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Catalogue of the papers and correspondence of

TONY HILTON ROYLE SKYRME

(1922 - 1987)

Compiled by Peter Harper and Timothy E Powell

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## GENERAL INTRODUCTION

## PROVENANCE

The material was received in May 1988 via Dr J E Bowcock, a colleague in the Department of Mathematics, University of Birmingham.

## OUTLINE OF THE CAREER OF T H R SKYRME

Professor Tony Skyrme - an original thinker in nuclear physics who gave his name to a type of fundamental particle the Skyrmon - died in June 1987 at the age of 64. At Harwell in the 1950s he put forward (in the words of his Times obituarist) 'original ideas in non-linear quantum field theory, proposing a model, the Skyrme model, which lay distinctly outside the mainstream of contemporary thinking in elementary particle physics'. It was only from about 1983 that the significance of this work was widely appreciated leading in 1985 to the award of the Royal Society's Hughes Medal for his contributions to theoretical, particle and nuclear physics.

Tony Hilton Royle Skyrme was born in Lewisham on 5 December 1922. He was educated at Eton (a King's Scholar) and Trinity College Cambridge where he studied for the Mathematical Tripos. After his final Cambridge examinations in June 1943 he was assigned to work with the Tube Alloys Directorate (the UK atomic bomb project) and joined R E (later Sir Rudolf) Peierls's group at Birmingham University which was working on theoretical questions posed by the bomb's design and construction. In March 1944 he was sent to the USA to work first

in New York and then at Los Alamos on the atomic bomb project.

On his return to England in 1946 Skyrme was admitted as a Research Fellow at Trinity College Cambridge. In fact he never resided at Cambridge, working instead in Peierls's new Department of Mathematical Physics at Birmingham where he held a university research fellowship 1946-48. In August 1948 he married Dorothy Millest, a lecturer in nuclear physics at Birmingham, and then spent two years in the USA. In 1948-49 he was a Research Associate at the Massachusetts Institute of Technology and in the following year he was a member of the Institute of Advanced Physics at Princeton.

In 1950 Skyrme returned to England to take up the post of Senior Principal Scientific Officer in the Theoretical Physics Division of the Atomic Energy Research Establishment (AERE) Harwell where he was head of the Nuclear Physics Group. It was in his later years at AERE Harwell - he resigned in 1961 - that he did his most important scientific research, especially the four papers on non-linear meson theories published in the Proceedings of the Royal Society A 1958, 1959 and 1961 which, together with three related papers, achieved 'a nuclear theory based entirely on meson fields, without particulate nucleons'.

Skyrme spent 1958-59 on leave from AERE Harwell. He was Visiting Professor for a term at the University of Pennsylvania before travelling back to the UK via California, Australia, Malaya and India. He resigned from AERE Harwell in September 1961 to take up a Senior Lectureship in the Mathematics Department of the University of Kuala Lumpur. He remained there until 1964 when he returned to England to take up the Chair in Mathematical Physics at Birmingham in succession to Peierls. In 1982 his Department was obliged to



amalgamate with the Mathematics Department and his Chair was redesignated a Chair in Applied Mathematics.

Skyrme's move to a university teaching post in Malaya marked a decisive shift in his career away from research. He was not very active in research in his later years in Birmingham though he was always accessible to colleagues and researchers in other departments who brought mathematical problems to him. In many ways he remained aloof from the great interest in his early research which coincided with the last years of his life. However, he did agree to give the 'Historical Introduction' to a small Workshop on Skyrmions in November 1984 and was only prevented from repeating the talk at the Peierls 80th Birthday Symposium by his death in 1987.

For further information on the life and career of Skyrme see R H Dalitz 'Professor Tony Hilton Royle Skyrme: 1922-1987. A Brief Biography' in Dalitz and R B Stinchcombe eds. A Breadth of Physics (1988) 205-219 and the same author's 'An Outline of the Life and Work of Tony Hilton Royle Skyrme (1922-1987)' in International Journal of Modern Physics A, Vol.3, No.12 (1988) 2719-2744. Skyrme's historical talk on Skyrmions is also published in the same issue of the International Journal of Modern Physics (pp2745-2751) and in A Breadth of Physics. The compilers of this catalogue have drawn freely on these published sources in the writing of this introduction and the listing of the manuscripts.

#### DESCRIPTION OF THE COLLECTION

The material is presented in the order given in the List of Contents. The collection, although small in size, offers a respectable amount of material relating to Skyrme's research at AERE Harwell and his teaching at the University of Malaya, Kuala Lumpur and the University of Birmingham.

Section A, Notebooks, is a sequence of eighteen notebooks used for records of Skyrme's own research, conferences attended, and seminars at Harwell and Birmingham.

Section B, Notes and drafts, covers the whole of Skyrme's scientific career from undergraduate notes at Trinity College Cambridge to records of his work at Birmingham at the end of his life. Although the section includes teaching material from his fellowship years at Birmingham, 1946-48, and the Visiting Professorship at the University of Pennsylvania, 1958, and a few drafts for publications, it is principally a collection of unpublished research material.

Section C, Malaya, and Section D, Birmingham, comprises records of Skyrme's teaching at the University of Malaya, Kuala Lumpur, 1962-64, and at the University of Birmingham from 1965. Section D also includes documentation of Skyrme's advice to colleagues on mathematical problems.

Section E, Publications, comprises Skyrme's reprints including the posthumously published talk on the origin of skyrmions and Dalitz's articles on his life and work.

#### ACKNOWLEDGEMENTS

We are very grateful to Dr Bowcock for making the material available and to Dr Bowcock and Professor R H Dalitz for advice and encouragement.

Peter Harper  
Timothy E Powell  
Bath 1989



SECTION A

NOTEBOOKS

A.1 - A.18

- A.1 Two notebooks glued together, the back cover of the notebook used second glued to the front cover of the notebook used first. nd.

