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

ANNUAL REPORT
1982

10 Burlington Road, Dublin 4

P1.1930

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 1982

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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 1982

School of Celtic Studies

There is, as yet, no change in the staffing of the Celtic School. The withholding of permission to fill vacancies, including that of Senior Professor, leaves the staff at a critically low level.

During the year three scholars left: Diarmuid Ó Sé on 30 June, Mark Scowcroft on 30 September and B. T. Hudson on 31 December.

Research, editing, and publication continued successfully and all members of the staff, including the scholars, contributed to this.

A colloquium was held by Professor D. A. Binchy during Hilary term, a seminar by Professor James Carney during Michaelmas term, and seminars by Professor Brian Ó Cuív during the Hilary, Trinity and Michaelmas terms.

Mr. Fergus Kelly delivered a lecture in University College, Dublin, and Dr. Malachy McKenna delivered a lecture and held seminars at the New University of Ulster. He subsequently gave a series of lectures at University College, Dublin. Dr. Mark Scowcroft, scholar, lectured at St. Patrick's College, Maynooth.

A successful symposium was held in April for the Celtic School, university and college staff and research workers.

Professor James Carney lectured on 'The School of Celtic Studies' on the occasion of the celebration of the de Valera centenary on 20 October and the lecture was made available in the Éamon de Valera Centenary Brochure.

Professor Ó Cuív was awarded the Derek Allen Prize of the British Academy for work in Celtic Studies.

School of Theoretical Physics

The First Conference of the European Molecular Liquids Group, on Analytical and Computational Studies of Basic Problems in Molecular

Liquids, with 32 participants, was held from 19-21 April, inclusive; in October Professor McConnell was elected Chairman of the Group. The First Dublin Summer School in Physics, on Laser Physics with Applications, with 45 participants, was held from 28 June to 9 July inclusive.

The use of the School's facilities for research continued to increase; 27 research workers from the universities and other institutes of higher education and/or research were admitted to research associate-ships with the School. Thirty-one scientists from abroad visited the School during the year, and a Delegation from the Alexander von Humboldt Foundation visited the School on 19 September.

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 2 for final year undergraduates (or first year graduates) from the Dublin area, were given at DIAS; three seminars/talks were given at UCD, two at the Royal Astronomical Society's Dublin Meeting, one at the Limerick Algebra Conference, and one at an Irish Mathematical Society Meeting. The Statutory Public Lecture was given at TCD by Visiting Professor Walter Thirring: his subject was 'Solved and Unsolved Problems in Mathematical Physics'.

The School continued its research. The primary areas of research were theoretical particle physics, classical statistical mechanics, quantum statistical mechanics, theory of wave propagation, lasers, and general relativity and gravitation; secondary areas were applied mathematics and pure mathematics. Twenty-six contributions to journals or scientific proceedings were published.

Members of the School attended 25 conferences abroad, and gave courses or seminars at 10 of these. They gave 30 other courses or seminars abroad.

School of Cosmic Physics

Astronomy Secton:

The observational work on cepheid variable stars in the Magellanic Clouds reached publication stage for 320 stars in all during the year. The rate of change of period has also been investigated. Work on clusters of galaxies has continued.

Indication of luminosity criteria for quasars were studied in detail, particularly in respect of determining the deceleration-parameter. In the the theory of the solar system a rigorous form of the perturbing function and its effect on asteroid stability has been investigated.

Instrumental development continued through the year, which was also marked by substantial contributions to the work of the General Assembly of the International Astronomical Union.

Cosmic Ray Section:

Development and implementation of the Ultra Heavy Cosmic Ray Experiment for the shuttle-launched Long Duration Exposure Facility (LDEF) Mission continued during the year. The first set of flight qualification tests of experiment hardware were carried out successfully and agreement was finally reached with the National Aeronautics and Space Administration (NASA) on details of the experiment thermal control specifications. The launch date for the LDEF Mission has been changed to 13 April 1984.

Development of the Energetic Particle Experiment (EPONA) for the European Space Agency's Giotto Mission to Halley's comet has proceeded very rapidly. In January, the European Space Agency accepted a proposal for a significantly upgraded version of the EPONA experiment featuring three semiconductor particle telescopes. The new design yields much higher temporal and spatial resolution together with an extended range of energies (down to 15 keV) in return for a small increase in mass and power requirements.

Several studies of cosmic ray Iron Group spectra and of the track response in solid state nuclear track detectors were continued, extended or initiated. Detector stacks were exposed to the world's first high energy ultra heavy ion beams produced by the upgraded heavy ion accelerator (the BEVALAC) at the Lawrence Berkeley Laboratory, California. Two very significant discoveries in the field of track detector response by the Cosmic Ray Section, the registration temperature effect and a new polycarbonate detector, have provided the basis for a new generation of heavy cosmic ray experiments with greatly improved charge resolution.

Geophysics Section:

The systems of geographical and rectangular coordinates in use in Ireland were investigated and various transformation formulae derived. These have been published.

A method suitable for a small computer to enable gravity data on maps to be contoured was implemented.

The low temperature study of titanomagnetite failed to solve the mechanism of the unusual magnetic transition of this mineral in the region of 50 K.

The magnetic analysis of the Greek lake sediments is still proceeding.

The seismic networks were operated throughout the year and five earth

tremors on and close to Ireland were recorded. One on the mainland near Drinagh, Co. Wexford was not reported as being felt.

A large scale seismic project entitled the Irish Caledonian Suture Seismic Project was carried out in collaboration with the universities of Durham, Karlsruhe and Dublin (Trinity College). It involved a 250 km long reversed seismic refraction and reflection line from Dundalk Bay to the Shannon estuary. The results were satisfactory and preliminary analysis was begun. The project was carried out only by considerable financial assistance from external sources including industrial companies.

The seismic project in east central Ireland using quarry blasts as sources was completed. The project involved the joint interpretation of short period surface wave and refraction data. This combined approach indicates a new valuable method of investigating thick sedimentary formations.

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 1982

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 1982.

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 1982.

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 1982.

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 Boards of Constituent Schools

J. P. Carney, B.A., Fil.Dr., 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.; C. Ó Ceallaigh, M.Sc., Ph.D.; 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

C. Ó Ceallaigh, M.Sc., Ph.D.; T. Murphy, D.Sc; P. A. Wayman, Ph.D.

Appointed Members

A. Brock, M.A., Ph.D., F.R.A.S., F.Inst.P.; P. K. Carroll, M.Sc., Ph.D.; M. de Groot, Ph.D.; B. Henderson, B.Sc., M.A., Ph.D., F.I.P.; 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; Geraldine Esmonde; Desmond Pender.

II - Annual Report of the Governing Board of the School of Celtic Studies for the year ended 31 December 1982, adopted at its meeting on 6 May 1983.

1. STAFF AND SCHOLARS

Professor Emeritus:

D. A. Binchy.

Senior Professors:

James Carney, Director; Brian Ó Cuív.

Professor:

Heinrich Wagner.

Assistant Professors:

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

Research Assistant:

Malachy McKenna.

Assistants (Part-time):

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

Assistant Librarian/Clerk:

Máire Breatnach.

Secretary/Publications Officer:

Máire Uí Chinnseala.

Clerical Staff:

Patricia Dunne.

Scholars:

Diarmuid Ó Sé to (30 June 1982); Ian Hughes, Mark Scowcroft to (30 September 1982); George Broderick; Máire Breathnach; Aoife Nic Ghiollamhaith, David Johnston (from 1 October 1982); B. T. Hudson (from 1 October 1982 to 31 December 1982).

Continued staff vacancies, which leave the full-time academic staff at eight, have resulted in a serious curtailment of the activities of the School and they render difficult the planning of our triennial Summer School of Celtic Studies, due to be held in 1984. Since 1980 permission has been withheld by the Department of Education for appointments to posts of Junior Research Assistant left vacant by the resignation of Liam Breatnach and Katharine M. Simms. The post of Senior Professor, left vacant by the death of Professor David Greene in 1981, remains unfilled although the Governing Board recommended a successor for appointment in February 1982. In the survey of the achievements of the School which he gave on the occasion of the commemoration of the centenary of the birth of Éamon de Valera, the Director, Professor James Carney, pointed out that where expansion had been intended there had been contraction, and he expressed the hope that some expansion would prove possible in the not too distant future.

2. RESEARCH AND EDITING

Professor D. A. Binchy held a colloquium on the legal text Gubretha Caratniad during Hilary term.

Professor James Carney continued work on Early Irish Poetry. An article entitled 'Dating of Early Irish Verse Texts 500-1100 A.D.' was accepted for publication in Éigse and an edition of a poem entitled 'A maccucáin, sruith in tíag' was accepted for publication in Celtica xv. See also sections 4, 5, 6, 7.

Professor Brian Ó Cuív continued work on a catalogue of the Irish manuscripts in the Bodleian Library in Oxford; worked on linquistic, literary and historical topics, including an examination of Irish versions of Giraldus Cambrensis's Expugnatio Hibernica; completed the editing of Celtica xv; checked the edited typescript of a contribution on 'Irish language and literature, 1691-1845' for Vol. IV of A New History of Ireland; revised the text and bibliographical material of 'Ireland in the eleventh and twelfth centuries' for a new edition of The Course of Irish History; completed the following for publication: (i) Ireland's Manuscript Heritage' (Éire-Ireland); (ii) 'A Poem for Fínghin Mac Carthaigh Riabhach'(Celtica xv); (iii) 'A Poem for Cathal Croibhdhearg Ó Conchubhair' (Ériu xxxiv; (iv) 'Observations on the Book of Lismore' (Proc. Royal Irish Academy). See also sections 4, 6, 7.

Professor Heinrich Wagner worked on (i) Zeitschrift für Celtische Philologie Vol. 40 which he will see through the press; (ii) assisted George Broderick in the preparation of his 'Handbook of late Spoken Manx' which will be published in two parts as volumes 3-4 of Buchreihe der ZCP edited by Professor Wagner; (iii) preparatory work on 'Comparative Celtic Grammar'; (iv) the relationship between Celtic grammar and Germanic; (v) preparation for publication of a booklet (with Nollaig Mac Congáil) entitled Phonetic Texts from Cárna, Connemara. See also section 7.

Dr. Pádraig de Brun continued work on the cataloguing of Irish manuscripts in Trinity College, Dublin; prepared an annotated list of

teachers of the Bible in Irish in the early nineteenth century. An introductory article on this subject is to be published in Éigse 19. The following articles were accepted for publication: (i) 'The Irish Society's Bible teachers, 1818-27': Éigse; (ii) 'Cúrsaí Gaeilge: filí agus scríobhaithe' (for a volume on the history of the parish of Liselton/ Ballybunion to be edited by Rev. Fr. M. Ó Ciosáin). See also section 7.

Mr. Fergus Kelly completed work (in collaboration with Thomas Charles-Edwards, Oxford) on an edition of Bechbretha to be published as volume 1 in the Early Irish Law Series; the material went to press during the year. He finished the first draft of a work on Early Irish Justice and acted as extern examiner in Old Irish to NUI. An article entitled 'Note on infixed pronouns in Audacht Morainn' was accepted for publication in Ériu. See also section 6.

Mr. Rolf Baumgarten worked on the four indexes which are to be included in Bibliography of Irish Linguistics and Literature. A bibliography of the work of the late Professor David Greene was accepted for publication in Ériu.

Micheál Ó Siadhail continued work on the grammar of Modern Irish dialects with a view to producing a grammar (in co-operation with Dr. Arndt Wigger); rechecked Córas Fuaimeanna na Gaeilge and Learning Irish for reprinting; an article entitled 'The Erosion of the Copula in Modern Irish Dialects' was accepted for publication in Celtica xv. See also section 7.

Dr. Malachy McKenna completed the index to a series of articles on the Breton of Guémené (ZCP 35-38) which brings this project to an end; made a field-trip to the Cornauaille (Doelan) area of Brittany to begin work on a study of the spoken Breton of the area; recorded the speech of a native speaker of Breton from Eastern Brittany now resident in Dublin; continued work on an edition of 'The Spiritual Rose'. An article entitled 'A Note on a Feature of Omeath Irish' and a review of Le Breton Parlé a Saint-Pol-de-Léon were accepted for Celtica xv. See also sections 3, 6, 7.

Mrs. Nessa Doran completed the preparation of Mss. G350-G367 for Fasc. VIII of Catalogue of Irish MSS in the National Library of Ireland. See also section 7.

Mrs. Anne O'Sullivan checked first proofs of her edition of The Book of Leinster Vol. VI. Work progressed on a catalogue of Irish manuscripts in Trinity College, Dublin in collaboration with Dr. Pádraig de Brún. An article entitled 'St. Brecan of Clare' was accepted for publication in Celtica xv.

Diarmuid Ó Sé completed his Ph.D. thesis on the phonology and morphology of the Irish of West Kerry; continued the accumulation of material, such as vocabulary, not directly relevant to the thesis; continued work on drafts of two articles for future publication; carried out four weeks field-work in West Kerry.

Mr. Ian Hughes worked on the final stages of his doctoral thesis 'The Irish Gospel of Nicodemus' which was submitted to the University of Wales.

Mr. Mark Scowcroft submitted his thesis The Hand and the Child: Studies of Celtic Tradition in European Literature to Cornell University in January where the degree of Ph.D. was conferred on him. He then began work on an edition of Leabhar Gabhála, recension II. The following articles were accepted for publication: (i) 'Miotas na Gabhála i Leabhar Gabhála' (trans. Pádraig Ó Fiannachta) Léachtaí Cholm Cille, XIII (1982); (ii) 'Some recent Work on Irish Mythology and Literature' Cambridge Medieval Studies, IV (winter 1982). See also sections 6, 7.

