JIN-CHENG GUU

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EDUCATION

Stony Brook University *Sep 2017 - present*
Ph.D., Mathematics, supervised by Alexander Kirillov.
National Taiwan University *Sep 2013 - Jan 2017*
B.S. in Mathematics (GPA: 3.91/4.30, High Honors).

MATHEMATICS RESEARCH

Publications and Preprints

- *Categorical center of higher genera and 4D factorization homology*, arXiv:2107.05914.
- *Explicit factorization of categorical centers*, to appear.
- *Turaev shadow state sum and Crane-Yetter state sum model*, to appear.
- *Module categorical structure of higher genus center*, to appear.

1. Crane-Yetter theory in dimension two
Crane-Yetter theory (a state-sum model parallel to Walker-Wang model) is a fully extended TQFT. However, not until 2019 was its categorical aspect investigated. In my work, I proved the Crane-Yetter theory for all oriented surfaces with at least one puncture are equivalent to a family of explicitly constructed categories (categorical centers of higher genera).

2. (q,t)-deformation of knot amplitudes
Quantum $6j$-symbols are numerical presentations of the monoidal structures for $Rep(U_q\mathfrak{g})$. Their squares seem to admit (q,t)-deformations by the numerical evidence discovered by Shamil Shakirov and Semeon Arthamonov. We aim to find a theoretic basis for such (q,t)-deformation.

3. Matrix-valued symmetric Macdonald polynomials
Alexander Kirillov and Pavel Etingof found a link between Macdonald symmetric polynomials and the generalized traces of (special) representations of quantum groups (type A) in the 90s. It is natural to consider all representations instead, and ask for the properties of the corresponding matrix-valued symmetric polynomials.

PROFESSIONAL ACTIVITIES

Research Presentation

- *Topological Quantum Field Theories from Tensor Categories*, The New York City Category Theory Seminar, Mar 09, 2022.
- *Categorical Center of Higher Genera and 4D Factorization Homology*, Session on Skein Theory and Quantum Algebra at the Joint Mathematics Meetings, Jan 06, 2022
- *(Higher) Category-valued Manifold Invariants*, Quantum Algebra & Topology Seminar at UC Santa Barbara, Dec 01, 2021.
- *Triangulation and Quantum Invariant*, Algebra Seminar, University of Kansas, Nov 23, 2021.
- *Crane-Yetter model in dimension* 2, Foam Evaluation Research Conference at ICERM, Brown University, Nov 06, 2021.

- *Jones polynomials and their 4D generalization*, Low Dimensional Topology and Gauge Theory Seminar at Stony Brook University, Sep 16, 2021.
- *Integrating categories over surfaces*, Remote Rendezvous for Quantum Topologists (online), Aug 09, 2021.
- *Higher Invariants*, Graduate Student Seminar at Stony Brook University, Mar 12, 2021.

Conference & seminar

- Participant. Chern-Simons and Other Topological Field Theories, Workshop at MSRI, Nov 16-18, 2021.
- *Internal Skein Algebra*, Learning Seminar on the Finiteness Conjecture of Skein Modules, Nov 10, 2021.
- *Harish-Chandra Modules*, Learning Seminar on the Finiteness Conjecture of Skein Modules, Oct 27, 2021.
- *Kazhdan-Lusztig category II*, https://www.ias.edu/math/events/quantum-groups-seminar-13, IAS Online Seminar: Quantum Groups (organized by Roman Bezrukavnikov (IAS/MIT), Pavel Etingof (MIT) Ivan Losev (IAS/Yale)), May 06, 2021.
- *Serre Spectral Sequences*, Simplicial Study Group (organized by Jin-Cheng Guu), Apr 28, 2021.
- *Kazhdan-Lusztig category I*, IAS Online Seminar: Quantum Groups (organized by Roman Bezrukavnikov (IAS/MIT), Pavel Etingof (MIT) Ivan Losev (IAS/Yale)), Apr 22, 2021.
- *Quantum Schur-Weyl Duality*, Cherednik Algebras and Applications Learning Seminar (organized by Sam DeHority), Mar 31, 2021.
- *Introduction to simplicial sets*, Simplicial Study Group (organized by Jin-Cheng Guu) Mar 24, 2021.
- *Higher Invariants*, Graduate Student Seminar at Stony Brook University, Mar 12, 2021.
- *Koszul Duality and Kazhdan-Lusztig conjecture*, Modern Techniques in Representation Theory (organized by Cailan Li, Henry Liu, Mrudul Thatte), Mar 05, 2021.
- *Pictorial presentation of 2-categories*, Modern Techniques in Representation Theory (organized by Cailan Li, Henry Liu, Mrudul Thatte), Jan 29, 2021.
- *Representation of affine Hecke algebra and the decomposition theorem*, Student Geometric Representation Seminar (organized by Jee Uhn Kim), Jan 13, 2021.
- *Geometric Construction of the Weyl Group*, Student Geometric Representation Seminar (organized by Jee Uhn Kim), Dec 30, 2020.
- *The Kazhdan-Lusztig Conjecture*, Category $\mathcal{O}$ Learning Seminar (organized by Cailan Li, Henry Liu, Mrudul Thatte), Oct 09, 2020.
- *Projectives in category $\mathcal{O}$*, Category $\mathcal{O}$ Learning Seminar (organized by Cailan Li, Henry Liu, Mrudul Thatte), Aug 21, 2020.
- *Feynman Diagrams*, QFT for mathematicians seminar (organized by Dmitry Vaintrob), Jul 23, 2020.
- *Feynman Diagrams*, QFT seminar at CUNY (organized by Mahmoud Zeinalian), Oct 24, 2019.
- *Participant.* International Summer School of Mathematical Physics, July 1-12 2019, Skoltech, Moscow, Russia.
- *Weyl Character Formula*, Seminar on representation of compact Lie groups (organized by Jin-Cheng Guu), Nov 11, 2018.
- *Fourier Analysis and Representation Theory*, Seminar on representation of compact Lie groups (organized by Jin-Cheng Guu), Oct 18, 2018.
- Participant. Representations of Finite and Algebraic Groups at MSRI, Apr 9-13, 2018.
- *Minimal surfaces in $\mathbb{R}^3$*, Analysis Student Seminar (organized by Silvia Ghinassi), Dec 6, 2017.

OUTREACH

Organizer

- Simplicial Study Group, Mar - Jun, 2021.
- Representations of compact Lie groups, Oct - Dec, 2018.

Presentations

- *The Idea of Recurrence*, Math Summer Camp for High School Students at Stony Brook University, Summer 2018.
- *Counting patterns*, Math Summer Camp for High School Students at Stony Brook University, Summer 2019.
- *Recurrence and rational equations*, Math Summer Camp for High School Students at Stony Brook University, Summer 2020.

AWARDS AND FELLOWSHIPS

- 2013: Academic Excellence Awards. 2014: Da-Kai Hu Mathematics Scholarship. 2014: Academic Excellence Awards. 2015: Zhang, Yang Mathematics Scholarship. 2016: Zheng-Tang Xiao Mathematics Scholarship. 2016: Academic Excellence Awards. National Taiwan University.
- