

数理解析研究所講究録 2074

RIMS 共同研究 (公開型)

Tosio Kato Centennial Conference

京都大学数理解析研究所

2018年7月

数理解析研究所講究録は、京都大学数理解析研究所の共同利用研究集会および共同研究の記録として1964年に刊行が開始されました。現在の共同利用・共同研究拠点（2010年発足）の前身である、全国共同利用研究所として当研究所が発足した翌年のことでしたが、以来半世紀、毎年数十巻を刊行し、2016年には第2000巻が刊行されるに至りました。第1巻から第2000巻までに収録された論文数は29,265編、総頁数は342,960頁という膨大なものであり、最先端の数学・数理科学分野の研究状況を伝えるのみならず、我が国の数学・数理科学の発展の歴史を留める文献として、他に類例を見ない論文集となっています。

講究録の内容は当研究所のウェブサイトおよび京都大学の学術情報リポジトリにおいても公開され、年間の総アクセス数は1,380,032回（2017年度）を数えるなど、多数の方にご利用いただいています。

講究録の使用言語は論文著者の判断に任されていますが、結果的に日本語が多用されていることが特徴の一つとなっています。その結果、講究録は、数学・数理科学の広い領域における最先端の専門知識に母国語でアクセスできるものとして、近年の英語化の流れの中で、重要な文献となりつつあります。

当研究所の共同利用事業に参加し講究録の論文を執筆していただいた多数の方々に対し、講究録を大きく成長させていただいたことを深く感謝いたしますとともに、これからも、当研究所の共同利用・共同研究拠点としての活動にご参加いただき、講究録の発展にご協力いただけますよう心よりお願い申し上げます。

RIMS Kôkyûroku 2074

Tosio Kato Centennial Conference

September 4 ~8, 2017

edited by Kenji Yajima

July, 2018

Research Institute for Mathematical Sciences

Kyoto University, Kyoto, Japan

This is a report of research done at the Research Institute for Mathematical Sciences,
a Joint Usage/Research Center located in Kyoto University.
The papers contained herein are in final form and will not be submitted for publication elsewhere.

Foreword

The present volume of RIMS Kôkyûroku contains most of the material presented at the “Tosio Kato Centennial Conference”, which was held September 4–8, 2017, at University of Tokyo. This conference celebrated the centennial of Tosio Kato. He was born August 25, 1917, in Kikusawa-mura (now part of Kanuma city), Tochigi prefecture, Japan. Tosio Kato is renowned for his fundamental contributions to the mathematical analysis of (non-relativistic) quantum mechanics, and equally for his contributions to non-linear partial differential equations.

The organizers have all been strongly influenced in their research by Tosio Kato, both his results and his approach to problems. It was imperative for them to celebrate the work of this great mathematician on the occasion of his centennial. This conference was focused on his contributions to the mathematical analysis of quantum mechanics. The selection of speakers emphasized equally the importance of his contributions and his continued influence on younger researchers in the area.

This volume contains both presentation papers and extended abstracts from the conference. The conference had more than 150 participants. Each presentation was followed by lively discussions. At the conference dinner a selection of photographs and 8mm movies of Tosio Kato were presented, many of them for the first time to a wider audience.

We would like to draw attention to the volume RIMS Kôkyûroku No. 1234, which contains material from a conference held soon after Tosio Kato passed away. This volume is focused on his contributions to non-linear partial differential equations. Together with the present volume they give a broad view of Tosio Kato’s great contributions to mathematics.

The conference was held as a part of the RIMS research project 2017. The organizers express their deepest gratitude to RIMS, Kyoto University, for its financial support. They are very grateful to the Graduate School of Mathematics, University of Tokyo, for its hospitality during this conference.

Organizers of the conference

Arne Jensen (Aalborg University)

Shu Nakamura (University of Tokyo)

Hisashi Okamoto (Gakushuin University)

Yoshio Tsutsumi (Kyoto University)

Kenji Yajima (Gakushuin University)

Tosio Kato Centennial Conference

September 4–8, 2017

Main Auditorium, Graduate School of Mathematical Sciences
University of Tokyo

September 4 (Mon):

14:00–14:10: Opening

14:10–15:00: Elliott Lieb (Princeton Univ.)

A dual form of the sharp Nash inequality and its weighted generalization

15:10–16:00: Hal Tasaki (Gakushuin Univ.)