Dr. George Broderick worked on a Handbook of Late Spoken Manx which is to be published in two volumes by Max Niemeyer Verlag, Tübingen; worked on an article 'Ny Kirree fo Nîaghtey' with a view to publication in Celtica. The following articles were accepted for publication (i) 'Ec ny Fiddleryn', (ii) 'Berrey Dhone: A Manx Caillech Bérri?' (ZCP 40); (iii) 'Creag and Carraig in Manx placenames' (Bulletin of the Ulster Placenames Society); (iv) 'Boddagh yn Cooat Laaghagh' (Béaloideas 51). See also sections 5, 7.

Máire Bhreathnach continued work on her edition of Togail Bruidne Da Derga; chapters on manuscript affiliation and on the structure and sources of TBDD are completed; work on the apparatus criticus of Recension II (YBL and affiliated texts) and Recension III (Egerton 1782 and H.I.14) progressed. An article 'A new Edition of Tochmarc Becfhola' was accepted for publication in Ériu. See also section 7.

Aoife Nic Ghiollamhaith worked on her doctoral thesis 'The O'Brien Kingdom of Thomond after the Anglo-Norman Invasion ' using genealogies, annals, bardic poetry and the Anglo-Irish record sources.

Mr. David Johnston worked on the preparation of an edition of the work of the Welsh poet Iolo Goch. The text is fully established, the manuscripts collated and the textual notes written. A review of two collections of translations of poems of Dafydd ap Gwilym (R. Bromwich and R. M. Loomis) was accepted for publication in Cambridge Medieval Celtic Studies 5.

Mr. Benjamin Hudson did preparatory work on an article of The Prophecy of Berchán.

3. STATUTORY PUBLIC LECTURE

A Statutory Lecture entitled 'The Breton Literary Tradition' was delivered by Dr. Malachy Mc Kenna at University College, Belfield, Dublin on 26 November 1982.

4. SEMINARS

Professor James Carney held a seminar on Dating in Early Irish Poetry 500-1100 A.D. during Michaelmas term.

Professor Brian Ó Cuív held a seminar on The Rule of Mo Chuta during Hilary, Trinity and Michaelmas terms; he gave a class on manuscript reading and textual editing in the Michaelmas term.

5. SYMPOSIUM

On 2-3 April 1982 a symposium was held for university and college staff and research workers. The following papers were read:-

James Carney	: Early Irish Poetry: The Dating Problem
Seán Ó Briain	: Verbal noun endings -(e)amh / -(i)ughadh /-adh
Art Ó Maolfabhail	: Tóin re/le Gaoith
Dáibhi Ó Cróinín	: The Bamberg Cryptogram
Kim McCone	: AIII and BV Presents, the long a- Preterite, and Verbal Ablaut
George Broderick	: The problem of Stress in Manx
Donncha Ó hAodha	: The Middle Irish Metrical Tract Córus Bard cona Bardni
Mark Scowcroft	: Balor Nuadu and Georges Dumézil

6. EXTERNAL ACTIVITIES

Professor James Carney lectured on 'The School of Celtic Studies' on the occasion of the celebration of the de Valera Centenary which was held at the National Art Gallery on 20 October 1982.

Professor Brian Ó Cuív was awarded the Derek Allen Prize of the British Academy for work in Celtic studies and the prize was presented at the Academy's Annual General Meeting in London on 1 July; he examined manuscripts in the British Library, Lambeth Palace Library and the Bodleian Library in connection with work in progress; he gave three seminars in University College, Cork, on 11-12 May on (i) editing amhrán, (ii) editing dán díreach, and (iii) Irish Grammatical Tracts - I Introductory; he also gave a seminar in University College, Dublin, on 5 November on 'Filí, Pátrúin is Traidisiún na Lámhscríbhinní'.

Mr. Fergus Kelly lectured on 'Lots and Ordeals in Early Irish Law' at University College, Dublin on 4 November 1982.

Dr. Malachy McKenna delivered a lecture and held a seminar on 'Some aspects of the relationship between East Ulster Irish, Manx and Scottish Gaelic' at the New University of Ulster in February; during the autumn term he gave a series of lectures on 'Foghraíocht na Nua-Ghaeilge' at University College, Dublin.

Dr. Mark Scowcroft lectured on 'Origins and Identity' as part of the series Léachtaí Cholm Cille at St. Patrick's College, Maynooth on 4 February 1982.

7. PUBLICATIONS

(a) Works in course of printing

The following works were in course of printing during the year but were not completed:

The Annals of Ulster edited by S. Mac Airt and G. Mac Niocaill.

The Book of Leinster Vol. VI. edited by Anne O'Sullivan.

Bechbretha edited by Thomas Charles -Edwards and Fergus Kelly.

Sex Aetates Mundi edited by Dáibhí Ó Cróinín.

Celtica XV edited by Brian Ó Cuív.

The Proceedings of the 6th International Congress of Celtic Studies edited by Gearóid Mac Eoin.

(b) Books published by the Institute

Celtica xiv	Ed. Brian Ó Cuív 187 pp.	£12.00.
Catalogue of Irish MSS. in National Library of Ireland Fasc. VII.	Nessa Ní Shéaghdha 97 pp.	£9.00.

(c) Reprints

1. Linguistic Atlas and Survey of Irish Dialects Vol. 1.
2. Armes Prydein
3. Christmas Hymns
4. Linguistic Training of the Mediaeval Poet

(d) Contributions to periodicals and other publications

James Carney:		
The School of Celtic Studies.	Éamon de Valera Centenary Brochure.	6-12.
Brian Ó Cuív:		
An Irish Poet in the Roman Curia	Celtica xiv.	6-7.
Addenda to Celtica xiii.	ibid.	26.
The Etymology of dia do bheatha.	ibid.	27-42.
A Fragment of Irish Annals	ibid.	83-104.
Sicínf Circe Sheáin Chláraigh	ibid.	124.
Reviews of publications	ibid.	171-87.
Acallam na Senórach	Dictionary of the Middle Ages Vol. 1 (Ed. Joseph R. Strayer)	33-4.
Heinrich Wagner:		
A syntactical feature of Archaic Old Irish Poetry.	Zeitschrift für Celtische Philologie 39.	78.
Old Irish bria subjunctive of bronnaid 'injuries'.	ibid.	83.
Studies in the History of Gaelic Dialects, Part 1	ibid.	96.
Nekrolog David William Greene	ibid.	271.
The name Eithne and the background of the tale Esnada Tige Buchet.	Topothesia. (Essays in honour of T. S. O Máille). Ed. B. S. Mac Aodha 1982.	65.
Pádraig de Brún:		
Lámhscríbhinní Gaeilge sa Mhuileann gCearr.	Éigse xix.	82-102.

A Schoolmaster's Advertisement	Seanchas Chairbre 1.	33-8.
Rev. Forster Archer's Account of Kerry in 1801.	Kerry Archaeological and Historical Society Journal 14.	26-30.
Caoineadh ar an Easpag Ó Siochfhradha.	ibid.	31-6.
Kildare Place Society in Kerry: IIa. Schools addenda.	ibid.	37-93.

Mícheál Ó Siadhail:

Cardinal Numbers in Modern Irish.	Ériu xxxiii.	99-107.

George Broderick:

Manx Stories and Reminiscences of Ned Beg Hom Ruy.	Zeitschrift für Celtische Philologie 39.	117-194.
Manx Traditional Songs and Song-fragments II	Béaloideas 50.	1-41.
The Baronial Possessions of Bangor and Saul in Man.	Bulletin of the Ulster Place-names Society, Series 2 Vol. 4.	24-5.

Mark Scowcroft:

Miotas na Gabhála i Leabhar Gabhála (trans. Pádraig Ó Fiannachta).	Léachtaí Cholm Cille xiii.	41-75.
Some recent work on Irish Mythology and Literature.	Cambridge Mediaeval Celtic Studies iv.	86-9.

Máire Bhreathnach:

The Sovereign Goddess - Goddess of Death ?	Zeitschrift für Celtische Philologie 39.	243-260.
Review of Saoithiúlacht na Sean-Ghaeilge.	ibid.	304-308.

III - Annual Report of the Governing Board of the School of Theoretical Physics for the year 1982 adopted at its meeting on 21 June 1983.

1 STAFF, SCHOLARS, FELLOW, RESEARCH ASSOCIATES, VISITING SCIENTISTS

Emeritus Professor:

John L. Synge.

Senior Professors:

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

Assistant Professors:

S. Ciulli to 30 September; M. van den Berg from 1 October.

Librarian-Executive:

Evelyn R. Wills.

Secretary:

Margaret Matthews.

Scholars:

L. P. Singh (India) to 30 June; S. Rouhani (Iran), D. Heffernan (Ireland) to 30 September; L. Papiez (Poland); T. Murphy (USA): J. Rayski (Poland); G. Prince (Australia) from 1 October); Y. Fujimoto (Japan) from 18 October; J. Burzlaff (Fed. German Rep.) from 1 November.

NBST Research Fellow:

B. Lenoach (Ireland)

Research Associates (all appointments to 31 December 1984):

UCD: S. Dineen, P. A. Hogan, D. J. Judge, J. D. McCrea, J. V.Pulè, W. Sullivan, D. Weaire (new from 20 December)
TCD: R. K. Dodd, P. S. Florides, H. C. Morris, B. K. P. Scaife, R. S. Ward, D. J. Bradley (new from 7 April).
St. Patrick's College, Maynooth: C. Nash, A. O'Farrell, J. Spelman, D. H. Tchrakian.
An Foras Forbartha: J. M. Golden.
DIT Kevin Street: T. Garavaglia, B. Goldsmith.
DIT Rathmines: M. Tuite (new, from 1 January)
UCG: M. J. Conneely, T. N. Sherry.
NIHED: R. Flood.
NIHEL: J. Kinsella (new from 1 January)
NUU: P. McGill.
Open University: A. I. Solomon.

Visiting Scientists:

O. Bratteli (Trondheim and Warwick) 12-16 July; G. Cicuta (Milan) 8-15 September; D. E. Evans (Warwick) 29 December 1981 - 10 January 1982, and 19 April - 6 May; D. G. Frood (Lakehead, Ont.) 10-30 December; R. Fulton (Florida State, Tallahassee) 1 December 1981 - 31 January 1982; P. Garbaczewski (Wroclaw) 13 October - 4 November; E. Kluk (Slaski Univ., Katowice) 26 October - 19 November; M. Lunn (Oxford) 11 January - 22 March, and 27 September - 8 October; A. Nakazawa (Kyoto) 10 December 1982 - 27 January 1983; M. O'Reilly (Rhodes Univ., Grahamstown, S.A.) 16 August - 22 December; G. Parravicini (Milan) 30 December 1981 - 6 January 1982; O. Penrose (Open Univ.) 24-27 February; D. Pottinger (Glasgow) 5-7 January; P. de Smedt (Leuven) 1 February - 22 March, and 27 September - 8 October; J. Tafel (Warsaw) 24-31 May; W. Thirring (Vienna) 17-21 June; E. Weinberg (Columbia Univ. and Cambridge) 8-9 June; A. Wipf (Zurich) 27 August - 24 September.

2 GENERAL

The First Conference of the European Molecular Liquids Group, on Analytical and Computational Studies of Basic Problems in Molecular Liquids, was held at DIAS on 19-21 April, inclusive; the attendance was thirty-two. In October Professor McConnell was elected Chairman of the Group.

The First Dublin Summer School in Physics, on Laser Physics and its Applications, was held at DIAS from 28 June to 9 July, inclusive, with an attendance of forty-five.

A Delegation from the Alexander von Humboldt Foundation visited the School on 19 September; the delegation consisted of Dr. T. Berberich (Head), Dr. W. Holl, and Mr. D. Feddern (Finance).

Professor Synge donated his working notebooks - some 200 books dating from 1924 - to the School's library.

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 G. Prince, J. Burzlaff and Y. Fujimoto, and the scholarships of T. Murphy, L. Papiez, and J. Rayski were renewed for a further year; the scholarship already held by L. P. Singh ended on 30 June, and those of S. Rouhani and D. Heffernan ended on 30 September.

In addition to the use made by the Staff, Scholars, and Fellow of the School in their primary research activities, much use was made also by visitors and research associates, particularly during the summer months, of the School's facilities for research - especially of the opportunities for informal discussions, and the library resources. Twenty-seven 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 section 9.

A small collection of photographs (1940-1982) and other material was provided from the School's archives for display at the DIAS Commemoration on 20 October of the centenary of the birth of Éamon de Valera.

3 RESEARCH AND STUDY

Primary areas -

a) Theoretical Particle Physics

i) Gauge Theories, Monopoles

Professor O'Raifeartaigh continued his work on solutions to magnetic monopole field equations, in collaboration with Drs. Rouhani and Singh, and he completed his research with Dr. Parravicini (Milan) and Dr. Fujimoto on effective potentials. With Dr. Murphy he initiated work on the application of effective potentials to systems with spontaneous symmetry breakdown, and this work is continuing. Dr. Murphy also studied 2-loop β renormalization group equations for gauged scalar fields, and steepest descent approximations for functional integrals in Minkowski space.

Dr. Tchrakian continued his collaboration with Dr. Sherry on the dimensional reduction of 6-dimensional gauge field systems to 3- and 4-dimensional models with Higgs fields. He also began to work on the dimensional reduction of torsionless 4-D gravity to 3-D gravity with torsion, interacting with a Higgs system.

Dr. Burzlaff completed a paper on classical solutions to Yang-Mills theory (begun at Yale Univ., with Dr. J. E. M Hornos), and began the compilation of a review article on magnetic poles, based on a graduate course presented at Yale the previous year.