The notebook used first is paginated 1 - 216 with a contents list on pl. Topics covered are: 'notes on scattering matrix'; 'the completeness of the closed and quasi-closed states'; 'a model for the scattering equations'; 'use of non-Hermitian operators'; 'relation of  $\beta$ -decay with meson theory'; 'decay of free meson'; ' $\beta$ -decay spectra'; 'a new expansion for many-body problem'; 'use of redundant coordinates in many-body problem'; definition of potential scattering'; 'on point interactions'; 'equations of an electron in the radiation field'.

The notebook used second is paginated 217-359. Notes on beta-decay begin on p219.

- A.2 Spiral notebook inscribed 'T H R Skyrme' and 'Rm 6-306 MIT' on front cover and 'Notes - 3' inside front cover. The book is undated but probably used during Skyrme's Research Associateship at Massachusetts Institute of Technology, 1948-49.

Contents include notes on quantum electrodynamics.

- A.3 Notebook used for notes on atomic nuclear moments from 1948. Paginated 1 - 91 with index at rear of book. A few loose items are enclosed, including AERE Harwell station circular no.316, 3 February 1953.

- A.4 Notebook used for notes on experimental methods from 1948. Paginated 1 - 13. The remainder of the book is unused.

- A.5 Notebook ' $\beta$ TI' used for experimental data on beta-decay and notes on the theory, nd. Paginated 1-189 with index of topics at rear of book.



Notebooks

- A.6 Notebook 'BT2' used for notes on beta-decay, nd.  
Paginated 191-389 with index of topics at rear of book.
- A.7 Notebook used for notes on complex spectra, probably in  
use early 1950s (1952 bibliographical reference pl64).  
Paginated 1-167 with index of topics at rear of book.
- A.8 Notebook used for notes on the literature (principally  
papers in Physical Review), 1952-53. Paginated 1-336  
(many pages unused) with index of authors at front of  
book.
- A.9 Notebook used for notes on relativistic quantum field  
theory, nd but probably in use in 1953 (latest Physical  
Review reference pl08). Paginated 1-145 with index  
of topics at rear of book.
- A.10 Notebook used for notes on meson theory, nd but there  
are references to the preceding book (ppl9, 37).  
Paginated 1-125 (many pages unused) with index of topics  
at rear of book.
- A.11 Notebook inscribed inside front cover 'Amsterdam Conference  
1956' and used for a detailed record of the proceedings,  
2-7 July. Unpaginated. At least one page is missing  
from the front of the notebook.
- Participants include Bethe, A Bohr, Hofstadter, Weisskopf  
and Wilkinson.
- A.12 Notebook used for records of theoretical physics colloquia  
and seminars, visits and conferences, November 1956 -  
December 1957. Paginated 1-249 with index of individuals  
and topics at front of book.
- The colloquia etc are dated and the name of the speaker  
and topic given but not usually the location which probably  
indicates that most of the occasions took place at Harwell.

continued...

Notebooks

A.12 cont'd Speakers include D Ter Haar on 'Excitons & Polarons' (pp4-7), R J Blin-Stoyle on 'Beta Interactions' (pp12-14) and W Marshall on 'Critical Scattering' (pp142-147). There are also notes on the Physical Society Conference on 'Nuclear & High Energy Physics', Harwell, 16-17 January 1957 (misdated 1956 by Skyrme), (pp54-75).

A.13 Notebook used for records of theoretical physics colloquia and seminars, visits and conferences, January 1958 (misdated 1957 by Skyrme) - May 1960 (continuation of A.11). Paginated 1-252 with index of individuals and topics at front of book. A few loose items are enclosed.

The colloquia etc are dated and the name of the speaker and topic given but not usually the location which probably indicates that most of the occasions took place at Harwell. Speakers include A Salam on 'Dispersion Relations' (pp11-13), V F Weisskopf on 'Properties of Nuclear Matter' (pp19-21) and D H Wilkinson on 'Parity Conservation in Strong Interactions' (pp36-38). There are also notes on the Physical Society Conference, Cambridge, 10-11 April 1958 (pp53-68).

A.14 Notebook used for records of conferences 1957, 1960 and 1961. Paginated 1-200 with incomplete index of conferences at front.

The conferences are:

- 1) Seventh Rochester Conference, 15-19 April 1957. Participants include Alvarez, Bethe, Dalitz, Feynman, Fowler, Hofstadter, Marshak and Oppenheimer. The revised programme is enclosed at front of book.
- 2) Parity Conference, Harwell, 13 May and seminar on 'Neutrino Theory', 14 May 1957.
- 3) Rehovoth Conference, Israel, September 1957. Participants include Flowers and Wilkinson.

continued...



Notebooks

A.14 cont'd

- 4) Physical Society Meeting, Liverpool, 30-31 March 1960.  
Participants include Flowers, P Matthews and Merrison.
- 5) Physical Society Conference, Birmingham, 17-19 April 1961.
- 6) Manchester Rutherford Jubilee Conference, 4-8 September 1961.  
Participants include Dalitz, Flowers and Peierls.

A.15

Spiral notebook used for records of extended overseas trip, 1959.

Skyrme visited USA (East coast, Texas, Los Alamos, California including discussions with Feynman at Cal Tech); Australia (Canberra including C F Powell's lectures); India (Tata Institute), January - August 1959.

He also used the book for notes on 'Kiev Conference Reports', Harwell theoretical physics colloquium 14 October 1959, and visit to Birmingham 3 March 1960.

A.16

Notebook used for records of theoretical physics colloquia etc., June 1960 - July 1961 (continuation of A.13).  
Paginated 1-254 with index of individuals and topics at front of book.

Speakers include A Salam on 'Weak Interactions' (pp75-79), P Matthews on 'Strong Interactions' (pp93-95) and C C Butler on 'Bubble Chambers' (pp117-118).

A.17

Spiral notebook used for record of Department of Mathematical Physics seminars, Birmingham, October 1964 - January 1967.

