

数理解析研究所講究録 1150

ソーフィス・リー没後百年記念

国際研究集会

京都大学数理解析研究所

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RIMS Kokyuroku 1150

*Lie Groups, Geometric Structures
and
Differential Equations*

- One Hundred Years after Sophus Lie -



April, 2000

Research Institute for Mathematical Sciences

Kyoto University, Kyoto, Japan

Preface

On the occasion of the centennial after the death of Sophus Lie, an International Conference entitled "Lie Groups, Geometric Structures, and Differential Equations - One Hundred Years after Sophus Lie" took place in December 1999 in Kyoto and Nara, at RIMS Kyoto University (Dec.13 - 17) and at Nara Women's University (Dec.19 - 21).

The influence of Sophus Lie on our mathematics of this century is so immense and so deep that it is almost out of our scope to overview all the aspects developed after Lie. But we wished that the conference would give us an opportunity to contemplate and discuss what Lie pursued, what developments had been achieved during this century and what would be important for the coming century, with the emphasis on the links between Lie groups, geometry and differential equations.

There were thirty-two lectures given by mathematicians of various countries and more than one hundred twenty participants.

This volume of Kokyuroku is an abridged version of the proceedings of the conference and contains short papers prepared for the lectures. An expanded version of the proceedings will be published in *Advanced Studies in Pure Mathematics*.

Originally a plan of the conference started at the birthplace of Sophus Lie, Nordfjord-Eid, where International Sophus Lie Centre organized an International Workshop in June 1996 and Professor B. Komrakov proposed at the Workshop to open an international conference in the special year 1999. The conference had been prepared mainly through the cooperation of ISLC and Japanese mathematicians, in particular, through the preparatory workshops entitled "Towards 100 years after Sophus Lie" held successively at Kyoto University of Education (April 11 - 12, 1997), at Kazan State University (September 7 - 17, 1998), and at Yamaguchi University (November 4 - 6, 1998). (The Volumes 3, 4 (1998) of the *Lobachevskii Journal of Mathematics* is devoted to the proceedings of the Kazan Workshop.)

The conference was made possible thanks to the support of RIMS Kyoto University, Grant-in-Aid for Scientific Research of the Ministry of Education, Science, Sports and Culture of Japan, and Nara Women's University, and above all, to the cooperation of many friends of many countries.

I would like to express my sincere gratitude to all those who have helped us for the conference.

Nara, April 2000
Tohru Morimoto

*“Don't follow in the wake of a sage of old,
but try to embark on the quest he pursued.”
(Matsuo Basho, Translated by S. Ando)*

International Conference
on
Lie Groups, Geometric Structures and Differential Equations

— *One Hundred Years after Sophus Lie* —

December 13 (Monday) - 17 (Friday), 1999
Research Institute for Mathematical Science, Kyoto University

December 19 (Sunday) - 21 (Tuesday), 1999
Memorial Hall, Nara Women's University

Supported by

Grants-in-aid for Basic Scientific Research, Ministry of Education, Science and Culture, Japan,
Research Institute for Mathematical Science, Kyoto University,
Nara Women's University

Organizing Committee

B. Komrakov, M. Kuranishi, B. Malgrange,
T. Morimoto (chairman), H. Sato, K. Yamaguchi

Program

December 13 (Monday)

- 9:00 – 9:15:** **Opening**
- 9:30–10:30:** **M. Kuranishi (Columbia Univ.)**
Lie groups and complex analysis
- 11:00–12:00:** **P. Tomter (Univ. of Oslo)**
Isometric immersions of homogeneous spaces
- 13:30–14:30:** **S. Kaneyuki (Sophia Univ.)**
Recent development in geometry of parahermitian symmetric spaces
- 15:00–16:00:** **J. Slovak (Masaryk Univ., Brno)**
Bernstein-Gelfand-Gelfand sequences
- 16:30–17:30:** **K. Yamaguchi (Hokkaido Univ.)**
Geometry of higher order differential equations of finite type associated with symmetric spaces

December 14 (Tuesday)

- 9:30–10:30:** **B. Komrakov (Kazan State Univ., International Sophus Lie Centre)**
Transformation groups and geometric structures (on some Sophus Lie ideas in differential equations)
- 11:00–12:00:** **J. P. Ramis (Univ. of Toulouse)**
Differential Galois group and integrability of hamiltonian systems