Dr. Garavaglia studied gauge theory properties of massive neutrinos; he collaborated with Dr. Rayski in a study of quantum field theory of composite models, and with Dr. Fujimoto in a study of temperature dependent effective potentials.

ii) Scattering theory

Professor Ciulli continued his work with Professor Spearman on the use of function-analytic techniques in the reconstruction of Green's functions, amplitudes, etc., from ill-converging perturbative series.

b) Classical Statistical Mechanics

i) Brownian Motion and Dielectric Phenomena

Professor Mc Connell continued his research on Brownian motion, dielectric phenomena, and nuclear magnetic relaxation. He studied relaxation in solid dielectrics. He applied a general method developed in the school to the investigation of nuclear magnetic relaxation by spin-rotational interactions to linear and symmetric molecules. In collaboration with Professor Frood (Lakehead Univ., Ont.) he studied the literature on collision-induced absorption. They concluded that in its present state the theory is applicable to gases composed of simple systems of nonpolar molecules, but not to liquids.

ii) Phase Transitions in Lattice Systems

The joint work of Professor Lewis and Dr. D. E. Evans (Warwick) on the spectrum of the transfer matrix in the Ising model (described in the previous Report) was completed.

Dr. Solomon continued his programme of research into the coexistence of phases in multi-phase systems (begun in 1981, with Dr. J. Birman). Systems studied included metals exhibiting superconductivity and charge-density waves.

Dr. Sullivan continued work with Dr. Flood on the description of Gibbs states by means of specifications, and also worked with Dr. Vanheuverzwijn (Leuven) on a problem in canonical Gibbs states. Following a suggestion made by Drs. Pulè, Buffet and de Smedt, he is studying spectral properties of stochastic processes which are generalized random walks.

c) Quantum Statistical Mechanics

i) Boson Condensation

Professor Lewis continued his collaboration with Dr. Pulè on boson condensation, involving Dr. E. Buffet (UCD), Dr. M. Lunn (Oxford), Mr. P. de Smedt (Leuven), and Prof. van den Berg.

ii) Quantum Stochastic Processes

Professor Lewis continued his work on quantum stochastic processes.

Dr. Papiez worked on stochastic optimal control in quantum mechanics and on limit diffusion theory, with applications to statistical physics.

d) Theory of Wave Propagation

Mr. Lenoach continued his work on applications of asymptotic analysis of stockhastic differential equations, in particular applications to surface waves in a random medium.

e) Lasers

Dr. Heffernan continued his investigations of bistability, picosecond pulsing, and mode-locking in coupled semiconductor lasers, in collaboration with Prof. Bradley and Mr. Stallard (TCD), which were reported on in the previous Report, and also those on the process of four-wave-mixing, amplified reflection, phase conjugation, and hologram recording in photo-refractive media, in collaboration with Prof. Bradley and Mr. Devine (TCD). He commenced a study of amorphous semiconductors, using phase conjugate optics, in collaboration with Prof. Bradley and Mr. Mahoney (TCD).

f) General Relativity and Gravitation

Dr. McCrea constructed REDUCE programmes to deal with the quadratic Poincaré gauge field equations of Hehl and von der Heyde, and applied these to find new cylindrically symmetric solutions to these equations.

Dr. Prince extended classical projective differential geometry, using tangent bundle techniques. He combined these ideas with Langrangian theory in an investigation of exact solutions in general relativity using the Lagrangian structure of the geodesic equation. He studied analysis on manifolds techniques for general relativity, and tangent bundle differential geometry.

Dr. Hogan continued his studies of aspects of classical gauge theory, in particular solutions of the Yang-Mills equations, symmetries of gauge configurations, and broken symmetries, from the point of view of principal fibre bundles.

Prof. Florides made a study of the generalized Schwarzschild solution due to Cooperstock and Saracino, and re-examined the question of 'localization of energy in general relativity' (with Mr. Davitt, TCD).

Secondary areas -

g) Applied Mathematics

Dr. Goldsmith studied background material for future use in mathematical models relating to pharmacokinetics.

Dr. Golden collaborated with Prof. G. A. C. Graham (Simon Fraser) in work on viscoelastic crack and contact problems.

Prof. van den Berg studied eigenvalues and eigenfunctions of the Laplacian, and the application of functional analysis to correlation functions in 2-component plasmas.

h) Pure Mathematics

i) Geometry

Professor Synge studied the properties of infinite sequences of triangles, in particular pedal sequences in which each triangle is the pedal of its predecessor. In collaboration with D. J. G. Kingston (Nottingham) he has written a paper on the subject elucidating the observed fact that there exist pedal n-cycles in which the angles of the original triangle are restored after n pedal steps. He is now seeking analagous results in Minkowskian 2-space the geometry of which is basic in special relativity.

ii) Group Theory

Dr. Goldsmith studied the use of large cardinals in problems relating to endomorphism rings of abelian groups.

Research Reports

Research work during the year was written up in the first instance in research reports. Two 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-82-01: L. O'RAIFEARTAIGH & S. ROUHANI: On the symmetry properties of separated monopole configurations.

-02: A. I. SOLOMON & J. L.BIRMAN: Dynamical group model of the CDW state.

-03: A. I. SOLOMON & J. L. BIRMAN: Dynamical group SO(6) and co-existence: superconductivity and charge density waves.

-04: L. O'RAIFEARTAIGH, S. ROUHANI & L.P. SINGH: On the finitely separated two-monopole solution.

-06: J. GIBBONS: Rational solution of Lax equations.

-07: T. N. SHERRY & D. H. TCHRAKIAN: Dimensional reduction of a six-dimensional self-dual gauge field theory.

-09: S. CIULLI & T. D. SPEARMAN: The search for physical structures on the boundary by optimal analytic continuation from a finite set of interior data points.

-11: D. H. TCHRAKIAN: Self dual gauge field equations on N-dimensional manifolds.

DIAS-STP- 82-12: J. R. McCONNELL: Nuclear magnetic relaxation by quadrupole interactions in non-spherical molecules.

-13: T. GARAVAGLIA: Neutrino mass effects in neutrino-electron elastic scattering.

-14: S. CIULLI & T. D. SPEARMAN: Functional analytic continuation techniques with application in field theory.

-15: E. BUFFET & J. V. PULÈ: Fluctuation properties of the imperfect Bose gas.

-16: L. O'RAIFEARTAIGH: Cosmology and unified gauge theory.

-17: T. MURPHY: Two-loop β functions for scalar fields.

-18: A. J. SOLOMON: Order parameters for broken Abelian symmetries.

-19: P. A. HOGAN: Some Yang-Mills fields constructed from Maxwell fields.

-20: T. MURPHY & L. O'RAIFEARTAIGH: A note on super-symmetry breaking in 1+1 - dimensions.

-21: D. EVANS & J. T. LEWIS: The spectrum of the transfer matrix in the C*-algebra of the Ising model at high temperatures.

-22: L. O'RAIFEARTAIGH & S. ROUHANI: On the stability of the SU(2) separated two-monopole configuration.

-23: J. RAYSKI & J. M. RAYSKI: On a fusion of super-symmetries with gauge theories.

-24: J. D. McCREA: Static, vacuum, cylindrical and plane symmetric solutions of the quadratic Poincaré gauge field equations.

-25: J. R. McCONNELL: Theory of dielectric relaxation.

-26: M. LUNN: Integral functions of the Bose gas.

-27: B. GOLDSMITH: Representation of algebras over a complete discrete valuation ring.

-28: G. PRINCE: A note on the higher-order Neother symmetries of Sarlet and Cantrijn.

-29: P. A. HOGAN: Some solutions of the Yang-Mills equations generalising the Wu-Yang monopole.

DIAS-STP-82-30: P. GARBACZEWSKI: Chiral invariant Gross-Neveu model: classical versus quantum.

-31: A. I. SOLOMON: Dynamical groups and coexistence phenomena.

-32: G. PRINCE: Reflections on the symmetry-conservation law duality and the Runge-Lenz vector.

-33: D. HEFFERNAN: Condensed matter single parameter characterization of bistability in double contact injection lasers.

-34: S. AOYAMA, Y. FUJIMOTO & Z. ZHIYONG: Unification incorporating observable fractional charge, magnetic monopole and maphon.

-35: M. van den BERG, J. T. LEWIS AND J. V. PULÈ: A general theory for non-interacting systems of bosons.

4 SEMINARS, REVIEW LECTURES, SERIES, COURSES

Review and seminar 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 institutes in the Dublin area, and by members of the scientific schools of DIAS.

a) Review and Seminar Lectures given at DIAS-STP by Visitors:

Dr. E. BUFFET (UCD):	Fluctuations in the Bose gas.
Dr. G. CICUTA (Milan):	1/N expansion in non-Abelian gauge theories.
Prof. R. FULTON (Florida State, Tallahasee):	Polarization fluctuations and long range forces in non-linear dielectrics.
	A (forgotten) theory of relaxation.
Dr. P. GARBACZEWSKI (Wroclaw):	Mechanisms of the fermion-boson reciprocity.
Prof. O. PENROSE (Open Univ.):	The hard-sphere boson gas.
Dr. D. POTTINGER (Glasgow):	Quantum chromodynamics (3 lectures).
Dr. J. TAFEL (Warsaw):	Asymptotic properties of classified gauge fields.
Prof. W. THIRRING (Vienna):	Gauge theory and gravitation.

Prof. E. WEINBERG (Harvard & Cambridge):	Fundamental, composite and deformable monopoles.
D. A. WIPF (Zurich):	Monopoles and cosmology.

b) Courses and Series given at DIAS-STP:

Professor O'RAIFEARTAIGH completed the series of lectures on GROUP THEORY AND ITS APPLICATIONS TO PHYSICS, forming part of the M.Sc. course for universities in the Dublin area, begun the previous ear; he began a repeat of this course in November.

Professor LEWIS completed the course on STATISTICAL MECHANICS, for graduate or final-year undergraduate students, begun the previous year; he commenced a new graduate course, on STOCHASTIC DIFFERENTIAL EQUATIONS AND THEIR APPLICATIONS, in October. He organised a course of seminars on STATISTICAL MECHANICS OF BOSONS beginning in January, and with Dr. PULÈ a seminar course on GEOMETRICAL METHODS IN SCATTERING THEORY, from October.

Dr. FUJIMOTO gave a series of informal talks on GRAND UNIFICATION, commencing in October.

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

Dr. Y. FUJIMOTO:	Grand Unification.
Dr. P. GARBACZEWSKI:	Quantization of spin fields.
Dr. T. MURPHY:	Report on Rutherford Meeting. Report on Paris Meeting. Supersymmetry breaking in two dimensions.
D. L. PAPIEZ:	Diffusion processes in quantum dynamics.
Dr. T. GARAVAGLIA:	Report on Paris Meeting, and composite models.
Dr. D. TCHRAKIAN:	Dimensional reduction of a 6-dimensional gauge field theory.
Dr. P. HOGAN:	Wu-Yang monopoles.

d) Other Lectures or Seminars given in Ireland by members of DIAS-STP:

Prof. J. T. LEWIS:	Inaugural Talk, UCD Mathematical Society, 5 March.

Prof. L. O'RAIFEARTAIGH:	Relationships between Euclidean and twistor spaces; at UCD, 18 November. Unified gauge theories and cosmology; Royal Astronomical Society Meeting at Dublin (RIA), 7 April.
Dr. J. D. McCREA:	Gravitational radiation damping; Royal Astronomical Society Meeting at Dublin (RIA), 7 April.
Dr. B. GOLDSMITH:	Representation of algebras over complete discrete valuation rings; Limerick Algebra Conference, November.
Dr. D. HEFFERNAN:	Optical bistability in semiconductor lasers. Irish Mathematical Society Meeting, 7 April.
Prof. P. S. FLORIDES:	Hypersurfaces of constant curvature in Riemannian manifolds. UCD, 11 March.

5 STATUTORY PUBLIC LECTURE

A Statutory Public Lecture under the auspices of the School was delivered by Professor W. Thirring (Vienna) on 18 June in Trinity College, Dublin. The title was 'Solved and unsolved problems in mathematical physics'.

6 SYMPOSIA

Two Mathematical Symposia were held during the year, 7-8 April, and 20-21 December. The attendances (49 in April, 54 in December) included professors, lecturers, and graduate students from the Irish universities and other third-level institutions, and from institutions abroad, and members of the scientific schools of DIAS.

Lectures were given as follows:

APRIL:

Review Lectures:

Prof. T. LAFFEY(UCD): The classification of simple groups.

Dr. M. MacCALLUM (QMC, London): The equivalence problem in general relativity, (with computer demonstration).

Lectures:

Dr. B. SMYTH (UCD): Differential geometry and algebraic geometry.

Prof. J. T. LEWIS (DIAS):	Folklore about pressure and a theorem on convex functions.
Dr. M. FRY (TCD):	Perturbation series at large orders in quantum field theories.
Dr. P. McGILL (NUU & DIAS):	The stochastic calculus.

Short talks:

Dr. A. I. SOLOMON (Open Univ. & DIAS):	Order parameters: A Lie- algebraic approach.
Dr. S. VERNON (UCC):	Commutativity in rings.
Dr. P. BOLAND (UCD):	On the probability of k or more successes in n independent trials.
Prof. P. M. QUINLAN (UCC):	The edge function method in underground fracture problems.
Dr. D. HEFFERNAN (DIAS):	Bistability.
Dr. C. NASH (St. Patrick's Coll., Maynooth):	K-theory and gauge fields over the hyper-torus.
Dr. P. DOLAN (Imperial Coll.):	Curvature in quantum theory.

DECEMBER:

Review Lectures:

Prof. D. McQUILLAN (UCD):	Analysis and commutative algebra.
Prof. F. HOLLAND (UCC):	The X-ray transform.

Lectures:

Dr. W. SULLIVAN (UCD & DIAS):	Positive matrices, spectral gaps, and the Pulè-Buffet boson random walk.
Dr. P. HOGAN (UCD & DIAS):	The fibre-bundle approach to gauge theory.
Dr. P. BOLAND (UCD):	A biographical glimpse of W. S. Gossett (alias 'Student' of the t-distribution).
Prof. J. FLAVIN (UCG):	A class of isoperimetric inequalities in mathematical physics.

