TABLE OF CONTENTS

OPENING SESSION

BOGOLUBOV, N.N., Academy of Sciences USSR: On Some Problems Associated with the Foundation of Statistical Mechanics 1

LÄMMERT, E., President of the Freie Universität Berlin: Begrüßungs-Ansprache zur 6th International Conference on Mathematical Physics, Berlin 1981 2

STATISTICAL MECHANICS

General Plenary Session:

FEIGENBAUM, M.J.: Periodicity and the Onset of Chaos 7

SINAI, Ya.G.: Lorentz Gas and Random Walks 12

FRÖHLICH, J., SPENCER, T.: The Kosterlitz-Thouless Transition 15

Special Plenary Session, Organized by J. Lebowitz:

GOLDSTEIN, S.: Mechanical Models of Brownian Motion 21

GRUBER, Ch., MARTIN, Ph.A.: Goldstone Theorem in Statistical Mechanics 25

BRICMONT, J., FONTAINE, J.-R., LEBOWITZ, J.L.: Some Inequalities Related to Roughening 29

SPOHN, H.: Self-Diffusion as an Example for the Hydrodynamic Limit 33

QUANTUM FIELD THEORY and STATISTICAL MECHANICS

General Plenary Session:

AIZENMAN, M.: Geometric Analysis of ϕ^4 Fields and Ising Models 37

SYMANZIK, K.: Some Topics in Quantum Field Theory 47

QUANTUM FIELD THEORY

Special Plenary Session, Organized by K. Osterwalder:

BUCHHOLZ, D.: What Is the State Space of Quantum Electrodynamics? 59

FRÖHLICH, J.: Results and Problems Near the Interface Between Statistical Mechanics and Quantum Field Theory 64

GAWEDZKI, K., KUPIAINEN, A.: A Renormalization Group Based Convergent Expansion for a Class of Massless Lattice Models 75

IMBRIE, J.Z.: Phase Diagrams for Low Temperatures $P(\phi)_2$ Quantum Field Models 79

STREATER, R.F.: Covariant Representations of Massless Fermi Fields 83

FLUID DYNAMICS

General Plenary Session:

GLIMM, J.: Singularities in Fluid Dynamics 86

GENERAL RELATIVITY (Classical Aspect)

Special Plenary Session, Organized by J. Choquet-Bruhat:

CHRISTODOULOU, D.: The Boost Problem 98

MONCRIEF, V.: Singularities, Cauchy Horizons and Extensions of a Large Class of Einstein-Maxwell Spacetimes 105

SEIFERT, H.-J.: Asymptotic Structure in General Relativity 111

GENERAL RELATIVITY (Quantum Aspect)

Special Plenary Session, Organized by C.J. Isham:

KUNSTATTER, G.: Yang-Mills Theory in a Multiply Connected Three Space 118

TAYLOR, J.G.: Recent Developments in Supergravity 123

QUANTUM MECHANICS

Parallel Session, Organized by J. Ginibre:

AVRON, J.E.: Bragg Scattering from Point Interactions: An Explicit Formula for the Reflection Coefficient 126

DAVIES, E.B.: Stability of Molecular Eigenstates 129

JONA-LASINIO, G., MARTINELLI, F., SCOPPOLA, E.: Description of the Semiclassical Limit of Quantum Mechanics in Terms of Diffusion Processes 132

MOURRE, E.: Algebraic Approach to Some Propagation Properties of the Schrödinger Equation 134

YAFAEV, D.R.: Scattering Theory for Time-Dependent Hamiltonians 138

General Plenary Session:

AGMON, S.: How Do Eigenfunctions Decay? The Case of n-Body Quantum Systems 142

SIGAL, I.M.: Geometric Methods in Quantum Many-Body Problem 149

SIMON, B.: Almost Periodic Schrödinger Operators: A Review 157

WEDER, R.: Scattering Theory for Obstacles with Infinite Boundaries 158

FOUNDATION OF QUANTUM MECHANICS

Parallel Session, Organized by A.S. Wightman:

ASPECT, A.: Experimental Tests of Bell's Inequalities 162

HAAG, R.: Mathematical Structure of Orthodox Quantum Theory and Its Relation to Operationally Definable Physical Principles 168

LUDWIG, R., NEUMANN, H.: Connections of Different Approaches to the Foundation of Quantum Mechanics Based on a Description of Preparing and Recording of Microsystems 173

PIRON, C.: What Is Wrong in Orthodox Quantum Theory? 179

General Plenary Session:

WIGHTMAN, A.S.: Parallel Session on the Foundations of Quantum Mechanics 183

NONLINEAR ANALYSIS AND INTEGRABLE SYSTEMS

General Plenary Session:

SIMMS, D.J.: Symplectic Geometry and Quantisation 184

ZAKHAROV, V.E.: Integrable Systems in Multidimensional Spaces 190

Special Plenary Session, Organized by J. Moser:

DEIFT, P., NANDA, T., TOMEI, C.: Ordinary Differential Equations and the Symmetric Eigenvalue Problem 217

JIMBO, M.: Theory of τ Functions in Integrable Systems 232

NOVIKOV, S.P.: The Kirchhoff Type Equations and Multivalued Functionals 238

RAUCH, J.: Singularities of Solutions of Semilinear Wave Equations 241

GAUGE THEORIES

Special Plenary Session, Organized by R. Stora:

JAFFE, A.: New Results for Classical Gauge Theories: Qualitative and Exact 242

MACK, G.: Lattice Gauge Theory 250

FUNCTIONAL INTEGRATION

General Plenary Session:

ALBEVERIO, S.: Some Applications of Functional Integration 265

Parallel Session, Organized by S. Albeverio:

BERTRAND, J., RIDEAU, G.: Stochstic Jump Processes in the Phase Space Representation of Quantum Mechanics 276

COMBE, Ph., RODRIGUEZ, R., SIRUGUE, M., SIRUGUE-COLLIN, M.: Applications of Jump Processes to Quantum Mechanics and Relativistic Bose Field Theory 278

STREATER, R.F.: Quantum Stochastic Processes 282

HIDA, T., STREIT, L.: Generalized Brownian Functionals 285

ELWORTHY, K.D., TRUMAN, A.: A Cameron-Martin Formula for Feynman Integrals (The Origin of the Maslov Indices) 288

WILLIAMS, D.N.: Instanton Gas Parameters in the Double Well Model 295

GROUP THEORY

Parallel Session, Organized by M. Flato:

LACHAUD, G.: Scattering Theory and Automorphic Functions 298

RIDEAU, G.: Extensions of Unitary Irreducible Representations of Poincare Group. Application to Quantum Field Theory 302

SIMON, J.C.H.: Nonlinear Group Representations and Applications to Nonlinear Equations 305

SOKATCHEV, E.: Supersymmetry, Supergravity and Geometry 308

STERNHEIMER, D.: Deformation Theory Applied to Quantization and Group Representations 314

TODOROV, I.T.: Conformal Invariance in (Gauge) Quantum Field Theory 319

DAOXING XIA: On the Representations of the Group of Diffeomorphisms and the Local Current Algebra 324

General Plenary Session:

FLATO, M.: Presentation of the Contributions in Group Theory at this Conference 327

FRONSDAL, C.: Generalized Gauge Theories and the Constituents of Massless Particles 329

MICHEL, L.: Symmetry in Condensed Matter Physics 336

SCHMID, W.: Singular Unitary Representations and Indefinite Harmonic Theory 348

OPERATOR ALGEBRAS

Parallel Session, Organized by R. Haag:

BELLISSARD, J.: Schrödinger Operators with Almost Periodic Potential: An Overview 356

BRONING, E.: A Note on Non-Linear Aspects of QFT 364

BUCHHOLZ, D., FREDENHAGEN, K.: Locality and the Structure of Particle States in Gauge Field Theories 368

LONGO, R.: Modular Automorphisms of Local Algebras in Quantum Field Theory 372

ROBERTS, J.E.: The Search for Quantum Differential Geometry 374

DISORDERED SYSTEMS

Parallel Session, Organized by J. Bellissard:

KIRSCH, W., MARTINELLI, F.: On the Spectrum of Schrödinger Operators with a Random Potential 380

KUNZ, H., SOUILLARD, B.: Localization: Physical Picture and Exact Results 383

SCHNEIDER, W.R., BERNASCONI, J.: Diffusion in One-Dimensional Lattice Systems with Random Transfer Rates 389

WESTWATER, J.: Edwards's Model for Long Polymer Chains 394

QUANTUM CHROMODYNAMICS

Status Report:

LEUTWYLER, H.: On the Status of QCD 397

GENERAL RELATIVITY AND COSMOLOGY

Status Report:

EHLERS, J.: Some Advances and Problems in Classical General Relativity 411

ASHTEKAR, A.: From General Relativity to Quantum Gravity 417

POSTER SESSION 423

Unfortunately the manuscripts of the following speakers were not available in time:
E. Alfsen, E. Brezin, I. Herbst, J. Lewis, C.J. Pope