Includes notes on 'Oxford Conference' [International Conference on Elementary Particles], September 1965.  
Participants include Dalitz, Gell-Mann, Kibble and Peierls.

Notebooks

A.18

Spiral notebook used for record of Department of Mathematical Physics postgraduate courses, Birmingham, 1964-65, 1966-67.

Staff assignment, books, topics, notes on elementary particle theory and group theory for 1964-65; notes on 'Phenomenology (NMQ)' for 1966-67.



SECTION B

NOTES AND DRAFTS

B.1 - B.88

Section B comprises manuscript and typescript notes and drafts covering (almost) the whole of Skyrme's scientific career from undergraduate notes at Trinity College Cambridge to records of his work at Birmingham at the end of his life. Although it includes some lecture notes from his research fellowship years at Birmingham 1946-48 (B.3) and his Visiting Professorship at the University of Pennsylvania 1958 (B.21, B.22) and a few drafts for published work (B.28, B.28A, B.30), the section is principally an assemblage of unpublished research material.

The notes and drafts are presented in two sequences, dated and undated, and where possible titles and pagination are given. Skyrme's pagination is of particular interest because he often employed an alphanumeric system combining subject identification and page number.

R H Dalitz has provided a selective list of unpublished research material as Appendix U of his 'Outline of the Life and Work of Tony Hilton Royle Skyrme', International Journal of Modern Physics A, Vol.3, No.12 (1988), 2743. This material is to be found at B.8, B.9, B.11, B.12, B.25 and, for a talk to the Malaysian Mathematical Society, C.47.

Dated Notes and Drafts

B.1, B.2      Contents of Skyrme's folder: ms notes and drafts, 'problems' sheet and 'solutions'. Material on phyllotaxy is dated May 1943.  
  
2 folders.

Notes and drafts

- B.3 - B.5      Contents of Skyrme's folder:    ms notes and drafts  
                 including material dated 1947 and 1948.  
  
                 3 folders.
- B.3              'Introduction' to course of lectures.  
  
                 Ms draft paginated 2 - 7 beginning 'object of course  
                 to explain general methods of tackling physical problems'.  
  
                 'Conformal Transformation'.  
  
                 Ms draft paginated 12 - 18 + 2pp ms calculations.  
  
                 'Final Honours Course.    Dynamics Revision'.  
  
                 Ms draft paginated 1 - 16.
- B.4              'Superfluidity'.  
  
                 Ms drafts referring to Oxford conference on liquid  
                 helium, 1947.  
  
                 'Superconductivity'.  
  
                 Ms draft referring to Oxford conference on liquid  
                 helium 1947, Shonberg seminar and Zürich conference 1948.
- B.5              'Relativity theory (Supplementary to Eddington,  
                 M T of R)'.  
  
                 Ms draft paginated 1 - 59.
- B.6, B.7        Contents of Skyrme's folder:    ms notes and drafts.  
  
                 2 folders.



Notes and drafts

B.6 'Hydrodynamics. Electrodynamics'.

Ms draft paginated HE1 - HE15.

Untitled ms draft paginated [FD1] - FD13. Skyrme used for FD12 back of Atomic Scientists' Association circular dated 15 May 1952.

Miscellaneous ms notes.

B.7 'Characteristics of a theory T'.

1p ms draft. This note was reproduced by Dalitz as Appendix T of his 'Outline of the Life and Work of Tony Hilton Royle Skyrme', International Journal of Modern Physics A, Vol.3, No.12 (1988), 2743 - 2744.

B.8

Contents of folder inscribed 'Wall corrections': typescript drafts, ms notes etc. The first three entries were listed by Dalitz in Appendix U of his International Journal of Modern Physics article (p2473). The dates he suggested for the undated material appear in square brackets after the titles.

'Wall corrections for a monoenergetic isotropic reaction' [ ?1952 ].

Typescript draft paginated gwcl - gwc2.

'Wall corrections in proportional counters' [ ?1952 ] .

Typescript draft paginated WC1 - WC8.

continued...

Notes and drafts

B.8 cont'd

'Wall corrections for He3 counter' [1955].

Typescript draft paginated 2WC1. - 2WC8.

Miscellaneous calculations, tables, graphs etc.

B.9, B.10

Letter from R Phillips to Skyrme, 9 January 1968, enclosing 'typewritten notes of your own early work on 3-body problem (left when you went to K L)' and 'calculations by Leggett, as a vacation student, on your non-linear field theory'. The draft on three body problem is listed by Dalitz, with suggested date, in Appendix U of his International Journal of Modern Physics article. Leggett's work relates to Skyrme's 1962 paper 'A unified field theory of mesons and baryons', Nuclear Physics 31 556-569.

2 folders.

B.9

Phillips's letter.

'Three body problem at low energies (Part 1)' [ ?1952 ] .

Typescript draft paginated 1 - 19 + 1p headed 'Seminar'.

B.10

'Report on work done at AERE, 9th Aug - 29th September 1961, in connection with a non-linear field theory of Dr Skyrme' by A J Leggett, Merton College, Oxford.

Ms draft, graphs, tables.



Notes and drafts

- B.11            'Deuteron cross-sections for heavy nuclei at high energies' [ ?1953 ].
- Typescript draft paginated 1 - 13. Listed by Dalitz with suggested date in Appendix U of his International Journal of Modern Physics article.
- B.12            'The stripping of fast deuterons' [ ?1953-54 ].
- Typescript draft paginated 1 - 10 + photocopy. Listed by Dalitz with suggested date in Appendix U of his International Journal of Modern Physics article.
- B.13 - B.15    Contents of Skyrme's folder: ms and typescript drafts including material dated 1955-57.
- 3 folders.
- B.13            'An alternative description of the many-body problem'.
- 6pp ms draft.
- 'Bell: Electromagnetic Theory'.
- Ms draft paginated JBEM1 - JBEM32.
- 'W B Thompson. Plasma Theory'.
- Ms draft paginated TPT1 - TPT20.

