review of the field. Nuclear Tracks and Radiation Measurements, 8, 545 - 554 (1984)

A. Thompson, D. O'Sullivan, K.-P. Wenzel, V. Domingo, J. Daly and A. Smit.

An Extensive Solid State Nuclear Track Detector Array for the Study of Ultra Heavy Cosmic Ray Nuclei aboard the Long Duration Exposure Facility (LDEF). Nuclear Tracks and Radiation Measurements, 8, 575 - 578(1984)

D. O' Sullivan, A. Thompson and J. H. Adams

Dinonyl Phthalate as a Dopant for CR-39 in Cosmic Ray Studies. Nuclear Tracks and Radiation Measurements, 8. 579 - 581 (1984)

D. O'Sullivan, A. Thompson, K.-P. Wenzel and V. Domingo

The Ultra Heavy Cosmic Ray Experiment on LDEF-1. Proceedings of the Conference on Cosmic Ray and High Energy Gamma Ray Experiments for the Space Station Era, Baton Rouge, USA, 17 - 20 October, 1984.

D. O'Sullivan

LDEF-1 and Beyond. Irish Astronomical Journal (In Press) (Vol. 17 p.40 - 47. 1985)

C GEOPHYSICS SECTION

1 STAFF AND SCHOLARS

Senior Professor:

T. Murphy

Professor:

A.W.B. Jacob

Research Assistant:

P. W. Readman

Experimental Officer:

T. A. Blake (from October 8)

Research Associate:

N. P. Murphy

Scholar:

C. P. Lowe

Technical and Clerical Staff:

K. Bolster, A. Byrne, E. Ryan, V. Ward, G. Wallace.

Vacation Student:

E. McCormack(July 30 - October 19)

ANCO trainee:

G. McDonald (March 14 - September 28)

2 RESEARCH WORK

(a) Gravity

Since the positions of the points at which gravity values have been measured can be specified to an accuracy of ten metres as reported previously, the decision was taken to produce Bouguer Anomaly maps on a scale of 1:126 720 using the layout of the Ordnance Survey series of this scale known also as the half-inch series. A start has been made on No. 16 which covers Dublin. This entails digitizing the 1:10 560 sheets of the counties involved. The plotting is being done by computer and the contouring by hand.

To bring the density of stations up to the standard of one station per 3 sq.km the additional areas measured included parts of Cavan, Clare and Louth.

(b) Magnetics

A short marine magnetics survey using the Lough Beltra was carried out in the area around Carnsore Point which has been our target on previous occasions. Unfortunately as on the earlier attempts the navigational aids used were not up to the standard required and little additional information has been accumulated.

This work was carried out in collaboration with the Geological Survey when shallow seismic and depth soundings were also being recorded. This part will be analysed separately.

(c) Palaeomagnetism

Work on the Danish lake sediments advanced significantly with the results of radiocarbon dates (performed by H. Tauber, Copenhagen) from lakes Skanderborg (8 dates) and Sorroso (7 dates) The base of the six-metre cores are dated as ∿3000 B.P. (years before 1950) in the case of the Skanderborg core (SK4) and ∿11900 B.P. for the Sorroso core (So3). The dates allow detailed correlation between the two sets of data to depths equivalent to an age of 3000 - 4000 B.P. and suggest dates for the older Skanderborg cores by correlation with Sorroco. It appears that the main features of the records of declination and inclination can be correlated with the established record from the U.K., but that the ages of the features are 500 - 1000 years older.

Furthermore, as a result of the faster deposition rate in the Skanderborg core (the whole Post Glacial is represented by ~4 metres in the U.K. records) additional features have been identified. Two more cores from Skanderborg are to be dated and it is hoped that these will both confirm the Sorroso record back to ~8000 B.P. (it is presumed that older dates from Sorroso are subject to errors) where further fine detail in the records is also present, and also check whether the age discrepancy with the U.K. records extends back in time. It seems unlikely that such large age differences in the characteristics of the earth's magnetic field between such geographically close sites are indeed real, in which case systematic dating errors may be the explanation.

(d) Meteorology

Routine observations of the meteorological elements were continued throughout the year, autographic records tabulated and results published. There is a steady demand from scientific and commercial interests for the results.

(e) Seismology

The major effort of the section is now devoted to the seismic structure of Ireland while the seismic networks continue to yield information of local events. Of the latter the most interesting occurred on 19 July and resulted in the section being swamped by inquiries from the media and the public for information. It required additions to our staff to cope with the situation.

