教授 (Professor)

河東 泰之 (KAWAHIGASHI Yasuyuki)

A. 研究概要

α-induction は，Q-system 付きの unitary modular tensor category から新しい fusion category を作る tensor functor である．これは quantum $6j$-symbols と braiding を用いて記述され，α-induced bi-unitary connection を生み出す．去年は Q-system の局所性 (可換性) が α-induced bi-unitary connection の flatness を導くことを示したが，今年は期待に反して，この逆も正しいことを示した．いくつかの具体例について計算してみた．

α-induction is a tensor functor producing a new fusion category from a unitary modular tensor category and a Q-system in it. This can be formulated in terms of quantum $6j$-symbols and braiding and gives α-induced bi-unitary connections. Last year, we showed that locality of the Q-system implies flatness of the α-induced connections. We now prove that the converse also holds, which was against expecation. We work out various examples.

B. 発表論文

1. Y. Kawahigashi, The relative Drinfeld commutant of a fusion category and α-induction, Internat. Math. Res. Notices. **2019** (2019), 6304–6316.

2. Y. Kawahigashi, A remark on matrix product operator algebras, anyons and subfactors, Lett. Math. Phys. **110** (2020), 1113–1122.

3. Y. Kawahigashi, Projector matrix product operators, anyons and higher relative commutants of subfactors, Math. Ann. **387** (2023), 2157–2172.

4. Y. Kawahigashi, Two-dimensional topological order and operator algebras, Internat. J. Modern Phys. B **35** (2021), 2130003 (16 pages).

5. Y. Kawahigashi, A characterization of a finite-dimensional commuting square pro-

ducing a subfactor of finite depth, Internat. Math. Res. Notices. **2023** (2023), 8419–8433.

6. Y. Kawahigashi, α-induction for bi-unitary connections, to appear in Quantum Topol.

7. D. E. Evans and Y. Kawahigashi, Subfactors and mathematical physics, Bull. Amer. Math. Soc. **60** (2023), 459–482.

C. 口頭発表

1. Tensor networks, two-dimensional topological order and operator algebras, Emerging Platforms for Quantum Computing, Tohoku University, April 2023.

2. Quantum symmetries in operator algebras and mathematical physics, Colloquium, Texas A&M University (U.S.A.), April 2023.

3. α-induction for bi-unitary connections, Where Mathematics Meets Quantum Physics: a workshop on the occasion of Roberto Longo's 70th birthday, Enrico Fermi Research Center (Italy), June 2023.

4. α-induction for bi-unitary connections, OAS Follow on: Operator Algebras: Subfactors and Applications, Isaac Newton Institute (U.K.), June 2023.

5. Operator algebras, tensor categories and quantum field theory, Workshop on Operator Algebras, Deformation Quantization and Related Field Theories, International Centre for Interdisciplinary Science and Education (Vietnam), July 2023.

6. Quantum symmetries in operator algebras and mathematical physics, International Congress on Basic Science, Beijing Institute of Mathematical Sciences and Applications (China), July 2023.

7. Two-dimensional topological order and operator algebras, Topological Quantum Computation, International Centre for Mathematical Sciences, Edinburgh (U.K.), October 2023.

8. Bi-unitary connections, modular tensor

categories and α-induction, Subfactors and Fusion (2-)Categories, Banff International Research Station (Canada), December 2023.

9. Quantum symmetries in operator algebras and mathematical physics, East Asian Core Doctoral Forum on Mathematics, Fudan University (China), January 2024.

10. Quantum $6j$-symbols and braiding, MIT Infinite Dimensional Algebra Seminar (U.S.A.), February 2024.

D. 講義

1. 数理科学の研究フロンティア：宇宙, 物質, 生命, 情報：理研の若手研究者によるオムニバス講義のコーディネート. (教養学部 1,2 年生講義)

E. 修士・博士論文

1. (博士) 羽柴康仁 (HASHIBA Yasuhito): On the structure of crossed product von Neumann algebras

2. (博士) 北村侃 (KITAMURA Kan): Discrete quantum subgroups of quantum doubles

3. (博士) 及川瑞稀 (OIKAWA Mizuki): Equivariant α-induction Frobenius algebras and related constructions of tensor categories

4. (修士) 中江優介 (NAKAE Yusuke): Constructing methods of Haag-Kastler nets by S-matrices, deformation and Lagrangians

5. (修士) XU Ziyun: The α-induction of superconformal nets

F. 対外研究サービス

1. *Communications in Mathematical Physics* の editor.

2. *International Journal of Mathematics* の chief editor.

3. *Japanese Journal of Mathematics* の managing editor.

4. *Journal of Mathematical Physics* の associate editor.

5. *Journal of Mathematical Sciences, the University of Tokyo* の editor-in-chief.

6. *Journal of Topology and Analysis* の editor.

7. *Letters in Mathematical Physics* の editor.

8. *Mathematics Open* の editor.

9. *Reviews in Mathematical Physics* の associate editor.

10. *Taiwan Journal of Mathematics* の editor.

11. *Pure and Applied Mathematics Quarterly* の guest editor.

12. Mathematical Physics Studies (Springer) の editor.

13. Theoretical studies of topological phases of matter (国際高等研究所, April 4–6, 2023) のオーガナイザー.

14. The Second Australia-China-Japan-Singapore-U.S. Index Theory Conference–Noncommutative Geometry and K-Theory (東大数理, May 29–June 2, 2023) のオーガナイザー.

15. Workshop on Operator Algebras, Deformation Quantization and Related Field Theories (International Centre for Interdisciplinary Science and Education, Vietnam, July 10–14, 2023) のオーガナイザー.

16. East Asian Core Doctorial Forum on Mathematics (Fudan University, China, January 8–11, 2024) のオーガナイザー.

17. CREST Tutorial Workshop "Theoretical studies of topological phases of matter" (Online, February 5–7, 2024) のオーガナイザー.

18. Frontier of Science Award in Functional Analysis and Operator Theory (International Congress of Basic Sciences, China, 2023) の選考委員.