Short talks:

Dr. J. McDERMOTT (UCG):	Infinite semi-regular trees.
Dr. A. I. SOLOMON (Open Univ. & DIAS):	Coexisting phases - an algebraic approach.
Mr. T. COX (UCC):	Resonant oscillations in gas tubes.
Prof. S. TOBIN (UCG):	The Burnside varieties.
Dr. G. PRINCE (DIAS):	A modern approach to projective differential geometry.
Dr. P. McGILL (NUU & DIAS):	The heat equation on a Riemann surface.
Dr. M. O'REILLY (Rhodes Univ., Grahamstown, S.A. & DIAS):	Modular representation algebra.

7 EUROPEAN MOLECULAR LIQUIDS GROUP CONFERENCE

The First Conference of the European Molecular Liquids Group, on Analytical and Computational Studies of Basic Problems in Molecular Liquids, was held at DIAS on 19-21 April, inclusive. The attendance was thirty-two, and there were eight 45-minute invited lectures, a poster session and a panel session. The invited lectures were as follows:

Prof. A. BELLEMANS (Brussels):	Computer simulation of molecular liquids.
Prof. S. BRATOS (Paris);	Infra-red and Raman band shapes of pure van der Waals liquids.
Dr. J. H. R. CLARKE (UMIST, Manchester):	Computer simulation studies of stress relaxation in molecular liquids.
Prof. A. GERSCHEL (ORSAY):	Characters of local dynamics and local structure inferred from far infra-red spectroscopy.
Prof. F. HUFNAGEL (J. Guthenberg Univ., Mainz):	Full band spectroscopy on encaged molecules in amorphous solids.
Prof. J. T. LEWIS (DIAS):	A survey of some results on random evolutions.

Prof. B. K. P. SCAIFE (TCD & DIAS):	A pedestrian approach to the dynamics of molecular liquids.
Prof. N. J. TRAPPENIERS (Amsterdam):	The study of self-diffusion in liquids by means of NMR.

8 DUBLIN SUMMER SCHOOL IN PHYSICS

The First Dublin Summer School in Physics, organised by the School of Theoretical Physics in association with Trinity College, Dublin and University College, Dublin, was held at DIAS from 28 June to 9 July, inclusive. The subject of the school was 'Laser physics and its applications', the attendance was forty-five and there were eight courses of lectures, as well as informal workshops, discussions and visits. The courses were as follows:

Dr. M. AVIGNON (CNRS, Grenoble):	Elementary excitations in solids.
Prof. D. J. BRADLEY (TCD & DIAS):	Optical electronics.
Dr. D. D. BURGESS (Imperial Coll., London):	Radiation processes in gases and plasmas.
Dr. D. HEFFERNAN (DIAS):	Physics of semiconductor lasers.
Prof. B. HENDERSON (TCD):	Colour centre lasers / Energy transfer.
Prof. G. F. IMBUSCH (UCG):	Solid state spectroscopy.
Dr. A. MILLER (RSRE, Malvern):	Non-linear optical effects in semiconductors.
Dr. C. NASH (St. Patrick's Coll., Maynooth):	Introduction to quantum optics.

9 VISITORS

For lectures given by visitors see sections 4, 5, 6, 7, 8.

As in previous years, visitors, mainly from abroad, came to the School for long or short 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 five days) were made by

D. Ó Mathúna (Dept. Transportation, USA), 2-6 January.

D. Pottinger (Glasgow), 5-7 January.

M. van den Berg (Groningen), 28 January - 2 February.

O. Penrose (Open Univ.), 24-27 February.

R. MacCallum (QMC, London), 7-8 April.

E. Weinberg (Columbia Univ. & Cambridge), 8-9 June.

W. Thirring (Vienna), 17-21 June.

R. F. O'Connell (Louisiana State, Baton Rouge), 22-25 June.

O. Bratteli (Trondheim & Warwick), 12-16 July.

F. Holland (UCC) 20-21 December.

R. C. Geary (ESRI), 21 December.

Longer visits (8 days to 4 months) were made by

R. Fulton (Florida State, Tallahassee), 1 December 1981 - 31 January 1982.

D. E. Evans (Warwick), 29 December 1981 - 10 January 1982, and 19 April - 6 May.

G. Parravicini (Milan), 30 December 1981 - 6 January 1982.

M. Lunn (St. Hugh's Coll., Oxford), 11 January - 22 March, and 27 September - 8 October.

P. de Smedt (Leuven), 1 February - 22 March, and 27 September - 8 October.

J. Tafel (Warsaw), 24 - 31 May.

M. O'Reilly (Rhodes Univ., Grahamstown, S.A.). 16 August - 22 December.

A. Wipf (Zurich), 27 August - 24 September.

G. Cicuta (Milan), 8-15 September.

P. Garbaczewski (Wroclaw), 13 October - 4 November.

E. Kluk (Slaski Univ., Katowice) 26 October - 19 November.

D. G. Frood (Lakehead Univ., Ont.) 10-30 December.

A. Nakazawa (Kyoto), 10 December 1982 - 27 January 1983.

Visits in connection with the EMLG Conference (see section 7) and the Dublin Summer School in Physics (see section 8) were made by

(19-21 April) A. Bellemans (Brussels), S. Bratos (Paris), J. H. R. Clarke (Manchester), A. Gerschel (Orsay), F. Hufnagel (Mainz), and N. J. Trappeniers (Amsterdam).

and (28 June - 9 July) M. Avignon (Grenoble), D. D. Burgess (Imperial Coll., London), B. Henderson (TCD), G. F. Imbusch (UCG), A. Miller (RSRE, Malvern).

Visit of Research Associate:

A. I. Solomon, 5 May - 4 June.

10 ACTIVITIES ABROAD

Professor McConnell attended the Meeting of the Dielectric Society at Cambridge, 30 March - 1 April, on 'Dielectric Properties of Molecular Liquids and Biological Systems', and in April visited the Culham Laboratory for discussions on nuclear fusion research; in May he visited the Univ. of Salford and UMIST (Manchester) for discussions of experiments on molecular liquids. He spent June and July in Canada, using an International Scientific Award from the National Science and Engineering Council of Canada to visit, for discussions with staff members on collision induced absorption, dielectric absorption in liquids and solids, and nuclear magnetic processes, the following: Laval Univ. (Quebec), National Research Council (Ottawa), Univ. of Toronto, Univ. of Guelph, Lakehead Univ. (Thunder Bay), Univ. of Manitoba (Winnipeg), and the Univ. of Alberta (Edmonton). He attended the Gordon Research Conference on Dielectric Phenomena, Plymouth (New Hampshire), from 2-6 August. In October he visited the National Physical Laboratory, Teddington, for discussions on dielectric absorption experiments and the Univ. of Pavia for discussions on dielectric experiments, and attended the Meeting of the Gruppo Nazionale di Struttura della Materia on 'Optical Spectroscopy and Dielectric Phenomena', at Cortona, from 20-22 October.

Professor Lewis visited the Math. Inst., Univ. of Warwick, for collaboration with Dr. D. E. Evans from 8-12 March, and attended the Workshop on Stochastic Differential Equations at Cambridge, 22-26 March. He visited Univ. Leuven, 10-15 May, and Univ. Oxford, 18-19 May, for boson collaboration; he attended the Meeting of the Advisory Board of the Math. Inst., Warwick, 20-21 May, and the Many Body Theory Meeting, London, 21 May. He attended the Statistical Mechanics Workshop at Trento, 4-10 June, and lectured to staff of the Math. Dept. Heriot-Watt Univ., Edinburgh, 14-26 June. From 26-31 August he attended the 25th Pugwash Conference, on Science and World Affairs, at Warsaw, and from 6-11 September he attended the Quantum Probability Conference, in Rome. He visited the University of Michigan from 20-22 September for collaboration with Prof. G. W. Ford, and attended the Executive Committee

Meeting of the IAMP (International Association of Mathematical Physics) at Princeton, 24 September. He visited the Rijksunivs. Groningen from 7-13 October for a Doctoral Examination (H. Maassen), and for collaboration with Prof. N. N. Hugenholtz, and attended the Statistical Mechanics One-Day Conference at the Open Univ., on 10 December.

Professor Ciulli visited CERN (for discussions) and the Univ. of Birmingham in July. With Drs. Murphy and Garavaglia he attended the 21st International Conference on High Energy Physics, at Paris, 25-31 July.

Prof. van den Berg visited the Univ. of Heidelberg from 1-10 December, for discussions with Dr. J. L. van Hemmen, and the Univs. of Groningen and Delft from 13-17 December.

Dr. Singh attended the S.I.N. Spring School (Zuoz, Switzerland), 14-21 March.

Dr. Murphy attended the 3rd UK Theory Institute (High Energy Physics), at St. Andrews, 21 August - 11 September.

Drs. Burzlaff, Fujimoto, and Tchrakian attended the Annual Rochester High Energy Physics Meeting, 15-17 December.

Dr. Burzlaff visited the Max-Planck-Institut, Munich, 20-23 December, for discussions.

Dr. Tchrakian visited Univ Köln, Univ. Kaiserslautern, and the Max-Planck-Institut, Munich, in June and July for discussions and to give seminars.

Dr. Prince attended the Meeting of the Mathematical Physics Group of the Institute of Physics, at the Open Univ., on 'Geometry and Physics', on 19 November.

Mr. Lenoach attended the British Theoretical Mechanics Colloquium, in London 29 March - 2 April.

Dr. McCrea visited Queen Elizabeth Coll., London and the Univ. of Southampton in November.

Dr. Goldsmith visited the Math. Inst. Oxford in May under the European Science Exchange Scheme, to learn about mathematical modelling in biology, and the Math. Dept. of Univ. of Essen from 18 November - 5 December, for collaborative work with Prof. Göbel on Abelian groups.

Dr. Solomon visited City College, New York, 18-25 January, for collaboration with Prof. J. Birman, and attended the Rencontre II - Stat. Phys. Meeting, in Paris, 28-29 January. He attended the Many Body Theory Meeting, in London 21 May, the Conference on Differential

Geometric Methods, Jerusalem 5-11 August, and the XIth International Group Theory Colloquium, Istanbul, 23-28 August. On 11 October he visited the Queen Mary Coll., London.

Seminars and Courses Given Abroad:

Professor McCONNELL:

Seminar on Rotational Brownian motion and physico-chemical processes, given at Lakehead, and Edmonton.

Seminar on Brownian motion and dielectric absorption, given at Laval, N.R.C., and Guelph.

Lecture on theory of dielectric relaxation, given at Cortona Meeting.

Professor LEWIS:

Univ. of Warwick, Seminar: The Ising phase transition and the Atiyah-Singer index.

Univ. of Cambridge, Workshop, Two lectures: Probability and statistical mechanics.

Univ. Leuven, Seminar: The quantum Langevin equation.

London Meeting, Lecture: The van der Waals limit for boson systems.

Trento Meeting, Survey Lecture: Rigorous results on boson condensation.

Heriot-Watt Univ., Course of Sixteen lectures: Statistical mechanics.

Rome Conference, Lecture: The quantum Langevin equation.

Open Univ. Conference, Lecture: Generalized condensation in boson systems.

Professor CIULLI:

Birmingham, Seminar: Some functional techniques which might be useful in extracting information from ill-converging perturbative series.

Professor van den BERG:

Seminar on Condensation in the free boson gas and the spectrum of the Laplacian, given at Heidelberg, Groningen, and Delft..

Dr. TCHRAKIAN:

Seminar on Dimensional reduction of 6-dimensional theory, given at Köln, Kaiserslautern, and the Max-Planck-Institut, Munich.

Seminar on Three-dimensional theory with torsion, given at Kaiserslautern.

Dr. McCREA:

London, Seminar: The gravitational field of a rotating, infinite cylindrical shell.

Southampton, Seminar: Cylindrically symmetric solutions of the quadratic Poincaré gauge field theories.

Dr. GOLDSMITH:

Essen, Three lectures: Endomorphism algebras of modules.

Dr. SOLOMON:

Paris Conference, Lecture: Group theoretical analysis of the BCS-CDW coexistence problem.

Jerusalem Conference, Lecture: A geometric approach to order parameters.

Istanbul Colloquium, Lecture: Dynamical group approach to coexisting phases.

London, Seminar: Dynamical group approach to coexisting phases.

11 PUBLICATIONS

Contributions to periodical and other publications:

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

J. R. McConnell:

* Stochastic differential equation study of nuclear magnetic relaxation by spin-rotational interactions. Physica 111A (1982), 85-113.

* Nuclear magnetic spin-rotational relaxation times for symmetric molecules. Physica 112A (1982), 479-487.

* Nuclear magnetic spin-rotational relaxation times for linear molecules. Physica 112A (1982), 488-504.

L. Accardi, A. Frigerio & J. T. Lewis:

* Quantum stochastic processes. Publns. RIMS Kyoto Univ. 18 (1982), 97-133.

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

* On generalized condensation in the free boson gas. Physica 110A (1982), 550-564.

M. van den Berg:

On boson condensation into an infinite number of low-lying levels. J. math. Phys. 23 (1982), 1159-1161.

L. O'Raifeartaigh:

Summary talk, Monopoles in quantum field theory. Proc. Monopole Meeting, Trieste 1981, Ed. N. S. Craigie et. al., World. Sci., 1982, pp. 417-423.

Cosmology and unified gauge theory (Invited Review). Ir. Astron. J. 15 (1981). Proc. Meeting RAS, Dublin 1982, pp. 130-137.

L. O'Raifeartaigh, S. Rouhani & L. P. Singh:

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* Analytic continuation from data points with unequal errors. J. Math. Phys. 23 (1982), 1752-1764.