This event was strongly felt in Wales, England and Ireland just before 8 a.m. (Summer Time) on Thursday the 19th of July 1984. In the period up to the end of August the network of stations operated by us has recorded about 120 aftershocks. In Fig. 1 we show a map of the Irish stations and the nearest of the large network operated by the British Geological Survey. All the aftershocks seem to lie very close to the site of the main event. The main shocks in July and August were:

(1)	19 July	0756	ML = 5.4
(2)	27 July	1356	4.0
(3)	29 July	2118	4.2
(4)	6 August	0822	3.8
(5)	18 August	1237	4.5

All these were at about 53.0° N, 4.4° W near the western coast of the Lleyn peninsula. The magnitude, ML, is the Richter Local Magnitude, and it is roughly equivalent to the Richter Magnitude which is often quoted in the press. The biggest aftershock so far was on the 18th of August and the waves it generated were only a little more than 0.1 of those experienced on the 19th of July. The only event of the five which was not reported to us as being felt in Ireland was no. 2. This was not the smallest, but it happened in the middle of a normal weekday and was thus less likely to have been widely noticed. We have about 1000 written and telephoned reports for the main shock and this may be less than 1% of the number of people who actually felt or heard something.

The scale we have used in the intensity survey is the MSK scale. Fig. 2 shows the decrease in intensity as the shock waves radiated from the area above the focus (intensity, I_o = VI) across the Irish Sea and into Ireland. Roman numerals are usually used for intensity because it is hard to quantify in terms of ground velocity or acceleration. There is a large zone of intensity IV in eastern Ireland. In this area there were a few reports which could be labelled as V and quite a few where the intensity was less than IV. Local conditions have a strong influence.

Damage is unusual in Irish and British earthquakes and the importance of intensity maps is that they allow us to extend our investigations further back into the past. In an event like that in July we have both an intensity map and accurate instrumental measurements of the earthquake itself. Instrumental records are generally not available for events before 1900 so we rely on reports of what people experienced in earlier events. Comparison with recent earthquakes then allows us to quantify these earlier events and thus build up a more realistic picture of the return periods for earthquakes of different sizes, i.e., how often they are likely to occur.

Most of the worlds large earthquakes occur at plate boundaries. The greatest stresses do occur in these regions and these are large enough to generate faulting. In quieter zones, like the relatively passive continental margin in which Ireland lies, the stresses are less but they do still exist. They may not be great enough to produce new faults but can be enough to cause movement on faults that already exist. Because stress can be concentrated by structural features, quite large events sometimes happen a long way from plate margins. In such intraplate surroundings the attenuation of seismic waves may be low and the affected areas can be very large.

The depth of the earthquake of the July event was about 20 km below the surface so no one could be less than about 20 km from the source. This reduced the maximum intensity. Had it been close to the surface there would probably have been quite severe damage and injury. The Belgian earthquake of November 1983 damaged 5000 houses and caused a couple of deaths. This was a smaller event. Events with a magnitude below 6 have had disastrous consequences. The Agadir, Morocco, event of 29 February 1960 had a magnitude of only 5.9 but it devastated Agadir and killed 14,000 people. It was shallow and immediately under the town. While most earthquakes in this part of the world are at mid-crustal depths (about 15 kms below the surface), some ar not. The event near Enniscorthy in January 1981, for example, seems to have been very shallow.

