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#### A. 研究概要

S. Carpi, R. Longo と共に super conformal field theory への作用素環的アプローチを研究した。まず、代数的場の量子論における super net の表現論の基礎を確立し、 $N = 1$  super Virasoro algebra の表現論を作用素環の文脈で研究した。さらに、我々が前に導入した modular net について、super charge operator の性質を調べることにより、Fredholm index と Jones index の関係式を初めて明らかにした。

We studied operator algebraic approach to super conformal field theory with S. Carpi and R. Longo. We first established basics of representation theory of super nets in algebraic quantum field theory and studied representation theory of the  $N = 1$  super Virasoro algebras in the context of operator algebras. We further studied properties of super charge operators for modular nets, which we introduced earlier, and obtained a relation between the Fredholm index and the Jones index for the first time.

#### B. 発表論文

1. Y. Kawahigashi and R. Longo: “Classification of local conformal nets: Case  $c < 1$ ”, *Ann. of Math.* **160** (2004) 493–522.
2. Y. Kawahigashi, N. Sato and M. Wakui: “ $(2 + 1)$ -dimensional topological quantum field theory from subfactors and Dehn surgery formula for 3-manifold invariants”, *Adv. Math.* **195** (2005) 165–204.
3. Y. Kawahigashi and R. Longo: “Classification of two-dimensional local conformal nets with  $c < 1$  and 2-cohomology vanishing for tensor categories”, *Commun. Math. Phys.* **244** (2004) 63–97.
4. Y. Kawahigashi: “Topological quantum field theories and operator algebras”, in “Quantum Field Theory and Noncommutative Geometry”, *Lect. Notes in Phys.* **662**, Springer Verlag, (2005) 241–253.

5. Y. Kawahigashi: “Classification of operator algebraic conformal field theories in dimensions one and two”, in “XIVth International Congress on Mathematical Physics”, World Scientific (2005) 476–485.
6. Y. Kawahigashi and R. Longo: “Noncommutative spectral invariants and black hole entropy”, *Commun. Math. Phys.* **257** (2005) 193–225.
7. Y. Kawahigashi and R. Longo: “Local conformal nets arising from framed vertex operator algebras”, *Adv. Math.* **206** (2006) 729–751.
8. Y. Kawahigashi, R. Longo, U. Pennig and K.-H. Rehren: “Classification of non-local chiral CFT with  $c < 1$ ”, *Commun. Math. Phys.* **271** (2007) 375–385.
9. Y. Kawahigashi: “Conformal field theory and operator algebras”, preprint 2007, arXiv:0704.0097.
10. C. Carpi, Y. Kawahigashi and R. Longo: “Structure and classification of superconformal nets”, preprint 2007, arXiv:0705.3609.

#### C. 口頭発表

1. Conformal field theory and operator algebra, “International Congress on Mathematical Physics - ICMP 2006” (Plenary talk), Rio de Janeiro (Brazil), August 2006.
2. Superconformal nets of factors and their classification, “Topics on von Neumann algebras”, Banff International Research Station (Canada), September 2006.
3. Conformal field theory and operator algebras, “MSJ-IHES Joint Workshop on Noncommutativity”, IHES (France), November 2006.
4. Superconformal nets of factors and their classification, “Recent Advances in Operator Algebras”, Rome (Italy), November 2006.

5. Superconformal field theory and operator algebras, “Operator Algebras and Related Fields”, Hawaii (U.S.A.), January 2007.
6. Conformal field theory and operator algebra, Colloquium, II Universita di Roma (Italy), March 2007.
7. Classification of superconformal nets of factors, Conference on Free Probability/Operator Spaces/von Neumann algebras, Sibiu (Romania), June 2007.
8. Conformal field theory and representation theory of von Neumann algebras, Operator Algebras Seminars, Fields Institute (Canada), September 2007.
9. Superconformal field theory and operator algebras, Workshop on von Neumann algebras, Fields Institute (Canada), October 2007.
10. Conformal field theory and operator algebras, Kolloquium für Reine Mathematik, Universität Hamburg (Germany), December 2007.

#### D. 講義

1. 数理科学 II: 常微分方程式の基礎理論 . (教養学部前期課程講義)
2. 全学自由研究ゼミナール: 超準解析の理論 . (教養学部前期課程講義)
3. 解析学 VI・解析学特別演習 II: Fourier 変換と超関数の入門講義およびその演習 . (理学部数学科 3 年生講義)

#### E. 修士・博士論文

1. (修士) 谷本 溶 (TANIMOTO Yoh): Inclusions and positive cones of von Neumann algebras.
2. (修士) 張 欽 (ZHANG Qin): A spatial property of the canonical map associated to von Neumann algebras.
3. (修士) 山下 真 (YAMASHITA Makoto): Cyclic cohomology of foliation algebras.

#### 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 editor.
5. *Journal of Mathematical Sciences, the University of Tokyo* の editor-in-chief.
6. *Reviews in Mathematical Physics* の associate editor.
7. Arbeitsgemeinschaft, “Algebraic structures in conformal field theories”, Oberwolfach, Germany, April 1–7, 2007 のオーガナイザー .
8. 日本数学会「第 2 回高木レクチャー」(東京大学大学院数理科学研究科, 2007 年 5 月 26 ~ 27 日) のオーガナイザー .
9. サマースクール数理物理「Bose-Einstein condensation を巡る数理と物理」(東京大学大学院数理科学研究科, 2007 年 8 月 18 ~ 21 日) のオーガナイザー .
10. 日本数学会「第 3 回高木レクチャー」(東京大学大学院数理科学研究科, 2007 年 11 月 23 日) のオーガナイザー .
11. RIMS 共同研究「作用素環と数理物理学の研究」(京都大学数理解析研究所, 2008 年 1 月 23 ~ 25 日) のオーガナイザー .

#### H. 海外からのビジター

Rolf Dyre Svegstrup, 学振外国人特別研究員 . (2006 年 10 月 ~ 2008 年 9 月) . Operator algebraic study of conformal field theory.  
 Mikael Pichot, 学振外国人特別研究員 . (2007 年 9 月 ~ 2009 年 9 月) . Discrete groups, ergodic theory and operator algebras.