Efficient heat engines are powerless: Universal trade-off relation between current and dissipation

16:30–17:20: Fumio Hiroshima (Kyushu Univ.)

Analysis of a scalar field model without ultraviolet cutoff by path measures

September 5 (Tue):

10:00–10:50: Barry Simon (California Inst. Tech.)

Tosio Kato's Work on Non-Relativistic Quantum Mechanics, I

11:00–11:50: Shinichi Kotani (Osaka Univ.)

Sato's Tau-functions expressed by Weyl-functions and its application to KdV flow

14:00–14:50: Heinz Siedentop (Univ. Munich)

The Ground State Energy of Heavy Atoms

15:00–15:50: Takuya Mine (Kyoto Inst. Tech.)

Scattering theory for the Aharonov-Bohm effect

16:20–17:10: Alexander Sobolev (Univ. College London)

Multi-parameter asymptotics for truncated Wiener-Hopf operators

September 6 (Wed):

10:00–10:50: Barry Simon (California Inst. Tech.)

Tosio Kato's Work on Non-Relativistic Quantum Mechanics, II

11:00–11:50: Erik Skibsted (Aarhus Univ.)

Spectral and scattering theory of Schrödinger operator at thresholds

14:00–14:50: Tadayoshi Adachi (Kyoto Univ.)

On quantum scattering in time-dependent electromagnetic fields

15:00–15:50: Kenichi Ito (Kobe Univ.)

Resolvent expansions for the Schrödinger operator on a graph with rays

16:20–17:10: Maciej Zworski (Univ. California, Berkeley)

Resonances for obstacles in hyperbolic space

18:00–20:00: Reception at Faculty House

Slideshow of Tosio Kato's photographs (by Hisashi Okamoto)

September 7 (Thu):

- 10:00–10:50:** Gustavo Ponce (Univ. California, Santa Barbara)
The Cauchy problem for the (generalized) Korteweg-de Vries equation after Tosio Kato
- 11:00–11:50:** Tetsu Mizumachi (Hiroshima Univ.)
Asymptotic Linear Stability of Benney-Luke line solitary waves in 2D
- 14:00–14:50:** Wilhelm Schlag (Univ. Chicago)
Structure theorems for intertwining wave operators in three dimensions
- 15:00–15:50:** Bernard Helffer (Univ. Paris, Orsay)
On the maximal domain of a Schrödinger operator with complex potential: old and new
- 16:20–17:10:** Setsuro Fujiié (Ritsumeikan Univ.)
Propagation of singularities at a non analytic hyperbolic fixed point and applications to the quantization of resonances

September 8 (Fri):

- 10:00–10:50:** Gianluca Panati (Univ. Rome, “La Sapienza”)
The Localization Dichotomy for Periodic Schrödinger Operators
- 11:00–11:50:** Hiroshi Isozaki (Tsukuba Univ.)
Inverse scattering on graphen — vertex model and edge model
- 11:50–12:00:** Closing

Organizers:

Kenji Yajima (Gakushuin University), Arne Jensen (Aalborg University), Hisashi Okamoto (Gakushuin University), Yoshio Tsutsumi (Kyoto University)

Local Organizers:

Shu Nakamura (University of Tokyo), Keiichi Kato (Tokyo University of Science), Norikazu Saito (University of Tokyo), Fumihiko Nakano (Gakushuin University)

Support: This conference is supported by RIMS Research Project: “Mathematical Analysis of Quantum Mechanics and Related Topics”, and Graduate School of Mathematical Sciences, University of Tokyo.



Tosio Kato Centennial Conference
RIMS 共同研究 (公開型) 報告集

2017年9月4日~8日
研究代表者 谷島 賢二 (Kenji Yajima)