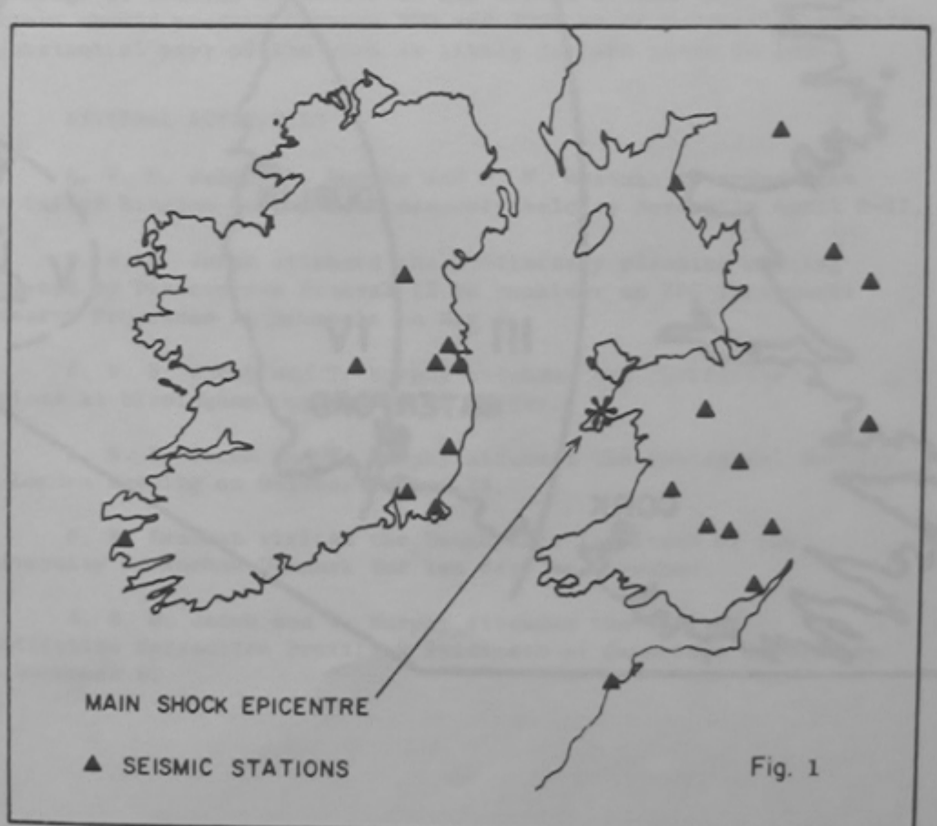

Fig. 1

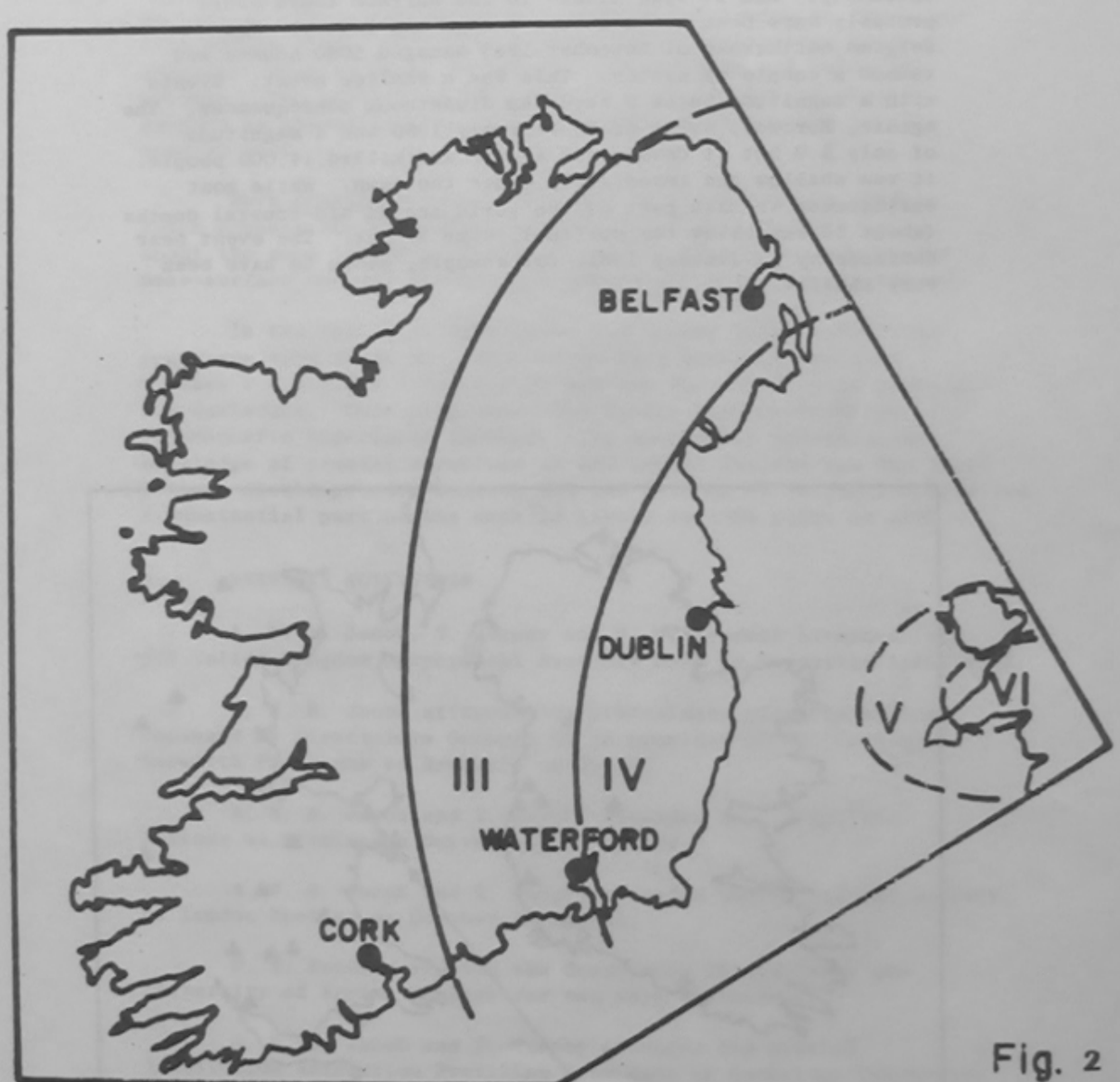

Fig. 2

Seismic structure of Ireland

The first paper on the crustal structure parallel to the Caledonian Suture Zone in Ireland was submitted to Tectonophysics in 1984 and it is now in press. Work is continuing on the lower lithosphere data. This will give detailed information on the structure down to dephs between 30 and about 80 kms below the surface. The quality of this data is so high that it should produce an unusually detailed picture of the structure in this complex area.

Work continued during the year on a north-south profile which crosses the Caledonian Suture Zone. This profile is about the same length as the 1982 one but should provide better near-surface control as the shot points are more closely spaced.

In the Spring of 1984 plans for a very large refraction programme were drawn up. This is to be a combined exercise between D.I.A.S., U.C.G., T.C.D. and the Universities of Hamburg and Karlsruhe. This programme, the Celtic Onshore-Offshore Lithospheric Experiment (COOLE), will enormously increase our knowledge of crustal structure in and around Ireland and the final pattern should produce between 200 and 3000 km of refraction profiles. A substantial part of the work is likely to take place in 1985.

3 EXTERNAL ACTIVITIES

A. W. B. Jacob, T. Murphy and P. W. Readman attended the 8th United Kingdom Geophysical Assembly held in Newcastle April 9-11.

A. W. B. Jacob attended the preliminary planning meeting convened by Directorate General 12 to consider an EEC Earthquake Research Programme at Brussels on May 4.

A. W. B. Jacob and T. Murphy attended the 'Griffiths' Seminar at Birmingham University on 31 May.

A. W. B. Jacob and T. Murphy attended the Geological Society of London Meeting on October 24 and 25.

P. W. Readman visited the Geophysics Institute of the University of Aarhus Denmark for ten days in November.