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D. Heffernan & R. L. Liboff:

* Review of fundamental processes for matter-radiation interaction. J. quant. Spectrosc. radiat. Transfer 27 (1982), 55-77.

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* A stationary cylindrically symmetric electrovac space-time. J. Phys. A: Math. Gen 15 (1982), 1587.

S. R. Jordan & J. D. McCrea:

* The gravitational field of a rotating infinite cycindrical shell. J. Phys. A: Math. Gen 15 (1982), 1807-1814.

P. A. Hogan:

* An embedding of some Stiefel bundles. J. math. Phys. 23 (1982), 2472-2474.

J. M. Golden:

* Approximate analytic treatment of the problem of a moving ellipsoidal punch on a viscoelastic half-space. Q. Jl. Mech. appl. Math. 35 (1982), 155-171.

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

  Dynamical group model of the CDW state. Phys. Lett. 88A (1982), 413-416.

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K. McFarlane:

* Appearance of a relativistically rotating disk. Int. J. theor. Phys. 20 (1981), 397-409.

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J. R. McConnell:

Nuclear magnetic relaxation by quadrupole interactions in non-spherical molecules. Physica A.

Y. Fujimoto, L. O'Raifeartaigh & G. Parravicini:

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L. O'Raifeartaigh & S. Rouhani:

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L. O'Raifeartaigh & T. Murphy:

A note on supersymmetry in 1+1 dimensions. Nuclear Phys. B.

T. Murphy:

Two-loop β functions for scalar fields. Nuclear Phys. B.

M. van den Berg:

On condensation in the free boson gas and the spectrum of the Laplacian. J. statist. Phys.

E. Buffet & J. V. Pulè:

Fluctuation properties of the imperfect Bose gas. J. math. Phys.

L. Papiez:

Stochastic formulation of Feynman path integrals from the least action point of view. J. math. Phys.

M. Lunn:

Integral functions of the Bose gas. LMP.

S. Ciulli & T. D. Spearman:

Search for physical structures on the boundary by optimal analytic continuation from a finite set of interior data points. Phys. Rev. D.

D. H. Tchrakian:

Some geometrical models with torsion for monopole-like solutions. Acta phys. Austriaca.

T. Garavaglia:

Polarized electron scattering on spin zero and polarized spin ½ targets. Int. J. theor. Phys.

W. G. Sullivan & P. Vanheuverzwijn:

On the canonical Gibbs states associated with certain Markov chains. Z. Wahrscheinlichkeitstheorie verw. Gebiete.

B. Lenoach:

Averaging methods for scalar wave propagation. J. Phys. A: Math. Gen.

P. S. Florides:

Generalized Robertson-Walker metrics and some of their properties. Phys. Lett. A.

The complete field of charged perfect fluid spheres and of other static spherically symmetric charged distributions. J. Phys. A: Math. Gen.

P. A. Hogan:

Some solutions of the Yang-Mills equations generalizing the Wu-Yang monopole. J. math. Phys.

Some Yang-Mills fields constructed from Maxwell fields. J. math. Phys.

J. D. McCrea:

Static vacuum, cylindrical and plane symmetric solutions of the quadratic Poincaré gauge field equations. J. Phys. A: Math. Gen.

G. Prince:

Reflections on the symmetry-conservation law duality and the Runge-Lenz vector. J. Phys. A: Math. Gen.

R. Dodd & A. Fordy:

The prolongation structure of quasi-polynomial flows. Proc. Roy. Soc. A.

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

Induced decay of positronium and grasers. Int. J. theor. Phys.

D. M. Heffernan:

Single-parameter characterization of bistability in double contact injection lasers. Phys. Lett. A

B. Goldsmith:

Essentially indecomposable modules over a complete discrete valuation ring. Rend. Sem. Mat. Univ. Padova.

A. I. Solomon:

Order parameters for broken Abelian symmetries. Ann. N.Y. Acad. Sci.

Dynamical groups and coexistence phenomena. Proc. XI Inter. Coll. on Group Theor. Methods in Phys., Istanbul 1982.

K. McFarlane & K. -K. Wan:

Quantization and meaning of observables linear in momentum. Int. J. theor. Phys.

12 LIBRARY

Approximately 330 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 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.

Professor Synge donated his working notebooks, dating from 1924 up to the present, to the Library. There are some two hundred books in the set - an archive of quite exceptional value.

Other gifts of books and journals, in addition to material received under exchange arrangements, were received from: Professor McConnell, Professor O'Raifeartaigh, Mr. R. Anderson (Dublin), Dr. L. Castell (Starnberg), Professor H. Ezawa (Tokyo). Dr. J. Hrbek (Prague), Dr. E. A. Robinson (Lincoln, MA),

Professor W. Thirring (Vienna), NBST, NEB, French Government, Consel. Nac. Desenvolv. Cien. e Tec. Brasil, CNRS (Luminy-Marseille), Johns Hopkins University, Higher School Kharkov, Gulbenkian Inst. (Lisbon), ICTP (Trieste), Math. Centrum (Amsterdam), Slovak Academy of Sciences (Prague), Tokyo INS, University of Warsaw. Mr. B. Clancy donated an early draft of 'What is Life?' (E. Schrödinger), annotated by the author.

IV - Annual Report of the Governing Board of the School of Cosmic Physics for the year 1982 adopted at its meeting on 30 September 1983.

A ASTRONOMY SECTION

1 STAFF AND SCHOLARS

Senior Professor:

P. A. Wayman

Professor:

T. Kiang

Research Assistant:

I. Elliott

Experimental Officer:

B. D. Jordon

Technical and Clerical Staff:

A. M. Callanan, W. M. Dumpleton, P. Duane (from 1 December), G. McMorrow (to 7 May), P. Murphy (to 1 October)

Scholars:

F. H. Cheng (to 31 May), H. Deasy (from 4 January).

P. A. Wayman served as General Secretary of the International Astronomical Union until 27 August 1982 and continued as Adviser to the IAU Executive Committee. He was absent from Dublin on IAU business on about 85 days during the year, including duties at the 18th General Assembly of the IAU in Patras, Greece, 14-26 August.

Y. Y. Zhou (Hefei, China) was appointed as a Visiting Professor from 1 March to 31 May and J. Sullivan (Boston) was a visiting student from 28 June to 30 November.

I. Elliott became President of the Junior Astronomical Society of Ireland (within the Irish Astronomical Society) during the year.

2 RESEARCH WORK

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

In a paper published in 'Astronomy and Astrophysics' M. J. Stift indicated his conviction, described in general in the Report for 1981, that the period-luminosity-colour relationship for cepheid variables is beset by uncertainties that render comparisons from separate data sets relatively meaningless. Written in a provocative style, his assertions have resulted in comment from several viewpoints and there is continuing demand for accurate photometric results on cepheid variables. Among the implications of Stift's work is uncertainty in the derived Magellanic Cloud distance modulus and hence the extragalactic distance scale. The form of the publication of the photometric results for cepheids in the Large Magellanic Cloud (LMC I) has been slightly modified and the data have been examined in the context of quantitative results concerning influence of chemical abundance estimates. A joint paper (Wayman, Stift and Butler) communicated to Astronomy and Astrophysics in December, completes the publication of observations carried out by Butler in 1966/67, covering 320 cepheid variables in all.

It was possible during the year to combine the Dunsink results for 115 stars with data published by the South African Astronomical Observatory, derived from observations made 1974-75, in order to produce information on variation in observed pulsation period. New accurate periods were derived which, taking into account estimates of accuracy, often differed significantly from periods given in earlier Harvard results. The rates of fractional period change per day (10^{-10} to 10^{-6} d^{-1}) were comparable with estimates predicted by stellar evolutionary theory but, with the possibility of evaluating rate of change of period for two epochs, c.1955 and 1970, these rates were found to be significantly non-constant in as many as 50% of those cases where a significant rate of change was measured. It is clear that effects other than evolution of the underlying stellar body can be operating. A possible cause is the light-time effect in a binary system; however, since there is a marked correlation with period length, longer period variables being more prone to instability in period, it is more likely that an instability exists in the mechanism of pulsation, possibly dependent on presence or absence of convection at a certain level in the stellar atmosphere.

Photometry of clusters of galaxies: H. P. Murphy.

Work on clusters of galaxies using CCD observations at the F. L. Whipple Observatory, Arizona, described in the Report for 1981, is the basis of a thesis for the Ph.D. degree completed by H. P. Murphy in October. The optical properties of clusters of galaxies are investigated in the context of the X-ray properties. The brightest member galaxies in 35 rich Abell clusters were observed and analysed resulting in a possible relation with X-ray luminosity. Detailed observations

in two colours of the X-ray emitting regions at different evolutionary stages indicate general agreement with a proposed new classification scheme but some discrepancies merit further detailed observations (e.g. for Abell 85 and Abell 262).

Observations of galaxies in cosmology: T. Kiang, Y. Y. Zhou, and F. H. Cheng.

The correlation was examined between on one hand the intensity and line-width of H β and the forbidden O III spectrum lines at wavelength 500.7 nm in the spectra of Type I Seyfert galaxies and on the other hand a generalized colour-measure combining the three optical wavebands U.B.V. An optimum measure of radiation beyond the Lyman limit using features of the visible spectrum was derived.

The review of q_o -determination prepared in 1981 was published during the year. The topic of luminosity-classifiers for quasers was pursued further in respect of Baldwin's discovery of an empirical correlation between the luminosity of a radio-loud quasar and the equivalent width of its emission lines. Such a relation was sought among the larger set of optically-selected, radio-quiet quasars. It was found, by dividing the dark set according to optical spectral index, that there is strong evidence that Baldwin's relation is indeed present in the optically-selected data, and that it is a similar relation to that established for the radio quasars.

Asteroid Dynamics: T. Kiang.

A new approach to the question of orbital stability of asteroids in near-resonant motion with Jupiter has been explored. Using the fully rigorous form of the perturbing function for the three-body model, and taking into account fully the variations in the fast-varying angles (e.g. mean anomaly), it has been possible to derive the appropriate second-order differential equation governing the behaviour of the variation in the semi-major axis. Other studies have a truncated perturbing function and ignore the concomitant variation in the fast-varying angles. The proposed scheme is particularly suited to examination of stability against the effect of a resisting medium, and for understanding the effect of Jupiter's orbital eccentricity or orbital inclination on asteroid orbital stability, or that of Saturn in 2:5 resonant motion with Jupiter.

3 ELECTRONICS LABORATORY AND WORKSHOP: B. D. Jordon, P. Murphy, P. Duane.

The electronics for the co-ordinate measuring machine and video digitizer was completed during the year. A CAMAC power supply was constructed for the CAMAC crate and installed with the Nova 2/10, system B. Two data acquisition modules were designed and built to CAMAC specifications; also a module incorporating a synchronising

pulse generator to provide control of the TV camera, video digitizer and display monitor was completed. This device includes a TV pattern generator for diagnostic purposes and a generator of a cross-wire pattern for the monitor.

Development of a CCD camera, jointly with the Physics Department UCD, has reached the stage of the CCD being connected to an LSI 11 computer which was purchased and adapted with suitable interfaces. The construction of the dewar for the CCD was completed at UCD and the CCD electronics was designed and built in UCD.

Following the retirement of Mr. P. Murphy after 35 years' service as Technician, Mr. Paul Duane was appointed and he has commenced overhaul of the principal items of workshop equipment.

4 COMPUTER INSTALLATION: I. Elliot, J. Sullivan.

The Nova 2/10 System A was used satisfactorily for general computing during the year and the similar System B was adapted to the work of the Coradograph measuring instrument via a CAMAC interface. The Apple II was equipped for word-processing in the general office and has been in constant use. Consideration has been given to the possible introduction of a Starlink terminal in co-operation with the Computer Department of University College, Dublin.

5. INTERNATIONAL ASTRONOMICAL UNION

P. A. Wayman attended the 18th General Assembly of the IAU in Patras, Greece, 14-26 August; I. Elliott was Official Representative of Ireland and Irish representative on the Finance Committee; T. Kiang also attended the Assembly. Miss A. M. Callanan assisted the IAU Secretariat in Patras. Professor Wayman, as General Secretary 1979-1982, had the major responsibility for the scientific and administrative programme. He was responsible for the work of the IAU Secretariat in Paris up to 3 September.

In addition to the formal sessions of the General Assembly and four days on which the IAU Executive Committee held a meeting there were four invited evening discourses, seven Joint Discussions with 1-day programmes, and some 160 scientific and administrative meetings of Commissions fitted into seven working days. Attendance was 1750 persons, approximately.

The administrative and commission proceedings are published in IAU Transactions Vol. 18B and the discourses and selected scientific papers are reproduced in Highlights of Astronomy, Vol. 6. The work of the Secretariat and the Executive Committee during the years 1979-81 is described in the Report of the Executive Committee, 1979-81, printed in IAU Transactions Vol. 18B and in IAU Information Bulletin No. 48.

The course of the 18th General Assembly at Patras was marred by the

illness and subsequent death in Munich of Prof. M. K. V. Bappu of India, President of the IAU, 1979-82. His place at the Assembly was taken by Vice-Presidents E. K. Kharadze (USSR) and D. S. Heeschen (USA) on different occasions.

The contribution of the Dublin Institute for Advanced Studies to the welfare of the Union was acknowledged in the Report of the Finance Committee to the 18th General Assembly.

6 CONFERENCES, LECTURES, ETC.

The following scientific meetings were attended:

P. A. Wayman: Hipparcos Colloquium, Strasbourg, 22-23 February.
Cospar XXIVth Plenary Meeting, Ottawa 20-30 May.
Workshop on Very Hot Plasmas in Astrophysics, Nice, 8-10 November.

T. Kiang: Royal Society Discussion 'The Big Bang and Element Creation', London 12 March.
IAU Symposium 104. 'Early Evolution in the Universe and its present structure'. Chania, Crete, 30 August - 2 September.