Notes and drafts

- B.14            'Group Theory. D Johnston', October 1956.  
  
Ms draft paginated JG1 - JG18  
  
'Lattice Groups'.  
  
Ms draft paginated GTJL1 - GTJL13 found attached  
to preceding.  
  
'Coulomb excitation'.  
  
Typescript and ms draft paginated CE1 - CE3 + 6pp  
ms notes. The last page of the notes is on the back of  
Harwell Bulletin for the week beginning 12 September 1955.
- B.15            'Influence of angular momentum on neutron evaporation'.  
  
Typescript draft paginated AMNE1 - AMNE3.  
  
'Variational formula for harmonic vibrations'.  
  
Typescript draft paginated VH1 - VH2.  
  
'Progress in Nuclear Physics. Parity Violation', April  
1957.  
  
Typescript draft with ms additions and corrections paginated  
1DPV1 - 1DPV13 + 1p bibliographical references.  
  
Untitled draft paginated LPVO - LPV15  
  
3pp typescript 'Comments'.



Notes and drafts

B.16                'Distortion in the P-shell'.

Typescript 'notes for paper (not to be quoted in this form)' paginated DDPl - DDPl2 + 1p ms on 'distortion operators'. First page of typescript refers to Rehovoth Conference held September 1957.

B.17 - B.20       Contents of folder inscribed 'Electrodynamics and 5-Dimensions': ms and typescript drafts including material dated 1957 and 1958.

4 folders.

B.17               List of topics for research typed on AERE Harwell notepaper.

'Electrodynamics and a fifth dimension of space'.

6pp typescript.

'Generalisation of quantum field theory'.

Typescript draft paginated DGFT1 - DGFT5.

B.18               'Iso Spin &c'.

Ms draft paginated IS1 - IS12.

Shorter ms notes on '4 - 5D ideas' January 1957,  
'field theory generalisations', 'variational method' etc.

Letter from Skyrme to M Gell-Mann on weak interactions,  
29 April 1958.

Notes and drafts

- B.19            'Time reversal etc.'  
Typescript draft paginated STR1 - STR15.  
  
                'Spinor analysis'.  
Typescript draft paginated SA1 - SA2 + 5pp ms notes.  
  
                'Structure of the nucleon'.  
Typescript draft paginated 2SN1 - 2SN5.  
  
                'A review'.  
Typescript draft paginated RSN1 - RSN5.
- B.20            'Meson fields in nuclear matter'.  
Ms draft paginated PM1 - PM10.  
  
Letter from J C Polkinghorne re Skyrme's work on non-linear meson theory, 27 May 1958.  
  
                'The Langrangean in quantum field theory'.  
10pp typescript draft.  
  
Untitled ms draft paginated 2 - 16.  
  
                'On symmetries of strong interactions' by A Salam.  
3pp duplicated typescript.
- B.21            'Physics 696 - Fall Semester 1958-59. Dispersion relations in elementary particle physics'.  
  
Course outline and ms lecture notes paginated PK1 - PK79.

continued...



Notes and drafts

B.21 cont'd...

Skyrme was Visiting Professor, University of Pennsylvania, for the Fall Semester, 1958-59.

B.22 'Collective motion'.

Ms lecture notes paginated PL151 - PL172 + 2pp ms notes on 'vibrational states'. From period of Skyrme's Visiting Professorship at Pennsylvania.

B.23 'Nuclear level densities and the shell model' by D W Lang and Skyrme.

6pp typescript draft prepared during visit to Australian National University, Canberra, 1959.

Folder also includes letter from Lang to Skyrme about the draft, 25 September 1959.

B.24 'The level structure of A<sup>37</sup>' by M B Hooper and Skyrme.

Typescript draft paginated HS1 - HS3 (latest bibliographical reference 1959).

B.25 Contents of Skyrme's folder: ms and typescript drafts including material dated 1960.

'A collective model for O<sup>16</sup>'.

3pp typescript summary of lecture at Physical Society Conference, Liverpool, [30-31 March] 1960.

continued...

Notes and drafts

B.25 cont'd...

'A collective model for  $O^{16}$ '.

Typescript draft lecture (incomplete) paginated BC1 - BC11.  
Listed by Dalitz in Appendix U of his International Journal of Modern Physics article.

' $O^{16}$  structure'.

Ms draft paginated 2AT1 - 2AT24.

lp ms notes, and lp typescript on 'energy of the breathing mode of  $O^{16}$ ', attached to preceding.

B.26            'The language and methods of field theory', 17 October 1960.

Typescript draft lecture paginated RIL1 - RIL18.

B.27            'A model unified field equation' by J K Perring and Skyrme.

7pp typescript draft (latest bibliographical reference 1961) and two typescript drafts (each paginated DPM1 - DPM6), with different ms additions and corrections.

B.28            'A unified field theory of mesons and baryons'.

19pp typescript draft, and 21pp typescript draft 'received 27 September 1961'. These are drafts of Skyrme's published paper Nucl. Phys. 31 (1962) 556.

B.28A           'A classical field theory of mesons and baryons'.

Typescript draft paginated 1DIR1 - 1DIR22. Probably an early version of preceding.



Notes and drafts

B.29 'Non-linear field theory'.

Duplicated typescript paginated 1 - 15 with ms inscription at head of first page 'Work Copy'. The note summarises four papers by Skyrme published in Proc. Roy. Soc. 1958, 1959 and 1961(2).

B.30 'Kinks and the Dirac equation'.

Typescript draft paginated [1] - 19. This is a draft of Skyrme's published paper J. Maths. Phys. 12 (1971) 1735.

B.31 - B.33 Contents of a folder inscribed 'Path Integrals': ms drafts, notes, calculations etc for book on path integrals. The drafts are not dated but Skyrme used the back of University of Birmingham memoranda etc 1983 and 1984 for some of the calculations.

3 folders.