A. W. B. Jacob and T. Murphy attended the British Institution Refraction Profiling Syndicate at Cambridge University on December 8.

P. W. Readman acted as an observer on a French scientific cruise in the Goban Spur area, 3 - 16 March 1984, in which heat-flow and single channel seismic reflexion work was undertaken as part of more extensive programme to study the evolution of a passive ocean/continent boundary. During the cruise some samples were taken from the sediment cores for preliminary palaeomagnetic analysis which showed that the sediments had retained a record of the earth's magnetic field: some samples were reversely magnetized showing that they had acquired their magnetization during a period in which the polarity of the earth's magnetic field was reversed, i.e. most probably older than 700,000 years.

P. W. Readman attended the 10th Annual European Geophysical Society Meeting in Louvain-la-Neuve, Belgium 30th July - 3 August 1984, and presented a paper entitled "Geomagnetic secular variation recorded in Brunhes-age sediments in long cores from Italy". He co-convened a Workshop at the Meeting on "Palaeomagnetism, Age Dating and Sedimentology of Young Sediments", the proceedings of which are to be published as a special issue of Physics of the Earth and Planetary Science Interiors.

4. PUBLICATIONS

A. W. B. Jacob, W. Kaminski, T. Murphy, W. E. A. Phillips and C. Prodehl:

"A crustal model for a NE/SW profile through Ireland", in press, Tectonophysics.

T. Turbitt, et al., with A. W. B. Jacob, E. Ryan and V. Ward:

"The North Wales earthquake of 19 July 1984", in press J. geol. Soc. London, vol. 142.

F. A. Cook, D. H. Matthews, A. W. B. Jacob:

"Crustal and Upper Mantle Structure of the Appalachian-Caledonian Orogen from Seismic results", in press, Special publication of the geol. Soc. London.

Bulletin

T. Turbitt, et al., with A. W. B. Jacob, E. Ryan, V. Ward:

"The earthquake of 19 July, 1984, Lleyn Peninsula, U.K. (Magnitude 5.4)", BGS, GSU Report no. 239, September , 1984.