I. Elliott: Summer School in Physics, Dublin, 27 June - 9 July.
IAU Colloquium No. 71 'Activity in Red Dwarf Stars', Catania, 10-15 August.
IAU Colloquium No. 73 'UV and X-ray Spectroscopy of Astrophysical and Laboratory Plasmas', Dublin, 30 August - 1 September.

Two colloquium lectures were arranged in the Astronomy Section:

22 April: C. Sharp (S. Andrews) - Molecular absorption cross-sections.

17 December: J. Wampler (S. Cruz. Univ. of California) - Carbon IV in Spectra of Quasars.

In connection with the invitation to the Royal Astronomical Society from the Astronomical Science Group (Irish Astronomical Society) to hold its Spring Meeting in Dublin in April, there was an Open Evening at Dunsink Observatory on 7 April. A principal guest was the Ambassador of China; Dr. Liam Mulcahy represented the Minister of Education. During the meetings,held at the Royal Irish Academy, the following contributions were made:

P. A. Wayman — Opening Address

" " — Phase Relationships in Cepheid Variables.

T. Kiang A Possible Luminosity Indicator for QSO's

" " Review of determination of q_o

I. Elliott served as Local Organising Committee Treasurer for the Group at the RAS Meeting. Also, at the Maynooth College Workshop of STIP, on 6 August, he represented the Astronomy Section at the Mervyn Ellison Memorial Lecture given by Prof. Sir Granville Beynon, F.R.S.

Other lectures in Ireland were given by P. A. Wayman (Irish Astron. Soc. Lecture Birr, 3 July; RDS Astronomy Week 5 July; RDS Youth Science Week 8 July; Dublin Centre, IAS 18 November) and by I. Elliott (Dublin Centre, IAS 15 February; UCD Astronomical Soc., March; Astron. Science Group Meeting, Maynooth 20 December).

Visiting groups included the Antiquarian Horologists of Ireland, the R.D.S. Youth Science Week students and the Review Committee of the School. Individual visitors included F. W. G. Baker, M. A. Hoskin, G. Crellinsten, M. Rudemann and T. C. Weekes.

7. PUBLICATIONS

Publication Committee of the Irish Astronomical Journal:
(published under the joint auspices of Armagh and Dunsink Observatories)

Chairman:	P. A. Wayman (Dunsink Observatory)
Chief Editor:	M. de Groot (Armagh Observatory)
Managing Editor:	S. Grew (Armagh Observatory)
Technical Editor:	P. B. Byrne (Armagh Observatory)
Associate Editors:	I. Elliott (Dunsink Observatory)
	D. J. Mullan (Delaware, USA)
	E. J. Opik (Armagh Observatory)

Other Editorships:

P. A. Wayman continued as editor of IAU publications up to August 1982 and served on the editorial board of Chinese Astronomy and Astrophysics.

T. Kiang is Chief Translation Editor of Chinese Astronomy and Astrophysics, published by Pergamon Press, Oxford, UK.

Published 1982:

Irish Astronomical Journal Vol. 14, No. 7/8 (Sept/Dec. 1980)
Vol. 15, No. 1 (March 1981)
Vol. 15, No. 2 (Sept. 1981

Chinese Astronomy and Astrophysics Vol. 5, No. 4.
Vol. 6, Nos. 1,2,3,4.

IAU Information Bulletin, Nos. 47, 48.

IAU Transactions, Vol 18A (D. Reidel, 1982) and paper edition "Reports on Astronomy, Patras 1982".

Journals, etc.:

(N.B. The first six entries are mentioned in the Report for 1981)

L. Z. Fang, T. Kiang, F. H. Cheng and F. X. Hu:
"Determination of the Deceleration Parameter q_o"
Quar. Journ. R. Astronomical Society, 23: 363-387, 1982 (Contribution No. 19).

H. P. Murphy, R. Schild and T. C. Weekes:
"CCD Camera Observations of Nearby Rich Clusters - I. R. Photometry of Brightest Galaxies".
Mon. Not. R. Astr. Soc., 202: 1127-1139, 1983 (Reprint No. 114).

T. Kiang:
"Stability of Real Hecuba and Hilda Asteroids", Proc. VIth European Regional Astronomy Meeting, "Sun and Planetary System", eds. W. Fricke and G. Teleki, p.411-412 (D. Reidel, 1982) (Reprint No. 110).

P. A. Wayman:
"Irish Participation in the Spanish International Astrophyical Observatory of the Canary Islands"
Irish Astr. Journ. 14: 243, 1980 (Reprint No. 109).

"Dunsink Observatory, Chinese Astronomy and the IAU"
Irish Astr. Journ. 15: 2, 1981 (Reprint No. 111).

F. H. Cheng:
"The determination of the Deceleration Parameter q_o using quasar data". Irish Astr. Journ. 15: 36, 1981.

M. J. Stift:
"The Cepheid Period-Luminosity-colour Relation A Most unsuitable Distance Indicator", Astronomy and Astrophysics, 112: 149-156, 1982. (Reprint No. 112).

F. H. Cheng:
"The Hubble Diagram of Quasars showing Interplanetary Scintillation" (in Chinese). Acta Astrophys. Sinica. 2: 91-96 1982. (English translation in Chinese Astr. Astrophys. 6: 333-337, 1982.

F. H. Cheng and T. Kiang:
"Determinations of the Cosmological Deceleration Parameter based on Various Quasar Subsets" (in Chinese).
Acta Astron. Sinica 22: 357-363, 1981. (English translation in Chinese Astr. Astrophys. 6: 48-53, 1982).

T. Kiang and F. H. Cheng:
"Posterior Probability of the Deceleration Parameter q_o from Quasars provided with a Luminosity Indicator", Journ. of Astrophysics and Astronomy, 3: 363-378, 1982.

P. A. Wayman, M. J. Stift and C. J. Butler:
"Photometry of Cepheid Variable Stars in the Large Magellanic Cloud". Astron. Astrophys. (in press (Contribution No. 21).

T. Kiang, F. H. Cheng and Y. Y. Zhou:
"On the Baldwin effect in optically-selected quasars", Mon. Not. Roy. Astr. Soc. 203: 25P-29P, 1983.

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

P. A. Wayman:
"Meeting of the Royal Astronomical Society, Dublin, 5-7 April 1982" 15: 93, 1981.
Opening Address, Royal Astr. Soc. Meeting 15: 95, 1981.
"Phase Relationships in Cepheid Variables". 15: 121, 1981.

T. Kiang, F. H. Cheng and Y. Y. Zhou:
"A Possible Luminosity Indicator for QSO's with Flat Optical Spectra". 15: 124, 1981.
"The Correlation between Colour and Line Intensities in Type-1 Seyfert Galaxies", 15: 281, 1982.

P. A. Wayman:
"Dunsink Observatory in 1980", 15: 138, 1981.
"Daniel J. K. O'Connell, S.J. - In Memoriam", 15: 349, 1982.
"Dunsink Observatory in 1981", 15: 331, 1982.

I. Elliott:
"The fastest pulsar", 15: 339, 1982.

Theses, Reviews, etc.

H. P. Murphy:
"A Comparison of Optical and X-ray Properties of Selected Clusters of Galaxies". Theses in candidature for the Ph.D. Degree, University College, Dublin, October 1982.

Julie Sullivan:
"Computer Control of the Dunsink Automatic Measuring Engine", November 1982.

T. Kiang:
Report to IAU Commission 9 (Instruments) on "Instruments in China".
Report to IAU Commission 41 (History of Astronomy) on "Recent Work on Chinese Historical Astronomy".

I. Elliott:
Report to Irish National Committee for Astronomy on the XVIIIth General Assembly of the IAU, Patras, August 1982. (Assistance with): Phase A Feasibility Study for LEST by O. Engvold and M. Hefner, April 1982 and Executive Summary for LEST (Large European Solar Telescope).

P. A. Wayman:
Advisory Board, La Palma Project, Information Sheet No. 5 (November 1982).

8. MISCELLANEOUS

La Palma Project

The 1-m Telescope, located at Royal Greenwich Observatory for final testing, awaits completion of the building at Roque de los Muchachos; the commissioning period is due to start in October/November 1983.

Buildings and Grounds, Dunsink Observatory

A mobile home was purchased as temporary housing for the groundsman and his family pending completion of a new small dwelling. This dwelling will replace the Anemometer House (built c.1844) which was demolished in November, following vacation by P. Murphy, Technician.

The Joyce Sundial

On the initiative of Cliodna Cussen, sculptress, a design has been produced by I. Elliott for a monument to James Joyce to be erected in Sandymount Park Ringsend, Dublin. The monument will incorporate a sundial and a "standing stone" aligned to the rising sun at the winter solstice.

Dublin Centre, Irish Astronomical Society

The members of the Dublin Centre produced, on the premises of Dunsink Observatory, copies of the Centre bi-monthly journal "Orbit". Assistance from Centre members, especially V. Collins and N. Smith with the work of the Dunsink Public Open Nights, held on 15 Saturdays during the year, is acknowledged.

B COSMIC RAY SECTION

1 STAFF AND SCHOLARS

Senior Professor:

C. O'Ceallaigh

Professor:

Vacant

Assistant Professors:

D. O'Sullivan and A. Thompson

Research Assistant:

Vacant

Experimental Officer:

J. Daly

Technical and Clerical Staff:

Mrs. E. Clifton, Mrs. E. Rankin-Brady (temporary part-time as required), Mrs. H. Sullivan, Mrs. A. Grace-Casey, Miss G. Broderick, Miss A. Larkin, Miss E. Ryan, Miss S. Ledwidge.

2 RESEARCH WORK

(a) The Long duration Exposure Facility (LDEF) Mission

Work on the preparation and testing of the flight hardware for the LDEF Ultra Heavy Cosmic Ray Experiment (UHCRE), which is a joint undertaking of the Dublin Institute for Advanced Studies (DIAS) and the European Space Research and Technology Centre (ESTEC), continued during the year. Following the experience of the first Space Shuttle orbital test flight in 1981, The National Aeronautics and Space Administration (NASA) established new flight acceptance requirements for LDEF hardware, replacing the existing vibration test procedures, which the UHCRE had successfully undergone, with significantly increased vibration test requirements. Consequently, a new programme of vibration testing was required, sinusoidal and random in three axes, incorporating greater acceleration values. The UHCRE successfully underwent all the new tests for one axis in October and it is planned to carry out the tests for the other two axes in February 1983.

The overall LDEF thermal analysis was finally completed at the Langley Research Center in September. NASA has now accepted, in toto,

the DIAS-ESTEC thermal design for the UHCRE. In particular, NASA has now agreed to the use of the controversial 125 μm silver-teflon outer thermal covers by the DIAS-ESTEC group. The fabrication and integration of the UHCRE outer thermal covers is now scheduled for the first half of 1983.

It was agreed that the slippage in the LDEF launch date should be exploited by replacing some of the UHCRE detector stacks in order to utilise some track detector developments which have occurred since these stacks were sealed in their respective pressure vessels. In particular, the replacement stacks will incorporate new types of doped allyl diglycol carbonate polymer (CR-39) recently developed by the DIAS Cosmic Ray Section and a new polycarbonate detector recently discovered by DIAS. The improved detector polymers represent several years intensive work in detector development by the DIAS group. Replacement of selected detector stacks is scheduled for the first half of 1983. The work will include new environmental testing of the relevant pressure vessels.

During the year the world's first beams of energetic ultra heavy ions were produced at the Lawrence Berkeley Laboratory (LBL) in California using an upgraded version of the billion electron volt heavy ion accelerator (the BEVALAC). Consequently, it will be possible to calibrate the UHCRE hardware with ultra heavy ions before the LDEF launch, greatly enhancing the scientific value of the experiment. The slippage in the LDEF launch date has thus yielded a major scientific benefit for the UHCRE. The group has established the necessary procedures for the hardware calibration and negotiated with the Lawrence Berkeley Laboratory for the provision of BEVELAC facilities. It is planned to carry out this work in May or June 1983.

The current schedule specifies the delivery of the complete set of UHCRE hardware to the Kennedy Space Center, Florida by 1 August 1983 and the launch of the LDEF on 13 April 1984.

Following recommendations by the Space Science Board of the United States National Academy of Sciences and by the United States Cosmic Ray Program Working Group, NASA has decided to consider a second LDEF mission dedicated entirely to ultra heavy cosmic ray research. The LDEF-2 mission would have a high inclination orbit and a two year exposure time. The central design features of the LDEF-2 experiment hardware would be dominated by the registration temperature effect and by a new polycarbonate detector which were both discovered recently by A. Thompson and D. O'Sullivan.

(b) Giotto Mission

Work on the Energetic Particle Experiment (code named EPONA) for the European Space Agency's Giotto Mission to Halley's comet proceeded very rapidly during the year. In January, the European Space Agency accepted a design for a significantly upgraded version of the EPONA experiment which had been proposed by the EPONA team. The new design yields much higher temporal and spatial resolution together with an extended range of energies in return for a small increase in mass and power requirements.

The experiment now consists of three identical very small semiconductor telescopes, each with two totally depleted silicon surface barrier detector elements. Two telescopes are mounted side by side at 45°, the third one at 135° from the relative velocity vector. This allows observations of field-aligned particle streaming for all inclinations of the magnetic field vector, in other words, together with the spacecraft spin, this allows 3-dimensional viewing of particle pitch angle distributions. Of the two telescopes mounted side by side one is covered by a thin foil, while the other is open. Low energy protons cannot penetrate the foil, therefore the covered telescope measures electrons only, while the open telescope measures protons and electrons.

The EPONA instrument will now measure particles in sixteen sectors with 0.5 seconds time resolution over twelve energy channels extending down to 15 keV. The low energy limit of 15 keV is essentially determined by detector noise. The energy of an incoming particle is calculated by measuring its energy loss in the silicon detectors in various threshold logic combinations, while particles of different species and energy ranges are identified using the dE/dX versus E technique.