B.31 Ms drafts of chapters 1, 2, 'Appendix 1 to Ch.2 (Ch.3?)' and 10.

B.32 Miscellaneous shorter ms notes and drafts etc.

B.33 Teaching material for course 'MS 315, Summer 1981' etc.

B.34 Letter from H E Daniels to Skyrme, 26 April 1984, enclosing photocopy of their joint paper 'The maximum of a random walk whose mean path has a maximum'.

Notes and drafts

- B.35 Ms and typescript drafts of Skyrme's historical introduction to a small 'Workshop on "Skyrmions" ', Cosener's House, Abingdon, 17 - 18 November 1984.
- A version of this talk was published in the International Journal of Modern Physics A, Vol.3, No.12, 2745-2751, and a reprint is presented at E.1.

Undated Notes and Drafts

- B.36 'Quantum mechanics (supplementary to Dirac's Principles of Q.M.)'.
- Ms draft paginated 1 - 20.
- B.37 Contents of a folder inscribed 'Ionisation loss in semi-inf. cyl.': variously paginated ms notes and drafts, graphs.
- B.38-B.41 Contents of a folder inscribed '3D Old': typescript drafts.
- 4 folders.
- B.38 'Development of the non-linear field theory in 3D'.
- Typescript draft paginated NLD1 - NLD41.
- B.39 Untitled typescript draft paginated NLE1 - NLE28.
- B.40 '3D Transformations'.
- Typescript draft paginated NLF1 - NLF28.



Notes and drafts

- B.41            'Analogies, 1 & 3 Dimensions'.  
  
Typescript draft paginated mbl - mb40 (lacks mb21).
- B.42            Contents of a folder inscribed ' "Greens Function"  
1D 3D': shorter ms and typescript drafts.
- B.43 - B.45    Contents of a folder inscribed 'field theory old work':  
ms and typescript notes, drafts etc.  
  
3 folders.
- B.43            'Meson-nucleon interactions'.  
  
Typescript draft paginated 1 - 23 + 1p appendix.
- B.44            'Nucleon magnetic moments'.  
  
Typescript draft paginated 1 - 29, S1 - S3 + 3pp appendix.
- B.45            Miscellaneous ms notes, drafts, graphs etc.
- B.46            Drafts found stapled together:  
  
"Collective motion": classical dynamics'.  
  
Ms draft paginated CMCl - CMC6.  
  
'Alternative treatment'.  
  
Ms draft paginated 2CMCl - 2CMC4.

continued...

Notes and drafts

B.46 cont'd.. 'Classical comparisons'.

Ms draft paginated 3CM1 - 3CM2

Untitled draft paginated BC1 - BC4

B.47 'Collective nuclear motion'.

Typescript draft paginated CNM1 - CNM2.

'Rotational states'.

Typescript draft paginated 2CNM1 - 2CNM3.

'Collective rotational motion in nuclei'.

Typescript draft paginated DCRM1 - DCRM11.

B.48 'An effective [?nuclear potent]ial'.

Typescript draft paginated [DET1] - DET11.

Folder also includes graphs and variously paginated  
shorter ms and typescript drafts found with the preceding.

B.49 'Use of D.R.'

Ms notes paginated DRC1 - DRC5.



Notes and drafts

- B.50            'E.    The conjectured value of  $\epsilon$ '.
- Typescript draft paginated NLM E1 - NLM E5 and A NLM E6.
- B.51            'Are fermions fundamental?'
- Typescript draft paginated CL1 - CL5
- B.52            'Mesons and particles'.
- Typescript draft paginated HBL1 - HBL8.    The draft  
begins 'This talk is a continuation of a short series  
I gave last Autumn on my field theory program'.
- B.53            Ms and typescript draft paginated CNL1 - CNL16.    First  
page headed 'On the particle number'.
- B.54            Untitled ms draft paginated T5 - T14.
- Folder also includes miscellaneous shorter ms drafts.
- B.55            'The effective interaction between nucleons in nuclei'.
- 13pp ms draft.

Notes and drafts

- B.56            Contents of a folder inscribed 'X, Y, T characteristics'.  
                 Variously paginated ms drafts.
- B.57            'Multi-valuedness'.  
                 Ms and typescript draft paginated CR1 - CR7.
- B.58            'Construction of fermion operators'.  
                 Variously paginated typescript drafts.
- B.59            'A.    Conventional Theory'.  
                 Typescript draft paginated [1] - 6.    The draft begins  
                 '1.    Consider the relativistic quantum field theory of  
                 a system of bosons...'
- B.60            'Anticommutation'.  
                 Typescript draft paginated NLK1 - NLK28.
- B.61            Contents of Skyrme's folder:   ms and typescript drafts.  
                 'Ising Model    (Cohen)'.  
                 Ms draft paginated TSP11 - TSP13.

continued...



Notes and drafts

B.61 cont'd.. 'Radiation diffusion equation'.

Typescript draft paginated DR1 - DR2.

'Diffraction from a vibrating source'.

3pp typescript.

'Polarisation and plural scattering'.

Typescript draft paginated PHP1 - PHP3.

'Tensor interaction'.

4pp typescript.

'Brueckner model. Relation to meson model'.

1p ms.

B.62 'On the unitary transformation'.

Ms draft paginated 3BV1 - 3BV3.

'On the exclusion principle'.

Ms draft paginated 4BV1 - 4BV7.

B.63 - B.65 Contents of Skyrme's folder: ms and typescript drafts.

3 folders.

continued...

Notes and drafts

- B.63            'The self-consistent field in Brueckner's model'.  
Typescript draft paginated BM1 - BM3.  
  
'Brueckner's model. Self-consistent field in a finite volume'.  
Typescript draft paginated 2BM1 - 2BM3.  
  
'On Brueckner's model'.  
Typescript draft paginated 3BM1 - 3BM4.
- B.64            'Effective nuclear potential'.  
Typescript draft paginated VEP1 - VEP2.  
  
