

CONTENTS

Invited lectures

<u>A. Supersymmetry and graded Lie algebras</u>	1
1. V. Rittenberg: A guide to Lie superalgebras	3
2. S. Ferrara: Supergravity in the physics of particles and fields	22
3. B. Kostant: Harmonic analysis on graded (or super) Lie groups	47
 <u>B. Concepts of symmetry and disorder arising from molecular physics</u>	 51
1. A. Kerber: The diagram lattice as structural principle in mathematics	53
2. H. Primas: Kinematical symmetries in molecular quantum mechanics	72
3. H. Frei and Hs. H. Günthard: Symmetry of non-rigid molecules	92
 <u>C. Symplectic structures and many-body physics</u>	 115
1. S. Sternberg: Some recent results on the metaplectic representation	117
2. D.J. Rowe and G. Rosensteel: The nuclear collective model and the symplectic group	144
3. A. Grossmann: Geometry of real and complex canonical transformations in quantum mechanics	162
4. P. Kramer: Composite particles and symplectic (semi-)groups	180

D. <u>Symmetry breaking in statistical mechanics and field theory</u>	201
1. J.L. Birman: Group theory of the Landau-thermodynamic theory of continuous phase transitions in crystals	203
2. G.G. Emch: Phase transitions, approach to equilibrium, and structural stability	223
3. L. Michel: Topological classification of symmetry defects in ordered media	247
4. H.P. Dürr: Dynamical origin of symmetry	259
E. <u>Automata and systems as examples of applied (semi-)group theory</u>	283
1. C. Lobry: Action of control semigroups on manifold and application to realization theory	285
2. H. Jürgensen: Some applications of the theory of semigroups to automata	307
F. <u>Renormalization group and critical phenomena</u>	323
J.M.J. van Leeuwen: Position space renormalization group	325
G. <u>Gauge fields</u>	343
L. O'Raifeartaigh: Static solitons in more than one dimension	345

Contributed papers

I. <u>Supersymmetry, symmetry in particle and relativistic physics</u>	357
1. S. Albeverio and R. Höegh-Krohn: Remarks on the energy representation of Sobolev-Lie groups	359
2. J.P. Antoine and C. Malou: Unbounded representations of the Poincaré and Gauge groups in the indefinite metric quantization of the electro- magnetic field	361
3. N. Backhouse: On the construction of graded Lie algebras	364
4. L.C. Biedenharn and L.P. Horwitz: Exceptional parafermions in a Hilbert space over an associative algebra	367
5. G. Burdet and M. Perrin: The SU(4) nuclear symmetry revisited	370
6. J.P. Dahl: The spinning electron	373
7. M. Daumens, M. Perroud and P. Winternitz: Group theoretical expansions of scattering amplitudes for particles with spin	376
8. F. González-Gascón: On the extension of vector fields and the superluminal transformations	379
9. H. Hoogland: A group theoretical derivation of the minimal coupling in elementary quantum mechanics	382
10. H. Nicolai: Towards a constructive approach to supersymmetric ϕ^3	385
11. J. Patera, P. Winternitz and H. Zassenhaus: The maximal abelian subgroups of the conformal group of space-time	388
12. T.S. Santhanam: The exceptional groups as candidates for supersymmetry	391
13. Dj. Šijački: Quark bag excitations, SL(3,R) spectrum generating group and vector states in e^+e^- annihilation	394

II. <u>Symmetry in molecular and solid state physics</u>	397
1. M. Boon and J. Zak: Completeness of networks of states	399
2. P.M. van den Broek: PUA representations of Shubnikov space groups and selection rules	402
3. A.P. Cracknell and B.L. Davies: Computer programs for determining wave vector selection rules (WVSRs) for space groups	405
4. B.L. Davies and A.P. Cracknell: Results of computer programs for determining the reductions of the Kronecker products of the irreducible representations of space groups	408
5. R. Dirl: Compatibility relations for factor systems and space group representations	411
6. A. Janner and T. Janssen: Bravais lattices associated with incommensurate crystal phases	414
7. B.R. Judd: Ligand polarizations and lanthanide ion spectra	417
8. R.W.J. Roël: Basic exchange integrals and the triple double coset symbol	420
III. <u>Broken symmetry and phase transitions</u>	423
1. G. De Concini and G. Vitiello: Group Contractions and infrared effect in theories with spontaneous breakdown of symmetry	425
2. F. Constantinescu and H.M. Ruck: Instantons in lattice models with discrete symmetries	429
3. M. Hongoh and D. Matz: Spontaneous breakdown of symmetry and the generalized coherent states	432
4. M.V. Jarić and J.L. Birman: Molien function and calculation of invariant polynomials for space groups	436
5. A.J. Kálnay: Gauge fields and quantum liquids	441

6. P. Kasperkovitz: A new model of a structural phase transition	444
7. L. Michel and J. Mozrzymas: Application of Morse theory to the symmetry breaking in the Landau theory of second order phase transition	447
8. J.P. Provost and G. Vallee: Spontaneous breakdown of the gauge symmetry and observable phase operator	462
IV. <u>Structure of groups and dynamical systems</u>	465
1. M. Dal Cin and E. Dilger: Semigroups and effective structures of automata	467
2. L.L. Boyle and K.F. Green: Studies of some physically-relevant representation groups	470
3. E. Dilger: Effective decompositions of automata	473
4. M. Hazewinkel: On invariants and canonical forms for linear dynamical systems	476
5. B. Kümmerer: Mean ergodic semigroups of contractions in W^* -algebras	479
V. <u>Representations of groups and Lie algebras</u>	483
1. C. Bretin and J.P. Gazeau: About some series associated to complex semi-simple Lie algebras	485
2. J.P. Gazeau, M.Cl. Dumont-Lepage and A. Ronveaux: Gelfand lattice polynomials and finite irreducible representations of $GL(n, \mathbb{C})$	488
3. J.W.B. Hughes: Partitions of integers and Lie algebras	491
4. Y. Ilamed: Lie elements, the killing form and trace identities	494
5. R.C. King and A.H.A. Qubanchi: Branching Rule $SO(7) \rightarrow G_2$	497
6. W. Laskar: Simplified Racah's eigenvalue formula for the second order Casimir operator	500

7. K. Srinivasa Rao:
A note on the series expansions for the Racah coefficient 503
8. J. Yadegar:
Construction of $O(3)$ shift operators and their use in
classification of Lie algebras 506

VI. General symmetries, quantization 509

1. F.J. Bloore and S. Swarbrick:
Wave functions of identical particles 511
2. M. Brunet:
The metaplectic Semigroup and the implementation of
complex linear canonical transformations in quantum
mechanics 512
3. G. Burdet and M. Perrin:
Weyl quantization and metaplectic representation 515
4. U. Cattaneo:
On quantum mechanical symmetry groups 518
5. P. Kramer, M. Moshinsky and T.H. Seligman:
Non-bijective canonical transformations and their
representations in quantum mechanics 521
6. U. Niederer:
Kinematical symmetries of the nonlinear diffusion
equations 522
7. J.F. Pommaret:
Lie pseudogroups and the structure of physical laws 525
8. A. Rieckers:
Equivalence of Kadison and Wigner symmetries in
traditional quantum mechanics 528
9. M. Romero:
The coherent states associated with a compact semi-
simple Lie group 531
10. R.N. Sen:
Theory of symmetry of infinite systems 534
11. M.C. Singh:
Group theoretic approach to similarity analysis with
applications to the problems of wave propagation 537
12. I. Szczyrba:
Generalized number operator in the Fock representation 540
13. J. Tolar:
Quantization and deformation theory 543