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A. 研究概要

Bischoff, Longo, Rehren と共に conformal field theory における phase boundary, topological defect の研究を作用素環の立場から行った。代数的場の量子論における phase boundary の定義を行い, その基本的性質を研究した。特に, 二つの Q -system の braided product の既約分解によってすべての phase boundary が生じることを示した。また, 各 phase boundary は二つの Q -system の bimodule として表させることを示した。

さらに Bischoff, Longo, Rehren と共に, factoriality を仮定しない Q -system の一般論を整備した。

We have studied phase boundaries and topological defects in conformal field theory from the operator algebraic viewpoints with Bischoff, Longo and Rehren. We defined phase boundaries in algebraic quantum field theory and studied their basic properties. In particular, we proved all phase boundaries arise from irreducible decompositions of a braided product of two Q -systems. We also proved that phase boundaries exactly correspond to bimodules over two Q -systems.

We also developed a general theory of Q -systems without assuming factoriality with Bischoff, Longo and Rehren.

B. 発表論文

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6. Y. Kawahigashi, N. Suthichitranont: “Construction of holomorphic local conformal framed nets”, *Internat. Math. Res. Notices* **2014** (2014), 2924–2943.
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8. M. Bischoff, Y. Kawahigashi, R. Longo, K.-H. Rehren: “Phase boundaries in algebraic conformal QFT”, arXiv:1405.7863.
9. M. Bischoff, Y. Kawahigashi, R. Longo, K.-H. Rehren: “Tensor categories and endomorphisms of von Neumann algebras (with applications to Quantum Field Theory)”, *SpringerBriefs in Mathematical Physics* Vol. **3**, 2015.
10. M. Bischoff, Y. Kawahigashi, R. Longo: Characterization of 2D rational local conformal nets and its boundary conditions: the maximal case, arXiv:1410.8848.

C. 口頭発表

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2. Boundary conformal field theory, subfactors and tensor categories, “NCGOA Spring Institute 2014: Subfactors, CFT, and VOA”, Nashville (U.S.A.), May 2014.
3. Full and boundary conformal field theory from operator algebras, “Operator Algebras and Mathematical Physics”, Dalian (China), June 2014.
4. Boundary conformal field theory and subfactors, “The 25th International Conference on Operator Theory”, Timișoara (Romania), July 2014.

5. Subfactors, tensor categories and boundary conformal field theory, “16th Workshop: Non-commutative harmonic analysis: Random matrices, representation theory and free probability, with applications”, Bedlewo (Poland), July 2014.
 6. Subfactors and phase boundaries in conformal field theory, “Subfactor Theory in Mathematics and Physics”, Hawaii (U.S.A.), July 2014.
 7. Boundary conformal field theory and subfactors, “ICM Satellite Conference on Operator Algebras and Applications”, Cheongpung (Korea), August 2014.
 8. Full and boundary conformal field theories and subfactors, “Operator and Geometric Analysis on Quantum Theory”, Levico Terme (Italy), September 2014.
 9. Boundary conformal field theory and operator algebras, RIKKYO MathPhys 2015 — Gauge Theory, CFT and Integrability —, Rikkyo University (Japan), January 2015.
 10. Boundary conformal field theory and subfactors, “4th Conference of Settat on Operator Algebras and Applications”, Marrakech (Morocco), January 2015.
- D. 講義
1. 解析学 XF・無限次元構造論：共形場理論の作用素環的研究について講義した．特に頂点作用素代数との関係を詳しく解説した．(数理大学院・4年生共通講義)
 2. 全学自由研究ゼミナール「英語による数学書の輪講」：“Resources for the Study of Real Analysis” (Robert L. Brabeneć) に基づいて英語による輪講を行った．(教養学部 1,2 年生講義)
- E. 修士・博士論文
1. (修士) 賀 卓豊 (Zhuofeng HE): Certain actions of finitely generated abelian groups on higher dimensional noncommutative tor
 2. (修士) 清野 堯明 (KIYONO Takaaki): A counterexample to the amenability condition for Hecke pairs
- F. 対外研究サービス
1. *Communications in Mathematical Physics* の editor.
 2. *International Journal of Mathematics* の 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. *Reviews in Mathematical Physics* の associate editor.
 7. *Mathematical Physics Studies* の series editor.
 8. サマースクール数理物理「トポロジカル相の数理」(東京大学大学院数理科学研究科, 2014 年 8 月 29–31 日) のオーガナイザー .
 9. 日本数学会「第 14 回高木レクチャー」(東京大学大学院数理科学研究科, 2014 年 11 月 15, 16 日) のオーガナイザー .
 10. The Second China-Japan Conference on Noncommutative Geometry and K -Theory (那覇, 2014 年 10 月 4–7 日) のオーガナイザー .
 11. East Asian Core Doctorial Forum on Mathematics (国立台湾大学, 2015 年 1 月 19–22 日) のオーガナイザー .
 12. Subfactors and Conformal Field Theory (Oberwolfach, 2015 年 3 月 23–27 日) のオーガナイザー .