Abstracts

A. W. B. Jacob, W. Kaminski, T. Murphy, W. E. A. Phillips and C. Prodehl:

"A crustal model for a NE/SW profile through Ireland" Terra Cognita, 4, 298 (1984).

N. P. Murphy:

"Seismic Refraction and short period surface wave studies in Eastern Ireland", Geophysics, J. R. astr. Soc., 77 299 (1984).

P. W. Readman:

"Geomagnetic secular variations recorded in Brunhes-age sediments in long cores from Italy", Terra Cognita, 4, 362, (1984).

5 SEMINARS

February 10	Dr. P. Barton, Cambridge University, "The North Sea Basin".
November 30	Dr. G. Stuart, University of Leeds, "Seismological evidence for rapid lateral changes in crust and upper mantle structure at pre-Cambrian shield boundaries".

6 MISCELLANEOUS

A. W. B. Jacob joined the Editorial Board of "Geophysical Surveys" in September 1984.

N. P. Murphy, ex scholar took up position of Lecturer in Petroleum Geophysics section of the Department of Geology U.C.D. in October.

COMPUTER INSTALLATIONS

Data General Eclipse System

There were no hardware changes in the Eclipse system during the year and the few faults were all quickly corrected by Data General. The order of a large System Industries Winchester disk late in the year will lead to significant improvements in the system in 1985. The S.I. disk will be formatted to mimic two 192 megabyte Data General Zebra disks. It will allow greater flexibility and speed in operation and will also permit the running of long programs without blocking access to the computer by other users.

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

Income and Expenditure Account
for the year ended 31 December 1984

1983 £		NOTES	1984 £
	INCOME		
1,435,800	Oireachtas Grants	1(a), 2	1,527,000
43,225	Sales of Publications	3	48,603
4,749	N.B.S.T. Project		---
---	Celtic Studies Summer School Fees		6,838
---	Theoretical Physics Summer School Fees		1,696
43,732	Miscellaneous	4	50,695
1,527,506			1,634,832
	EXPENDITURE	5	
393,121	Administration		414,789
327,925	School of Celtic Studies		339,982
232,786	School of Theoretical Physics		225,978
538,537	School of Cosmic Physics		545,764
34,933	Adaptation of Premises		2,458
1,527,302			1,528,971
204	SURPLUS (DEFICIT) for year	6	105,861

Notes 1 to 11 form part of these accounts.

CHAIRMAN - COUNCIL OF THE INSTITUTE

12th September, 1985.

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

Balance Sheet at 31 December 1984

1983				1984
£	CURRENT ASSETS	NOTES		£
188,100	Cash on hands and at Bank			349,815
102,135	Debtors and Prepayments			51,044
290,235				400,859
	Less			
	CURRENT LIABILITIES			
32,590	Creditors and accruals		35,730	
13,382	Vernam Hull Bequest	7	15,005	50,735
45,972				
244,263	NET CURRENT ASSETS			350,124
	Represented by	6		
244,263	INCOME and EXPENDITURE - Accumulated Surplus			350,124

Notes 1 to 11 form part of these accounts.

T. K. WHITAKER

CHAIRMAN - COUNCIL OF THE INSTITUTE

12th September, 1985.

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

NOTES TO THE ACCOUNTS

1. Accounting policies

(a) Oireachtas Grants:- Income shown in the Accounts as Oireachtas Grants is the actual cash received in the period of the Account and includes £17,500 for increases in remuneration.

(b) Premises:- The premises occupied by the Institute are leased from the Office of Public Works.

Expenditure on additions to such premises is written off in the Income and Expenditure Account.

(c) Furniture and Equipment:- Expenditure on furniture and equipment is written off in the year in which it is incurred. The estimated value for insurance purposes of these assets is £900,000.

(d) Library:- Expenditure on library books and materials is charged to the Income and Expenditure Account. The current value of such books and materials is estimated ar £368,000.

(e) Publications:- Expenditure on publications is written off in the year it is incurred. The estimated value of such publications on hand at 31 December 1984 was £448,000.