- 13:30–14:30:** **A. Onishchik (Yaroslavl State Univ., International Sophus Lie Centre)**
 Supermanifolds associated with the cotangent bundle
- 15:00–16:00:** **A. Cap (Univ. of Wien)**
 Almost CR-manifolds of CR-dimension and codimension two
- 16:30–17:30:** **H. Umemura (Nagoya Univ.)**
 Lie-Drach-Vessiot Theory and Painlevé equations
- 18:30–20:30:** **Reception**

December 15 (Wednesday)

- 9:30–10:30:** **K. Saito (RIMS, Kyoto Univ.)**
 Elliptic Lie Algebra (beyond Kac-Moody Algebra)
- 11:00–12:00:** **B. Malgrange (Institut Fourier)**
 On the characteristic variety of analytic differential systems
- 13:30–17:00:** **Excursion in Kyoto**

December 16 (Thursday)

- 9:30–10:30:** **T. Nomura (Kyoto Univ.)**
 Berezin transforms and Laplace-Beltrami operators on homogeneous Siegel domains
 — commutativity, symmetry of the domain and a Cayley transform —
- 11:00–12:00:** **O. Mathieu (Univ. of Lyon)**
 Connections on stable bundle
- 13:30–14:30:** **S. J. Cheng (National Cheng-Kung Univ.)**
 Infinite-dimensional simple transitive Lie superalgebras of vector fields
- 15:00–16:00:** **M. Wakimoto (Kyushu Univ.)**
 Some aspects of representation theory of affine Lie superalgebras
- 16:30–17:30:** **H. Urakawa (Tohoku Univ.)**
 Yang-Mills theory in Einstein-Weyl geometry and affine geometry

December 17 (Friday)

- 9:30–10:30:** **H. Sato (Nagoya Univ.)**
 Construction of contact diffeomorphisms from Schwarzian derivatives
- 11:00–12:00:** **H. Goldschmidt (Columbia Univ.)**
 Infinitesimal spectral rigidity of symmetric spaces
- 13:30–14:30:** **B. Doubrov (Kazan State Univ., International Sophus Lie Centre)**
 Contact invariants of ordinary differential equations
- 15:00–16:00:** **P. J. Olver (University of Minnesota)**
 Moving frames — in geometry, invariant theory, computer vision and numerical analysis
- 16:30–17:30:** **D. Tunitsky (International Sophus Lie Centre)**
 Global multivalued solutions of Monge-Ampère equations (with computer program demonstration)

December 18 (Saturday)

13:00–16:00: Sumoh and Noh in the Nara Park

December 19 (Sunday)

9:30–10:30: H. Omori, A. Yoshioka (Science Univ. of Tokyo) and Y. Maeda (Keio Univ.)

Anomalous exponent of quadratics in deformation quantizations

11:00–12:00: S. Gindikin (Rutgers Univ.)

Complex integral geometry on real semisimple Lie groups

14:00–17:00: Excursion to Horyuji

December 20 (Monday)

9:30–10:30: G. Ishikawa (Hokkaido Univ.)

Recent results on developable submanifolds: Examples and classifications

11:00–12:00: R. Bryant (Duke Univ.)

On some applications of Cartan's generalization of Lie's Third Fundamental Theorem

13:30–14:30: R. Miyaoka (Sophia Univ.)

Lie sphere geometry and Lie contact structure

15:00–16:00: J. Krasil'shchik (Moscow Independent Univ., International Sophus Lie Centre)

Complete integrability of nonlinear PDE and supersymmetry

16:30–17:30: P. Kersten (Univ. of Twente)

Supersymmetries and recursion operators for $N=2$ supersymmetric KdV-equation

December 21 (Tuesday)

9:00–10:00: K. Kiyohara (Hokkaido Univ.)

On manifolds whose geodesic flows are integrable

10:15–11:15: J. Conn (Univ. of Minnesota)

Levi-Malcev theorems in smooth Poisson algebras

11:30–12:30: T. Morimoto (Nara Women's Univ.)

Geometric structures and differential equations on filtered manifolds

13:30–15:00: Farewell dinner

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ソーフィス・リー没後百年記念国際研究集会
 Lie Groups, Geometric Structures and Differential Equations
 - One Hundred Years after Sophus Lie -

研究集会報告集

1999年12月13日～12月17日

1999年12月19日～12月21日

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