Other improvements in the EPONA experiment during the year included a new thermal design to reduce the detector temperatures during the Giotto spacecraft's nearest approach to the Sun and the provision of ten different operating modes for the instrument which will be under ground control from the European Space Operations Centre (ESOC) at Darmstadt.

The primary purpose of the EPONA experiment remains the detection of particles which are accelerated in the cometary environment from solar wind energies (≈ 1 keV). Intensity, spectral and angular information with 0.5 second time resolution will be provided via real time telemetry during the encounter with Comet Halley. During the cruise phase of the mission, 0.5 hour average flux measurements in each energy channel with limited sectorisation will be stored in an internal experiment 64 kbit random access memory (RAM), which will be dumped to a ground station at approximately weekly intervals.

D. O'Sullivan and A. Thompson spent several short working periods at ESTEC and at the Max-Planck-Institut für Aeronomie (MPAe) during the year in furtherance of the EPONA experiment. These visits included the EPONA conceptual Design Review Meeting, an EPONA/Spacecraft Interface Meeting, an EPONA Ground Support/Data Analysis Meeting and Giotto Science Working Team Meetings. Financial support for the experiment from the National Board for Science and Technology (NBST) continued during the year.

The EPONA instrument is now a very sophisticated particle telescope in terms of its scientific return per unit mass. Interest has been expressed in the possibility of using the EPONA "flight spare" unit in a baseline mission for the International Solar Polar Mission (ISPM). One possibility is a Russian spacecraft in an elliptic Earth orbit (about 40 Earth radii at apogee) in the ecliptic plane launched in conjunction with the European Space Agency.

(c) Cosmic Ray Iron Group Spectra

Collaboration between DIAS (A. Thompson and D. O'Sullivan) and the Naval Research Laboratory, Washington D.C. (J. H. Adams and B. Stiller) on an experiment to study the iron peak during solar maximum (the ISIS project) continued during the year. However, the second stage of this work, which involves extensive local calbration of the CR-39 component of the detector stacks (43 square metres of 500 μm detector foils) with energetic Iron ions, was considerably delayed by technical problems at the BEVALAC, followed by the BEVALAC one year close-down (beginning in June 1981) for machine rebuilding and upgrading to produce ultra heavy ions. The calibration was eventually carried out with complete success in August of this year. The experimental requirements for the local calibration in this project were particularly difficult and tedious since each cosmic ray nucleus had to be matched in direction and energy with Iron ions from the BEVALAC.

Collaboration with the Air Force Geophysical Laboratory (AFGL), Massachusetts, on very low energy ion peak studies continued. Most of the experimental work derived from the Fairbanks, Alaska balloon flight has been completed and final analysis is in progress.

In February a new collaboration was established with the Universidad Autonoma de Barcelona (A. Vidal-Quadras and colleagues) to carry out a high resolution study of relativistic cosmic ray nuclei in the Iron peak region. The study is based on the exposure of a CR-39 type solid state nuclear track detector array by means of a high altitude balloon flight over the Mediterranean. The hardware was assembled in Barcelona and J. Daly worked there for a period during the year building equipment. The flight, which was completely successful, was launched during July in Sicily and terminated over Spain. The experiment package was recovered undamaged. Flight operations were financed by the Spanish National Commission for Space Research (CONIE). Scanning and track measurement are now in progress.

(d) Solid State Nuclear Track Detector Development

The programme of track detector development and response studies continued as a major component of the Cosmic Ray Section's research activity.

During August a number of track detector stacks (polycarbonate and several types of CR-39) were exposed to Iron beams at the LBL BEVALAC using a temperature controlled pressure vessel in an experiment designed to extend the present data on the registration temperature effect into the region between -100°C and -200°C. In addition this experiment will provide limits for possible hysteresis in the registration temperature effect. Scanning, track measurement and data analysis are now in progress. This experiment is a collaboration between DIAS (D. O'Sullivan and A. Thompson) and the Naval Research Laboratory (J. H. Adams and L. P. Beahm).

Detector evaluation studies are being carried out with new varieties of CR-39 developed by the Cosmic Ray Section during the year. Detector stacks incorporating the new materials were exposed to stopping Iron beams at the LBL BEVALAC in August and track analysis is currently in progress. The most uniform CR-39 detector response to date was observed in samples doped with dinonyl phthalate (DNP) and using diisopropyl peroxidicarbonate (IPP) as an initiator.

During the year the world's first ultra heavy ion beams were produced at the upgraded LBL BEVALAC. This is a development of very great importance for the field of track response studies (and, indeed, for cosmic ray physics in general) as it is now possible to investigate experimentally the theories of detector response to ultra heavy nuclei, in particular the extrapolation from slow Iron (cosmic ray peak) to fast ultra heavy ions (e.g. relativistic Uranium). Between September and December, the DIAS group obtained sets of exposures of track detector stacks to several ultra heavy ion beams; 1009 MeV/N Gold (DIAS alone), 960 MeV/N Uranium (jointly with the University of Bristol) and 995 MeV/N Uranium (jointly with AFGL). Preliminary etching and track measurements are being carried out at present.

It should be emphasised that the discoveries of the Cosmic Ray Section in the field of detector response studies, in particular the temperature registration effect, have become critical issues in the design of future cosmic ray experiments, especially for long duration exposures in spacecraft, but also for balloon borne experiments. In fact, several balloon borne experiments have already been designed and built around the central requirement of the registration temperature effect in order to yield greatly improved resolution.

3. WORKSHOP

J. Daly continued work on the experiment hardware for the LDEF mission and on hardware for high altitude balloon and heavy ion accelerator exposures. He also continued the maintenance and development of equipment and facilities in the laboratories during the year.

4. EXTERNAL ACTIVITIES

During the year short working visits in furtherance of the LDEF programme and Giotto experiment were made by members of the staff as follows:

ESTEC, NETHERLANDS (24-26 January)	A. Thompson and D. O'Sullivan
MPAe, Germany (15-22 April)	" "
ESTEC, Netherlands (12-14 August)	" "
MPAe, Germany (18-19 October)	" "
ESTEC, Netherlands (14-16 December)	" "

D. O'Sullivan attended the XVIIIth General Assembly of the International Astronomical Union at Patras, Greece in August.

As a member of the Space Science Standing Committee of the European Science Foundation, C. Ó Ceallaigh attended a meeting in Paris (3-4 May).

C. Ó Ceallaigh contributed a presentation to the International Colloquium on the History of Particle Physics (Paris, 21-23 July).

A. Thompson and D. O'Sullivan attended the out-of-town meeting of the Royal Astronomical Society which was held at the Royal Irish Academy in April.

D. O'Sullivan and A. Thompson attended the International SCOSTEP/STIP Symposium which took place at St. Patrick's College, Maynooth in August.

Work on experiment hardware for the Cosmic Ray Section's research projects was carried out by J. Daly at other centres as follows:

ESTEC (21 January - 20 February)
Universidad Autonoma de Barcelona (22 May - 10 June)
Automatic Systems Ltd., Milton Keynes (12-16 December)

5 GENERAL

During the year A. Thompson served 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 secretary of the Irish Astronomical Science Group which was responsible for the arrangements during the Royal Astronomical Society's out-of-town meeting in Dublin in April.

D. O'Sullivan delivered an invited lecture at the Royal Astronomical Society's meeting at the Royal Irish Academy on 6 April and at the Workshop on Cosmic Ray Acceleration at the Max-Planck-Institut für Aeronomie, Lindau, Germany on 22 April. He also contributed to the Science Lecture series at the RDS and spoke to the Irish Astronomical Society on 7 December.

Working visits to the Cosmic Ray Section during the year were made by Dr. A. Richter, Max-Planck-Institut für Aeronomie, Germany (May); by Dr. A. Vidal-Quadras, University of Barcelona (July); and by Professor P. J. McNulty, Professor of Physics, Clarkson College, New York (October).

6 PUBLICATIONS

A. Thompson and D. O'Sullivan:

The form of the CR-39 Response Curve and its Effect on Particle Resolution and Areas of Application.
Nuclear Tracks: Methods, Instruments and Applications, Supplement No. 3, pp. 115-118 (1982).

D. O'Sullivan & A. Thompson:

The Abundance of Zinc in the Cosmic Radiation
Nuclear Tracks: Methods, Instruments and Applications,
Supplement No. 3, pp. 871-873 (1982).

S. McKenna-Lawlor, A. Thompson, D. O'Sullivan, E. Kirsch, D. Melrose and K.-P. Wenzel:

The Detection of Energetic Cometary and Solar Particles by
the EPONA Instrument on the Giotto Mission.
Proceedings of the 24th Plenary Meeting of COSPAR, Ottawa,
Canada, 16 May - 2 June 1982.

S. McKenna-Lawlor, A. Thompson, D. O'Sullivan, E. Kirsch, D. Melrose and K.-P. Wenzel:

In-situ Observations of Energetic Particles in the Environment
of Comet Halley and Associated Indirect Measurements of
Ambient Gas and Dust
Proceedings of the International Conference on Cometary
Exploration, Budapest, Hungary, 15-19 November 1982.

D. O'Sullivan:

The Elements and Isotopes of the Cosmic Radiation
The Irish Astronomical Journal 15, No. 2, 97 (1981.

S. McKenna-Lawlor, A. Thompson, D. O'Sullivan, E. Kirsch, D. B. Melrose and K.-P. Wenzel:

Solar Particles, Comet Halley and Epona
The Irish Astronomical Journal 15, No. 2, 111 (1981).

C GEOPHYSICS SECTION

1 STAFF AND SCHOLARS

Senior Professor:

T. Murphy

Professor:

A. W. B. Jacob

Research Assistant:

P. W. Readman

Experimental Officer:

J. C. Davies

Technical and Clerical Staff:

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

Scholar:

N. P. Murphy

Vacation Students:

Miss O. Scotti and C. Manning.

2. RESEARCH WORK

(a) Gravity

The drafting of the gravity results to date were suspended following the recommendation of the International Union for Geodesy and Geophysics that the International Gravity Formula 1980 should be used together with the International Gravity Standardisation Net 1971 with the Honkasalo correction removed. This was being carried out and the various sheets redrafted and contoured.

As the various activities in geophysics demand positional information, a study of the various systems of geographical and rectangular coordinates used in Ireland and on the adjacent seas was undertaken. It was initially intended for internal use only but outside interests in both academic and commercial circles requested the information, the study was extended, and the results published in Bulletin form.

The number of enquiries from mineral prospecting companies, due to reduced activity, decreased considerably during the year.

Dr. M. J. McCullagh, of Nottingham University, after his seminar on January 7th, demonstrated his method of contouring based on irregular triangular networks by adapting his software to suit our computer. Later vacation student C. Manning rewrote the software and McCullagh's method is now being used to contour the gravity data in the preliminary stages in preparing maps for publication.

(b) Magnetics

The marine magnetometer was mounted in the Asgard II, a sailing vessel of wooden construction as part of a short experimental scientific cruise in the Atlantic. The expedition was successful and proved the usefulness of such type of vessel.

(c) Rock Magnetism

The magnetic study of the titanomagnetite $Fe_{2.4}Ti_{0.6}O_4$ was extended to include a low temperature crystallographic investigation as it was anticipated that the peculiar magnetic properties observed for $T \lesssim 50$ K could be explained by some kind of crystal transition. However no clear transition to a different crystal type was found, and so the mechanism of the magnetic transition is still somewhat of a mystery. It may arise as a result of the enormous magnetostriction combined with thermal contraction leading to a complicated stress pattern which undergoes an abrupt change at ~ 50 K.

The analysis of the magnetic minerals in lake sediments from Greece was completed. Detailed magnetic, X-ray and Mossbauer analysis confirmed the earlier indications that detrital magnetite was the main magnetic constituent in these sediments. It is considered that variations in magnetic behaviour are largely due to variations in the magnetic grain size (domain state) of the magnetite grains, rather than a significant influence from other magnetic minerals. Initial investigations from other lakes in various countries tends to suggest that this may be a general result.

Greek lake sediments were also used in an attempt to derive geomagnetic palaeointensities. These were chosed for investigation because the wealth of Greek pottery of known age has led to a reasonably well defined archaeomagnetic record which can be used for comparison. Normalization of the natural remanence against laboratory induced depositional remanences does not always give reliable results and it is suggested that the original fabric of the sediment plays an important part in the natural magnetization process, and the fabric is changed or destroyed during the laboratory redeposition. Other parameters that have been used for normalization are low field susceptibility, anhysteretic remanence and isothermal remanence. Analysis of the results is still under way, although at this stage there is little hope of finding a reliable general method to determine palaeointensities from unconsolidated sediments.

(d) Meteorology

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

(e) Seismology

The seismology project in east central Ireland using quarry blasts as sources was completed. The earlier work had shown that these explosions provided good sources of surface waves and the study was extended to record these. The project then became involved in the acquisition, processing and joint interpretation of short period surface wave and refraction data. This combined approach has opened a new way of tackling thick sedimentary formations and has proved very valuable.

The main area of study lay between the quarries at Huntstown, north of Dublin, and Platin, near Duleek. A detailed profile of the structure along this path was found. Towards the southern end of the line, a layer with a shear velocity of 2.65 km/s about 1 km thick, attributed to the Carboniferous Limestone, lies on a layer with verocity 3.06 km/s which is probably Lower Palaeozoic. Areas where the cover of the 2.65 km/s layer is thick correlate to the Lower Carboniferous Limestone. Towards the north a velocity of about 3 km/s was observed over the Lower Palaeozoic Balbriggan inlier and the limestone near Platin was found to be only about 250 metres thick. Below the 3.06 km/s layer an approximately basinal formation occurs having a velocity of about 3.45 km/s down to 3 km.