'The effective nuclear potential'.  
Typescript draft paginated EPC1 - EPC8 + 1p ms.
- B.65            Miscellaneous ms drafts on 'many-body theory',  
'Brueckner theory', etc.
- B.66            Variously paginated typescript notes and drafts.  
  
Includes drafts on 'the classical potential',  
'discontinuities in 3D', 'the compressibility formula  
for neutron scattering in He' and 'electromagnetic  
interactions and gauge transformations'.
- B.67            'Pascal's Hexagrammum Mysticum'.



Notes and drafts

B.68                   Untitled ms draft paginated 1 - 24, a - c.

Ms graphs.

B.69 - B.88           Miscellaneous notes, drafts, calculations etc. Due to the dearth of information on this material no attempt has been made to describe them in detail. Groups of notes have been kept together; there are also very many single sheets.

Although the notes and drafts are undated it seems very probable that the greater part of the material is from Skyrme's later years in Birmingham and includes papers he was working on at the time of his death.

20 folders.

SECTION C

MALAYA

C.1 - C.48

- This section is predominantly Skyrme's lecture notes and tutorial and examination papers from courses he gave whilst Senior Lecturer in the Department of Mathematics, University of Malaya, 1962-64.

The material was found in official University of Malaya folders with the title and sometimes the date of the course inscribed thereon. Although the original folders have not been retained the titles have been reproduced in the catalogue entries.

The lectures and tutorial papers are typescript, though frequently with ms corrections and annotations or with ms pages interleaved, and usually classified according to an alphanumeric system combining course identification with pagination (for example, 2C1 is page 1 of the second year course in Calculus).

The examination papers are duplicated typescript and cover the full period of Skyrme's lectureship. Interleaved with them are various typescript and ms draft questions.

There are also a few miscellaneous papers not found in University of Malaya folders but from the same period. They include a paper on symmetry Skyrme gave to the Malayan Maths Society (C.47).

The material is arranged as follows:

- C.1 - C.39 Lectures and Tutorial Papers
- C.40 - C.44 Examination Papers
- C.45 - C.48 Miscellaneous



Malaya

Lectures and Tutorial Papers

- C.1            'Lecture Notes Dynamics I, 1962'.  
  
First year course in Dynamics, paginated D1 - D71.  
With 'Notes on Angular Velocity and Angular Momentum'  
for first year Applied Mathematics course, 4pp;  
'Tutorial Questions' for Dynamics I, 4pp;    'Principles  
for Dynamical Problems', 2pp.
- C.2            'Lecture Notes Hydromechanics III, 1962'.  
  
'Third Year Hydromechanics (Completion)', paginated  
3HA1-3HA8.  
  
'Third Year Course in Hydrodynamics Basic Lecture Notes',  
paginated 1-14.  
  
'Hydromechanics', paginated H1-H50.
- C.3            'Lecture Notes Relativity Theory; Hon.1962 and Basic  
Notes Original'.  
  
'Honours Course in Relativity Theory Basic Lecture  
Notes', paginated 1-13.  
  
'Relativity Theory', paginated R1 - R36.
- C.4            'Lecture Notes: Statistical Mechanics, Hon.1962  
and Basic Notes Original'.  
  
'Honours Course in Statistical Mechanics Basic lecture  
notes', paginated 1-14.  
  
Honours course in statistical mechanics, paginated  
S1 - S41.

Malaya

- C.5            'Lecture Notes Vectors I, 1962'.  
First year course in Vectors, paginated V1 - V28.
- C.6            '1st Year Applied Maths Tutorials 1-12, 1962 Q & A'.  
First year course in Applied Mathematics, Tutorial  
Papers 1-12 and Test Paper.
- C.7            '1st Year Applied Maths Tutorials 13-23, 1962 Q & A'.  
First year course in Applied Mathematics, Tutorial  
Papers 13-23.
- C.8            'Hon. Applied Maths Tutorials, 1962'.  
Honours course in Electromagnetic Theory, Tutorial  
Paper 1.  
Honours course in Applied Mathematics, Tutorial Papers 2-5.
- C.9            'Electromagnetism (Honours)'.  
Honours course in Electromagnetism, variously paginated,  
with ms annotations dated in 1962 and 1963.
- C.10           'Electromagnetism (Honours)'.  
Clean copy of preceding, paginated [HEM1] - HEM70.
- C.11           'Quantum Theory Honours 1962 1963 (Part I)'.  
'Honours Course in Quantum Theory Basic Lecture Notes',  
paginated 1-38.  
Honours course in Quantum Theory, paginated Q1 - Q45.



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- C.12            'Quantum Theory/Hon (part 2)'.  
  
Continuation of preceding, paginated Q46 - Q111.  
(pp Q87 - Q100 missing).
- C.13            'III Potential Theory and Hydrodyn; Tutorial Papers  
1962; III Pot. Theory, Dynamics, Hydromech, 1963'.  
  
Third year course in Applied Mathematics 1962,  
Tutorial Papers 1 - 6 and Test Paper.  
  
Third year courses in Mathematics and Applied Mathematics  
1963, Tutorial Papers 1 - 25.
- C.14            'Calculus II, 1963 (Completion); Statistics I (Completion);  
Statistics III (begin)'.  
  
'Second Year Calculus Course (Completion)', paginated  
2C1 - 2C21.  
  
'First Year Statistics (Completion)', paginated  
1ST1 - 1ST6.  
  
Third year course in Statistics, paginated 3PS1 - 3PS25.
- C.15            'Lecture Notes Dynamics II, 1963'.  
  
Second year course in Dynamics, paginated 2D1 - 2D74  
(pp.2D63-2D70 missing). With title page giving plan  
of the course.
- C.16            'Lecture Notes Additional Dynamics II, 1963'.  
  
Second year course in Additional Dynamics, paginated  
2AD1 - 2AD39.
- C.17            'Lecture Notes Gravitation II, 1963'.  
  
