特任助教 (Project Research Associate)
久保 利久 (KUBO Toshihisa)

A. 研究概要

私は絡微分作用素と一般 Verma 加群について主に研究をしているが, 本年度はそれらに関する３つのプロジェクトに取り組むことができた.

まず一つ目だが, 昨年度に引き続き, 本年度も本研究科の小林俊行教授と Université de Reims-Champagne-Ardenne（フランス）の Michael Pevzner 氏と共に絡微分作用素に関する研究を推し進めた. 本研究では特に小林教授の提唱する「symmetry breaking operator」と呼ばれる絡微分作用素について研究をしている. 近々本研究に関する論文を書き上げる予定である.

絡微分作用素の存在は一般 Verma 加群の可約性に密接に関係しているが, 本年度は Beijing International Center for Mathematical Research（中国）の Haian He 氏と Oklahoma State University（アメリカ）の Roger Zierau 教授と共に, スカラー型と呼ばれる一般 Verma 加群のうち, 極大放物型部分環から誘導されるものの可約点を全て決定することができた. 本研究に関する結果は既に３人の共著として１つの, そして私自身の単著として１つの論文としてまとめており (「B. 発表論文」の [9], [10] を参照), それぞれ査読付き論文雑誌に投稿中である.

最後に取り上げるプロジェクトだが, これは Aarhus University（デンマーク）の Bent Ørsted 教授との共同研究である. この研究はまだ始まったばかりであり, 来年度も引き続き推し進めていく予定である.

Intertwining differential operators and generalized Verma modules are some of my main research topics. In this year I had nice opportunities to study them in three different projects. I will briefly report these projects here.

The project that I first report is a joint work with Prof. Toshiyuki Kobayashi from our department and Prof. Michael Pevzner from Université de Reims-Champagne-Ardenne, France. This is a continuation of our project from the last two years. A main concern of this project is a construction of so-called differential *symmetry breaking operators*, whose notion was proposed by Prof. Kobayashi. We are planning to finish writing a paper some time soon.

The existence of the intertwining differential operators are closely related to the reducibility of generalized Verma modules. In this year, with Dr. Haian He from Beijing International Center for Mathematical Research, China, and Prof. Roger Zierau from Oklahoma State University, USA, I classified all the reducible points for scalar generalized Verma modules induced from maximal parabolic subalgebras. From this project one three-authored paper and one short single-authored paper were written (see the preprints [9] and [10] for "B. 発表論文"). Both of them are submitted to peer-reviewed journals.

The last project that I am going to report is a project with Prof. Bent Ørsted from Aarhus University, Denmark. As we are just in an early stage of the project, I can only say that this is related to intertwining differential operators. We are going to continue this project in the next year.

B. 発表論文

Peer-reviewed articles

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[3] T. Kubo, "The Dynkin index and conformally invariant systems associated to parabolic subalgebras of Heisenberg type." Osaka J. Math, **51** (2014), no. 2, 359-373.

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[6] T. Kobayashi, T. Kubo and M. Pevzner, "Covariant differential operators and the Rankin–Cohen bracket.(Japanese)" In J. Matsuzawa and N. Shimeno, editors, Proceedings of Symposium on Representation Theory 2014, (2014) pp. 75-86.

[7] T. Kubo, "On the F-method for constructing intertwining differential operators between homogeneous vector bundles." In M. Izumisawa and T. Kajiwara, editors, Real Anaylysis – Functional Analysis Joint Symposium 2014, (2014) pp. 85-95.

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[9] H. He, T. Kubo and R. Zierau, "On the reducibility of scalar generalized Verma modules associated to maximal parabolic subalgebras." (2015)

[10] T. Kubo, "On reducible criterions for scalar generalized Verma modules associated to maximal parabolic subalgebras." (2015)

C. 口頭発表

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[2] Covariant differential operators and the Rankin–Cohen bracket, 談話会, 金沢大学, 2015 年 12 月.

[3] Covariant differential operators and the Rankin–Cohen bracket, Analysis Seminar, Aarhus University, デンマーク, 2015 年 11 月.

[4] Covariant differential operators and the Rankin–Cohen bracket, Lie Group Seminar, Oklahoma State University, USA, 2015 年 10 月.

[5] On the reducible points for scalar generalized Verma modules, 日本数学会 2015 年度秋季総合分科会, 京都産業大学, 2015 年 9 月.

[6] On the reducible points for scalar generalized Verma modules, Analytic Representation Theory of Lie Groups, Kavli IPMU, 2015 年 7 月.

[7] On the reducible points for scalar generalized Verma modules, XI. International Workshop LIE THEORY AND ITS APPLICATIONS IN PHYSICS, ブルガリア, 2015 年 6 月.

[8] On the reducible points for scalar generalized Verma modules, AGU Workshop on Geometry and Representation Theory, 青山学院大学, 2015 年 5 月.

[9] Covariant differential operators and the Rankin–Cohen bracket, 日本数学会 2015 年度年会, 明治大学, 2015 年 3 月.

[10] Covariant differential operators and the Rankin–Cohen bracket, 2015 East Asian Core Doctorial Forum on Mathematics, National Taiwan University, 台湾, 2015 年 1 月.

D. 講義

[1] 数理科学基礎・演習 (微分積分学, 線型代数学)：微分積分学および線型代数学に関する演習問題に取り組ませた.
(教養学部前期課程講義)

[2] 補習（「代数と幾何」）：ジョルダン標準形に関する理解が深められるよう演習問題に取り組ませた.
(数学科進学予定者対象)

[3] 学修相談室：微分積分学および線形代数学に関する質問を受け付けた.
(教養学部１年生対象)

E. 修士・博士論文

F. 対外研究サービス

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- Fourier, Ghislain, “Weyl modules and Levi subalgebras.” Zbl 1321.17017 J. Lie Theory 24, No. 2, 503-527 (2014).

G. 受賞

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H. 海外からのビジター

連携併任講座