For various reasons, less detail was found on a path to the west, between Huntstown and Slane, but the results indicated that the gravity anomaly at Kentstown is very likely due to a granite mass rather than to a light sedimentary formation. a matter over which there has been some controversy.

Some additional surface wave data collected in Co. Wexford was also analysed with the same techniques. The foregoing work carried out by N. Murphy formed the subject matter for a Thesis submission (Ph.D).

The Irish Caledonian Suture Seismic Project, carried out in July 1982, involved a 250 km long reversed seismic refraction and reflection experiment on a NE-SW line from Dundalk Bay in the N. Irish Sea to the Shannon Estuary of the Atlantic coast. The experiment extended Durham University's 'Caledonian Suture Seismic Project' which extended north-eastwards from Dundalk Bay through Carlisle and Newcastle to the North Sea. In England the line was chosed because it lies along the Caledonian strike in a region undisturbed by granitic plutons where gravity data suggests homogeneous crustal structure along strike. The line lies in a region where LISPB results raised the problem of a possible gradational Moho, and it lies close to the proposed Caledonian Suture. In Ireland, the

line was selected to continue the UK line along the northwest side of the probably Caledonian Suture zone. It was also chosen to follow a path where other geological and geophysical data suggested that crustal structure would not vary in an uninterpretable way.

The Irish experiment involved 51 recording sites at which data was recorded (by 2 site side-stepping) using 15 MARS three component and 8 DIAS single component mobile recording stations. A five station DIAS radio-linked network was also used in the Kells region. The MARS stations were brought over from the Geophysical Institute of the University of Karlsruhe by Dr. C. Prodehl and five of his colleagues, without whose help it would have been impossible to mount the experiment. Recording was carried out by a team from the following institutions:

D.I.A.S. -	12
Geology Dept. T.C.D. -	5
Karlsruhe -	6

The project was organised with close co-operation and support from T.C.D. Geology Department and the Karlsruhe Geophysical Institute.

The UK experiment involved the firing of about 70 shots of 150 Kg each in the North Sea and Irish Sea at a spacing of 4 km. To facilitate the two side-stepping of recording in Ireland, five of the western Irish Sea shots were repeated. The Irish line was reversed by firing in the Shannon estuary off Kilrush and in the Atlantic off Loop Head. The 30 ft half-decked 'Undaunted' was used to fire two shots equivalent to 200 Kg each off Kilrush and one off Loop Head. Weather conditions prevented the second shot being fired at the latter locality. Navigational facilities for defining shot point positions were provided through the generous help of the Electricity Supply Board.

The whole programme went remarkably smoothly with less than the normal ration of human and instrumental failure. After the main experiment a very important extra section of the line was run again using quarry blasts near Ennis.

While the experiment was in progress, preliminary analogue records were made into sections. These have given some information about the main structural features. They also confirmed that a high ratio of good results had been obtained. Further, preliminary interpretation of analogue sections was carried out in late October at Karlsruhe by Drs. Jacob and Prodehl. The following describes the conclusions so far.

Under and near the Shannon Basin the Moho is sharp and the Pn time term is only about 2.4 s. To the northeast of the Shannon area, the Pn time term increases quite quickly, and at the northeast end of the line, the Moho has become a gradational feature extending over many kilometres of depth. Two other notable points (a) a sudden increase in P wave delays near the northeastern end, possibly due to a significant increase in thickness of Lower Carboniferous limestones, and (b) a rather abrupt deepening of the Shannon Basin between Ennis and Kilrush.

The data gathering part of ICSSP cost about £25,000, the contribution from DIAS, Geophysics Section being around £10,000. The balance came mainly from support by industrial companies and TCD Geology Department to whom we are extremely grateful.

The two seismic networks were operated successfully during the year and the data of all earthquakes recorded is sent routinely to the various Seismological Centres each week.

Five earth tremors on and close to Ireland were recorded. One on the mainland near Drinagh Co. Wexford, intensity only 0.9. was not reported as being felt. The others were offshore, two east of Tuskar and one in the Kish basin. These presumably are associated with the boundary faults of the Mesozoic Basins. The remaining two were of so low an intensity that their positionings were not accurate.

All the seismic data are still being transcribed and digitized, without charge, at the Institute of Geological Sciences, Edinburgh, to whom we are extremely grateful.

3 EXTERNAL ACTIVITIES

A. W. B. Jacob, T. Murphy and P. W. Readman attended the United Kingdom Geophysical Assembly in Cardiff in April.

A. W. B. Jacob attended meetings of the Royal Society Working Group on Explosion Seismology at Cardiff in April and London in October and the Council of Europ Meeting of the Ad Hoc Committee of Experts on Earthquake Research (CAHRT) at Strasbourg in December.

4 STATUTORY PUBLIC LECTURE

The Statutory Public Lecture of the School was delivered by Professor A. W. B. Jacob in the Davis Hall, Trinity College, Dublin on 30 November 1982. His subject was Ireland: its Seismic Structure.

5 PUBLICATIONS

T. Murphy:

"The geographical and rectangular coordinates in use in Ireland and their transformations".
Comm. D.I.A.S. Series D. Geophys. Bull. 35, 1982.

P. Readman:

"Low temperature magnetic properties of Ti-rich Fe-Ti spinels" (with E. Schmidbauer).
Journ. of Magnetism and Magnetic Materials, 27 (1982) 114-118.

"Magnetic mineralogy of lake sediments from Greece"
(with S. Papamarinopoulos, Y. Maniatis and A. Simopoulos)
Earth and Planetary Science Letters, 57 (1982) 173-181

Abstracts:

P. W. Readman and E. Schmidbauer:

'Low temperature magnetic properties of titanomagnetites'
Physics Earth & Planet. Int. 30, (1982) 322.

A.W. B. Jacob and V. Ward:

'Seismicity in Ireland since 1700'
Geophys. J. R. Astr. Soc. (1982) 69, 273-306.

6 SEMINARS

January 7	Dr M. J. McCullagh of Nottingham University: 'Mini/Micro - Computer Automated Cartography'
February 19	Dr. C. W. A. Browitt of Global Seismology Unit, IGS, Edinburgh: 'The U.K. Seismic Monitoring Programme'.
	Mr. R. McQuillin of Marine Geophysics Unit, IGS, Edinburgh: 'Extensional Tectonics as a control of Basin Development'.
May 7	Dr. C. Prodehl of University of Karlsruhe, Germany: 'Crustal Structure of Graben Areas from Explosion Seismology'.

7 MISCELLANEOUS

Undergraduate student Miss O. Scotti of Trinity College carried out a research project in seismology as part of her studies.

Vacation student C. Manning of University College, Dublin worked on computer software in connection with contouring of random data.

Vacation student Miss O. Scotti assisted in the C.S.S.P. project.

8 COMPUTER INSTALLATIONS

Data General Eclipse System:

The memory of the system was doubled and now reaches the maximum possible under the present operating system.

Some rearrangement of peripheral units was made and dual usership of the system can take place.

In order to overcome problems experienced by the Geophysics Section in implementing software packages the compiler (FORTRAN 5) and the Operating system (RDOS) have been revised.

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

Income and Expenditure Account
for the year ended 31 December 1982

1981		NOTES	1982
£	INCOME		£
1,193,000	Oireachtas Grants	1(a), 2	1,374,000
70,996	Sales of Publications	3	28,944
74,130	Fire Insurance Compensation		---
3,889	Celtic Studies Summer School: Fees		---
5,401	N.B.S.T. Project		5,920
33,011	Miscellaneous	4	50,165
1,380,427			1,459,029
	EXPENDITURE	5	
311,210	Administration		361,921
332,612	School of Celtic Studies		275,476
182,260	School of Theoretical Physics		209,623
455,092	School of Cosmic Physics		506,018
1,153	Adaptation of Premises		6,140
1,282,327			1,359,178
98,100	SURPLUS (DEFICIT) for year	6	99,851

Notes 1 to 12 form part of these accounts.

T. K. WHITAKER
CHAIRMAN - COUNCIL OF THE INSTITUTE

13th September, 1983.

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

Balance Sheet at 31 December 1982

1981		NOTES		1982
£	CURRENT ASSETS			£
82,182	Cash on hands and at Bank			246,723
122,329	Debtors and Prepayments			56,684
204,511				303,407
	Less			
	CURRENT LIABILITIES			
48,612	Creditors and accruals		47,657	
	Vernam Hull Bequest	7	11,691	59,348
155,899	NET CURRENT ASSETS			244,059
	Represented by	6		
155,899	INCOME and EXPENDITURE - Accumulated Surplus			244,059

Notes 1 to 12 form part of these accounts.

T. K. WHITAKER
CHAIRMAN - COUNCIL OF THE INSTITUTE

13th September, 1983.

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 £84,000 for increases in remuneration.

(b) Furniture and Equipment: Expenditure on Furniture and Equipment is written off in the period in which it is incurred.

(c) Publications: Expenditure on Publications is written off in the period in which it is incurred.

2. Oireachtas Grants

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

1981			
£		£	£
287,500	Administration	372,290	
277,450	School of Celtic Studies	257,800	
182,300	School of Theoretical Physics	206,000	
444,750	School of Cosmic Physics	537,900	
1,000	Adaptation of Premises	10	1,374,000
1,193,000			

3. Sales of Publications

70,845	School of Celtic Studies	26,743	
44	School of Theoretical Physics	55	
107	School of Cosmic Physics	2,146	28,944
70,996			

4. Miscellaneous Income

28,579	Administration	47,215	
1,228	School of Celtic Studies	1,800	
7	School of Theoretical Physics	---	
---	School of Cosmic Physics	1,150	
3,197	Sale of Temporary Building	---	50,165
33,011			

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

NOTES TO THE ACCOUNTS

5. Analysis of Expenditure

1981		Total	Administration	School of Celtic Studies	School of Theoretical Physics	School of Cosmic Physics
£		£	£	£	£	£
803,745	Salaries, Wages & Superannuation (Note 10)	862,710	173,250	197,866	129,666	361,928
49,859	Scholarships	57,946	-	16,979	31,608	9,359
750	Honoraria	100	-	100	-	-
40,426	Library	45,334	-	4,849	27,418	13,069
82,438	Publications (Note 1c)	47,358	962	45,048	388	960
21,851	Furniture & Equipment (Note 1b)	47,380	21,755	1,960	362	23,303
139,200	General Administration (Note 8)	152,412	152,412	-	-	-
42,399	Travel, Survey & Seismic Research (Note 11)	45,517	857	4,338	6,209	34,113
9,732	Symposium, Summer School & Seminar Expenses	1,581	-	141	1,440	-
17,973	Consumable Equipment	20,578	-	-	-	20,578
36,074	General Expenses	39,683	12,685	4,195	6,743	16,060
14,186	Special Commitments (Note 9)	22,706	-	-	-	22,706
8,333	Fire Replacement (Contents)	3,942	-	-	-	3,942
8,986	" " (Buildings)	-	-	-	-	-
5,222	NBST Project	5,789	-	-	5,789	-
1,281,174	Total:	1,353,038	361,921	275,476	209,623	506,018
1,153	Adaptation of Premises	6,140				
1,282,327	Total:	1,359,178				

6. Surplus/Deficit Position

	Balance 1/1/82	Adjustment	Year to 31/12/82	Balance 31/12/82
Administration	38,165		57,584	95,749
School of Celtic Studies	73,423	(11,691)	10,867	72,599
School of Theoretical Physics	1,306		2,352	3,658
School of Cosmic Physics	14,465		35,178	49,643
Adaptation of Premises	28,540		(6,130)	22,410
	155,899	(11,691)	99,851	244,059

This surplus is available towards meeting the Institute's expenditure on commitments outstanding at 31 December 1982 (see Note 12). The adjustment involves a change in accounting treatment for the Vernam Hull bequest (see Note 7). This bequest was formerly treated as part of the balance of the School of Celtic Studies.

7. Vernam Hull Bequest

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

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

NOTES TO THE ACCOUNTS

1981	8. General Administration Expenses	£	£
£			
57,388	Rent, Rates & Insurance	61,782	
33,488	Premises Maintenance	33,623	
21,242	Postage & Telephones	25,069	
23,996	Fuel, Light & Power	28,611	
3,086	Sundry Supplies	3,327	152,412
139,200			

9. Special Commitments

The expenditure under this heading consisted of -

(a)	the final contribution by DIAS towards the cost of a 1-metre Telescope being erected at La Palma, Canary Islands, in joint agreement with the Science Research Council (UK) and the National Board for Science and Technology.	7,687
(b)	Epona experiment - cost of equipment to be used in connection with a space mission scheduled for 1985/86 to study Halleys Comet.	15,019
		22,706

10. Superannuation

Expenditure arising under superannuation schemes is met out of Oireachtas Grants in the year of payment.

11. Seismic Research

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

Contributor	Research Project	Amount £
T.C.D.	Irish Caledonian Suture Seismic Project	5,795
E.S.B.	Seismic Survey at Carnsore	1,024
		6,819

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

NOTES TO THE ACCOUNTS

12. Outstanding Commitments

The estimated cost of commitments outstanding at 31 December 1982, exclusive of Current Liabilities shown on the Balance Sheet, is as follows:-

31/12/81		
£		£
38,500	Administration	96,000
72,548	School of Celtic Studies	79,809
3,479	School of Theoretical Physics	10,000
28,942	School of Cosmic Physics	49,500
30,000	Adaptation of Premises	22,410
173,469		257,719

Report of the Comptroller and Auditor General

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

In my opinion:-

(a) proper books of account have been kept by An Institiúid and the Income and Expenditure Account and Balance Sheet are in agreement with them, and

(b) the Income and Expenditure Account and Balance Sheet, together with notes 1 to 12, give, respectively, a true and fair view of the transactions of An Institiúid for the year ended 31 December 1982 and of the state of its affairs on that date.

P. L. McDONNELL
Comptroller and Auditor General

27 October, 1983.