Second year course in Gravitation, paginated G1 - G22.

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- C.18            'Gravitation II 1963'  
Clean copy of preceding, paginated G1 - G31.
- C.19            'Algebra III, 1963 (part 1)'.  
Third year course in Algebra, paginated A1 - A57.
- C.20            'Algebra III (1963) (part 2)'.  
Continuation of preceding, paginated A81 - A140.
- C.21            'Electricity & Magnetism III, 1963'.  
Third year course in Electricity and Magnetism, paginated  
EM1 - EM18, EM21 - EM31, EM75, EM76. With 3pp 'Problem'.
- C.22            'Electricity and Magnetism III 1963'.  
Clean copy of preceding, paginated [EM1] - EM39.
- C.23            'Hydromechanics Honours, 1963'.  
'Honours Course in Hydromechanics', paginated HH1 - HH43.
- C.24            'Potential Theory III, 1963'.  
Third year course in Potential Theory, paginated  
PT1 - PT67.
- C.25            'Potential Theory III 1963'.  
Clean copy of preceding, paginated [PT1] - PT79.
- C.26            'Vector Analysis (II)'  
Part one of second year course in Vector Analysis,  
paginated VA1 - VA37. Page VA36 is dated 1963.



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- C.27            'Vector Analysis (II) 1963 (part 2)'.  
Continuation of preceding, paginated VA47 - VA75.
- C.28, C.29    'Vector Analysis (II)'.  
Clean copy of C.26, C.27, paginated [VA1] - VA102.  
2 folders.
- C.30            'II Tutorial Papers Mathematics 1963 Papers 1 - 15'.  
Various second year courses in Mathematics, Tutorial  
Papers 1 - 15.
- C.31            'Tutorial Papers Second Year 1963 Papers 16 - 25'.  
Various second year courses in Mathematics, Tutorial  
Papers 16 - 25.
- C.32            'Tutorial Papers and Solutions Honours, Applied, 1963  
Papers 1 - 13'.  
Honours course in Mathematics, Tutorial Papers 1 - 13.
- C.33            'Tutorial Papers Honours Applied (C & D) 1963  
Papers 14 - 25'.  
Honours course in Mathematics, Tutorial Papers 14 - 25.

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- C.34            'III Tutorial Papers Mathematics (Pure) 1963'.  
  
Third year courses in Mathematics and Pure Mathematics,  
Tutorial Papers 2, 4, 6, 8, 10-13, 15, 17, 19, 21-25.
- C.35, C.36     'Fundamentals of Mathematics (Part I)'.  
  
Course in 'Fundamentals of Mathematics' (Algebra,  
Analysis and Geometry)', paginated FMO-FM106. Nd.  
  
2 folders.
- C.37            'Fundamentals of Mathematics (Part 2)'.  
  
Continuation of preceding, paginated FM111-FM175.
- C.38            'Misc Notes'.  
  
'Dirac's Delta Function', paginated AH1-AH5, 1962.  
  
Various second year courses in Mathematics 1964,  
Tutorial Papers 1-3, 5.  
  
Honours course in Mathematics 1964, Tutorial Papers  
1-5.  
  
Various third year courses in Mathematics 1964,  
Tutorial Papers 1-4.  
  
'Fourier's Theorem', unpaginated (18pp), nd.  
  
'Statics II', paginated 2MS1-2MS18, nd.  
  
Skyrme's notes on topics covered by 'Electricity and  
Magnetism III', nd, 2pp.
- C.39            Lecture material not found in University of Malaya  
folders.  
  
'Dynamics III', paginated 3D1-3D23, nd.  
  
'Advanced Calculus Honours Course - 1964/65', paginated  
AC1-AC17. As with the syllabus at C.46 this was probably  
prepared shortly before Skyrme's return to UK in 1964  
to take up the chair at Birmingham University.



Malaya

Examination Papers

- C.40, C.41      'Pure Maths Exam Papers Jan 1962, Jan 1963, May 1963, Jan 1964'.  
  
2 folders.
- C.42-C.44      'Applied Maths Exam Papers Jan 1962, Jan 1963, May 1963, Jan 1964'.  
  
3 folders.
- In C.42 is a letter from a colleague at the University of Chicago sending 2 questions (with solutions) on Dynamics.

Miscellaneous

- C.45            Problem sheets, Second Year Applied Mathematics, 1961-62. Not by Skyrme, inscribed 'V J Emery' on front. 19pp duplicated typescript.
- C.46            Department of Mathematics Syllabus, 1964-65. 27pp.
- C.47            'Symmetry', paper given by Skyrme to 'Mal. Maths Soc.', 22 January 1964. 7pp typescript with ms annotation. Listed by R H Dalitz in Appendix U of his article in International Journal of Modern Physics A, Vol.3, No.12 (1988), 2743.
- C.48            Contents of a folder inscribed 'THRS' on cover.
- With the contents of this folder was found a Malayan receipt dated 15 January 1963.
- 'Unitary Transformation and Many-Body Theory', ms notes, paginated 2BU1-2BU12.
- Misc ms calculations and notes.

SECTION D

BIRMINGHAM

D.1 - D.54

This section is divided between Skyrme's teaching material (by far the greater part) and material reflecting his consultancy work for researchers in other university departments and outside the university.

The teaching material covers virtually the whole of Skyrme's career as Professor at Birmingham, 1964-87 and includes undergraduate and post-graduate courses taught by Skyrme and a few research seminars attended or given by him. His lecture notes are usually typescript with occasional manuscript additions and corrections and are often classified with the alphanumeric system which he had employed for many of the research notes and drafts in Section B, and the University of Malaya lecture notes in Section C. For some of the undergraduate courses there are also examples of course problems and examination questions with their solutions.

The consultancy material, principally Skyrme's ms notes and calculations, relates to the advice he gave on mathematical problems to researchers in departments such as Metallurgy and Materials, Chemical Engineering and Mechanical Engineering, and (outside the University) to Wolverhampton and Dudley Breweries.