目次

1. On quantum scattering in time-dependent electromagnetic fields	1
足立 匡義 (Tadayoshi Adachi) 京都大 (Kyoto Univ.)	
2. PROPAGATION OF SINGULARITIES AT A NON ANALYTIC HYPERBOLIC FIXED POINT AND APPLICATIONS TO THE QUANTIZATION OF RESONANCES	9
藤家 雪朗 (Setsuro Fujiié) 立命館大 (Ritsumeikan Univ.)	
3. On the domain of a Schrödinger operator with complex potential -Old and New-	11
Bernard Helffer Nantes Univ.	
4. Renormalized Nelson model	14
廣島 文生 (Fumio Hiroshima) 九州大 (Kyushu Univ.)	
5. INVERSE SCATTERING ON GRAPHEN -VERTEX MODEL AND EDGE MODEL	35
磯崎 洋 (Hiroshi Isozaki) 筑波大 (Univ. Tsukuba)	
6. Resolvent expansion for the Schrödinger operator on a graph with infinite rays	47
伊藤 健一 (Kenichi Ito) 神戸大 (Kobe Univ.) Arne Jensen Aalborg Univ.	
7. Sato's Tau-functions expressed by Weyl-functions and its application to KdV flow	55
小谷 眞一 (Shinichi Kotani) 大阪大 (Osaka Univ.)	
8. A DUAL FORM OF THE SHARP NASH INEQUALITY AND ITS WEIGHTED GENERALIZATION	63
Eric A. Carlen Rutgers Univ. Elliott H. Lieb Princeton Univ.	
9. Solvable models in the scattering theory for the Aharonov -Bohm effect	68
峯 拓矢 (Takuya Mine) 京都工繊大 (Kyoto Inst. Tech.)	

10.	ASYMPTOTIC LINEAR STABILITY OF BENNEY-LUKE LINE SOLITARY WAVES IN 2D	80
	水町 徹 (Tetsu Mizumachi) 広島大 (Hiroshima Univ.) 島袋 祐介 (Yusuke Shimabukuro) Inst. Math. Academia Sinica	
11.	THE LOCALIZATION DICHOTOMY FOR PERIODIC SCHRÖDINGER OPERATORS	86
	Gianluca Panati Università di Roma	
12.	ON KATO'S PAPER "ON THE CAUCHY PROBLEM FOR THE (GENERALIZED) KORTEWEG-DE VRIES EQUATION"	90
	G. Ponce UC Santa Barbara	
13.	INTERTWINING WAVE OPERATORS, FOURIER RESTRICTION, AND WIENER THEOREMS	98
	W. Schlag Univ. Chicago	
14.	THE GROUND STATE ENERGY OF HEAVY ATOMS	123
	Heinz Siedentop Ludwig-Maximilians-Universität München	
15.	TOSIO KATO'S WORK ON NON-RELATIVISTIC QUANTUM MECHANICS: AN OUTLINE	133
	Barry Simon California Inst. Tech.	
16.	SPECTRAL AND SCATTERING THEORY OF SCHRÖDINGER OPERATORS AT THRESHOLDS	148
	E. Skibsted Aarhus Univ.	
17.	MULTI-PARAMETER ASYMPTOTICS FOR TRUNCATED WIENER-HOPF OPERATORS	151
	Alexander V. Sobolev Univ. College London	
18.	RESONANCES FOR OBSTACLES IN HYPERBOLIC SPACE	157
	Peter Hintz Univ. California Maciej Zworski Univ. California	

講究録

Kôkyûroku

RIMS Kôkyûroku was started in 1964 as the proceedings of symposia, colloquia and workshops supported by RIMS, the Research Institute for Mathematical Sciences, Kyoto University. It was the next year of the establishment of RIMS as one of the nationwide Cooperative Research Centers, the preceding system of the current Joint Usage/Research Centers that started in 2010. For half a century since then, about 50 to 60 volumes have been issued each year, and the 2,000th volume was issued in 2016. The volumes of Kôkyûroku from the 1st through the 2,000th, containing enormous 29,265 articles and 342,960 pages, not only deliver the latest research activities in mathematics and mathematical sciences but also constitute valuable and incomparable collections of articles that pass down history of progress of mathematics and mathematical science in Japan.

Articles in Kôkyûroku are available on the websites of RIMS and Kyoto University Research Information Repository. They are very frequently accessed on the internet, with a total of as many as 1,380,032 accesses in 2017.

The authors choose the languages to write articles, and many are written in Japanese, which is one of the characteristics of Kôkyûroku. As a result, Kôkyûroku is regarded as a significant and important literature which allows easy access to the latest specialized knowledge in the large fields of mathematics and mathematical sciences written in native language for Japanese readers, while more and more research papers are being written in English in recent years.

We are deeply grateful to many of those who have participated in cooperative research activities of RIMS and greatly developed Kôkyûroku. We heartily ask for your continuous participation in research activities at RIMS as a Joint Usage/Research Center and your warm support and cooperation for the fruitful development of Kôkyûroku.