

A. 研究概要

Longo とともに, 作用素環の局所共形ネットのエントロピーを研究した. それは「熱核半群」のトレースの対数をとったものの展開係数として定義される. この量は, 多様体のラプラシアン固有値の分布を調べることの類似として, 「無限自由度の非可換多様体」の幾何学的不変量と解釈できる. 自然なモジュラー性の仮定の下で, 「非可換面積」に当たる主要項が central charge に比例すること, 非可換オイラー数に当たる次項がネットの大域指数の対数に比例することがわかった. ブラックホールのエントロピーとの関係についても研究した.

また枠付き頂点作用素代数の構成法の類似を, Longo と共に作用素環の局所共形ネットに対して行った. 例として, ムーンシャイン頂点作用素代数に対応する作用素環の局所共形ネットを得た.

We have studied entropy of local conformal nets of von Neumann algebras with Longo. It is defined in terms of the coefficients in the expansion of the logarithm of the trace of the “heat kernel” semigroup. In analogy with study on the asymptotic density distribution of the Laplacian eigenvalues of a manifold, we regard these coefficients as noncommutative geometric invariants of infinitely many degrees of freedom. Under a natural modularity assumption, the leading term of the entropy, noncommutative area, is proportional to the central charge and the first order correction, noncommutative Euler characteristic, is proportional to the logarithm of the global index of the net. We have also studied their relations to black hole entropy.

We have made a construction of local conformal nets of von Neumann algebras analogous to the one of framed vertex operator algebras with Longo. As an example, we have obtained a local conformal net corresponding to the moonshine vertex operator algebra.

B. 発表論文

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C. 口頭発表

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3. Classification of operator algebraic conformal field theories, XIV International Congress on Mathematical Physics, Lisbon (Portugal), July 2003.
4. Local conformal nets and vertex operator algebras, Seminar, II Università di Roma (Italy), March 2004.
5. Operator algebras and vertex operator algebras in quantum field theory, Workshop “Tensor Categories in Mathematics and Physics”, Erwin Schrödinger Institute (Austria), June 2004.
6. Operator algebras and vertex operator algebras, 20th International Conference on Operator Theory Timișoara (Romania), July 2004.
7. Operator algebras and vertex operator algebras, Conference “Quantum Groups”, Haifa (Israel), July 2004.
8. Operator algebras and vertex operator algebras, Conference “Perspectives Arising from Vertex Algebra Theory”, Osaka (Japan), November 2004
9. QFT, operator algebras and framed vertex operator algebras Seminar “Algebraische Quantenfeldtheorie und Statistische Mechanik”, Universität Göttingen (Germany), December 2004.
10. Nets of operator algebras and vertex operator algebras, Operator Algebra Seminar, University of Southern Denmark (Denmark), February 2005.

D. 講義

1. 数理科学 I: 多変数解析学の基礎的な内容について講義した。陰関数定理, 逆関数定理, 条件付き極値問題, Green の定理などを取り扱った。(教養学部前期課程講義)
2. 解析学 VII・関数解析学: Banach 空間, Hilbert 空間等の関数解析学の基礎について講義した。(数理大学院・4年生共通講義)
3. 解析学 XD・スペクトル理論: 非有界自己共

役作用素のスペクトル分解について講義した。(数理大学院・4年生共通講義)

E. 修士・博士論文

1. (修士) 蓑田恭秀 (MINODA Yasuhide): On some transformations of directed graphs and their C^* -algebras

F. 対外研究サービス

1. *Communications in Mathematical Physics* の editor.
2. *International Journal of Mathematics* の editor.
3. *Journal of Mathematical Physics* の editor.
4. *Reviews in Mathematical Physics* の associate editor.
5. “Summer School 数理物理 2004: 頂点作用素代数とモンスター” を東京大学大学院数理科学研究科において主催, (小嶋泉氏と共同, 2004年8月21日~24日).

G. 受賞

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