2. Oireachtas Grants

Grants voted to the Institute have been allocated under the following headings:

1983		£	£
331,708	Administration	408,600	
298,000	School of Celtic Studies	294,100	
223,592	School of Theoretical Physics	234,750	
552,500	School of Cosmic Physics	589,450	
30,000	Adaptation of Premises	100	1,527,000
1,435,800			

3. Sales of Publications

42,943	School of Celtic Studies	48,100	
43	School of Theoretical Physics	476	
239	School of Cosmic Physics	27	48,603
43,225			

4. Miscellaneous Income

41,266	Administration	46,688	
711	School of Celtic Studies	---	
470	School of Theoretical Physics	---	
1,285	School of Cosmic Physics	1,007	
---	Adaptation of Premises	3,000	50,695
43,732			

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

NOTES TO THE ACCOUNTS

5. Analysis of Expenditure

1983		Total	Administration	School of Celtic Studies	School of Theoretical Physics	School of Cosmic Physics
£		£	£	£	£	£
940,505	Salaries, Wages & Superannuation	978,067	202,203	227,683	148,657	399,524
51,640	Scholarships	49,629	-	21,195	17,432	11,002
263	Honoraria	275	-	100	-	175
56,482	Library	54,692	-	5,281	32,599	16,812
71,665	Publications	68,522	692	63,956	2,337	1,537
59,065	Furniture & Equipment	49,084	18,853	-	7,773	22,458
190,420	General Administration	181,154	181,154	-	-	-
46,784	Travel, Survey & Seismic Research	56,280	969	2,112	5,759	47,440
3,071	Symposium, Summer School and Seminar Expenses	17,177	-	13,531	3,646	-
28,847	Consumable Equipment	24,470	-	-	-	24,470
35,755	General Expenses	43,974	10,918	6,124	7,775	19,157
2,812	Schroedinger Commemoration	-	-	-	-	-
5,060	NBST Project	-	-	-	-	-
-	Special Commitments	3,189	-	-	-	3,189
1,492,369		1,526,513	414,789	339,982	225,978	545,764
34,933	Adaptation of Premises	2,458				
1,527,302		1,528,971				

6. Surplus/Deficit Position

	Balance 1/1/84	Year to 31/12/84	Balance 31/12/84
Administration	75,602	40,499	116,101
School of Celtic Studies	86,328	9,056	95,384
School of Theoretical Physics	(274)	10,944	10,670
School of Cosmic Physics	65,130	44,720	109,850
Adaptation of Premises	17,477	642	18,119
	244,263	105,861	350,124

This surplus is available towards meeting the Institute's expenditure on commitments outstanding at 31 December 1984 (see Note 11).

7. Vernam Hull Bequest

The project to be financed by this bequest to the School of Celtic Studies has not yet been decided on.

INSTITIUID ARD-LEINN BHAILE ATHA CLIATH
(Dublin Institute for Advanced Studies)

NOTES TO THE ACCOUNTS

1983 £	8. General Administration Expenses	£	£
65,216	Rent, Rates & Insurance	69,162	
62,626	Premises Maintenance	47,391	
28,413	Postage & Telephones	30,729	
30,228	Fuel, Light & Power	28,882	
3,937	Sundry Supplies	4,990	181,154
190,420			

9. Superannuation

Salaries are charged net of pension contributions. Expenditure arising under the Institute's superannuation schemes is met out of Oireachtas Grants in the year of payment. No provision has been made in these accounts for future superannuation commitments.

10. Seismic Research

Contributions received from external sponsors and agencies have been set off against the expenditure of the Institute. These contributions were as follows:-

1983	Contributor	Research Project	Amount
			£
5,742	T.C.D.	Irish Caledonian Suture Seismic Project	---
300	E.S.B.	Seismic Survey at Carnsore	300
---	Institute of Geological Sciences, Edinburgh	Seismic Data Collection	307
6,042			607

11. Outstanding Commitments

The estimated cost of commitments outstanding at 31 December 1984 exclusive of Current Liabilities shown on the Balance Sheet, is as follows:-

31/12/83		£
76,500	Administration	116,000
86,700	School of Celtic Studies	95,000
500	School of Theoretical Physics	10,000
65,000	School of Cosmic Physics	109,000
17,000	Adaptation of Premises	18,000
245,700		348,000

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

Report of the Comptroller and Auditor General

I have examined in accordance with approved auditing standards the Accounts set out on Pages 1 to 5 which are in the form approved under the provisions of Acht um Institiúid Ard-Léinn, 1940. I have obtained all the information and explanations which I considered necessary for the purpose of my audit.

In my opinion proper books of account have been kept by An Institiúid and the Accounts, which are in agreement with them, give a true and fair view of the state of its affairs at 31 December 1984 and of its transactions for the year then ended.

P. L. McDONNELL
Comptroller and Auditor General

30 October, 1985.