The material is arranged as follows:

D.1 - D.48	Teaching
D.49- D.54	Consultancy Work



Birmingham

TEACHING

Undergraduate courses

- D.1                    Mathematics for Physicists, 1965-66.  
  
Lecture notes, paginated MfP22 - MfP24.  
  
Problems and solutions, terminal examination paper  
and solutions.
- D.2 - D.11            Course MS 1/4.    Mathematical Applications and Methods.
- D.2 - D.4            'Original typescript MS 1/4 1968/69'.    Contents of a  
folder so inscribed, divided into three for ease of  
reference..
- D.5 - D.9            'MS 1/4 Spring 1969'.    Contents of a folder so inscribed,  
divided into five for ease of reference.    Includes 'Course  
MS 1/4 Spring Term 1969-70' and 'Course MS 1/4 Applied  
Mathematics'.
- D.10, D.11           Miscellaneous typescript drafts, 1967, 1969.  
  
2 folders.
- D.12, D.13           MS 3/18 Differential Equations, 1971-72.  
  
82pp lecture notes.  
  
2 folders.

Birmingham

- D.14, D.15      Duplicated typescript divided into chapters numbered 11-17. The material was found in a folder inscribed 'Group studies 1972. Paper II',
- D.14            Chapter 11. 'Introduction to Newtonian mechanics'.  
Chapter 12. 'Motion of a particle in one dimension'.  
Chapter 13. 'Forces in 3D'.  
Chapter 14. 'Motion of a particle in three dimensions'.
- D.15            Chapter 15. 'Motion of a system of particles'.  
Chapter 16. 'Introduction to rigid body dynamics'.  
Chapter 17. 'Variable mass problems'.
- D.16            Mathematics 2.1a, 1973-74.  
  
Lecture notes on probability theory, paginated 71-92.  
  
Lecture notes on statistics for 1971-72, paginated 93-96 and found with preceding.  
  
Problems and solutions.
- D.17, D.18      MS 3/1, 1973-74.  
  
Lecture notes, paginated L1 - L65.  
  
2 folders.



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- D.19            MS 262 Engineering Systems, 1980-81.  
Lecture notes, problems and solutions.
- D.20            MS 316 Information Theory.  
Lecture notes, problems and solutions, 1980, 1981, 1984.
- D.21-D.25       MS 223 Differential Equations, 1983-84.
- D.21, D.22       Lecture notes paginated D.40-119.       2 folders.
- D.23            Summary course notes paginated [DS1] - DS24.
- D.24            Problems and solutions.
- D.25            Examination questions and answers, draft examination papers.
- D.26, D.27       MS 314 Concept of Quantum Mechanics, nd.    Variously paginated lecture notes.  
2 folders.
- D.28-D.32       PH 327 (MA 394) Mathematics, 1984-85, 1985-86.
- D.28-D.30       Variously paginated lecture notes, 1984-85, 1985-86.  
3 folders.

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- D.31            Problems and solutions, 1984-85.
- D.32            Problems and solutions, 1985-86.
- D.33, D.34     MA 252   Engineering Systems,   Spring 1985, Spring 1986.
- D.33            Lecture notes paginated MES1 - MES90,   1985.
- D.34            Problems and solutions, 1985 and 1986.
- D.35, D.36     MA 310B   Information Theory and Coding,   Summer 1985.
- D.35            Lecture notes, paginated IT1 - IT40.
- D.36            Problems and solutions.
- D.37 - D.40     MA 291   Complex Variable Theory and Laplace Transforms and  
                 Other Applications,   Spring 1986.
- Variously paginated ms and typescript drafts incorporating  
                 1972-73, 1983 and 1984 material.
- 4 folders.
- D.41, D.42     'Workshops'.   Contents of a folder so inscribed, divided  
                 into two for ease of reference.
- Includes material re workshop projects in applied  
                 mathematics.



Birmingham

Postgraduate courses

D.43, D.44      Field Theory, nd.  
  
Lecture notes paginated F1 - F16, F21 - F72, F81 - F100,  
F111 - F121.  
  
2 folders.

D.45              Gauge Field Theories, nd.  
  
Lecture notes paginated G1 - G10, G23 - G44, G49 - G80.

Colloquia and seminars

D.46              Physics Colloquium, 20 February 1985.  
  
Untitled ms and typescript draft by Skyrme, paginated  
PC1 - PC27.  
  
The draft begins 'I have been asked to say something in  
a simple way about ideas that have interested me for a  
long time. They are all ultimately related to the  
Q - what is matter? how should we describe it? -  
the problem that has always been of deepest interest  
to physicists, particularly theorists! '

D.47              Miscellaneous material re applied mathematics and  
mathematical physics seminars, 1986 and nd.  
  
Notices, abstracts, Skyrme's ms notes.

Birmingham

D.48                   Transparencies for research seminar on skyrmions,  
                      ?1986 or 1987.

CONSULTANCY WORK

D.49 - D.54       Ms notes, calculations, computer print outs etc.,  
                      re advice on mathematical problems to researchers  
                      in other departments and outside the university.  
                      Includes material re 'tool heat' problem for  
                      researcher in Department of Metallurgy and Materials  
                      and 'tilting a hogshead' for Wolverhampton and Dudley  
                      Breweries.

6 folders.



SECTION E

PUBLICATIONS

E.1

E.1 Published papers 1943-88. Not a complete set.

1 Box.

This includes the posthumously published talk on 'The origin of Skyrmions', International Journal of Modern Physics A, Vol.3, No.12 (1988) 2745-2751, and two biographical articles by R H Dalitz in Dalitz and R B Stinchcombe eds. A Breadth of Physics 205-219 and in International Journal of Modern Physics A, Vol.3, No.12 (1988) 2719-2744.

Dalitz's International Journal of Modern Physics article includes a list of publications (pp.2742-2743)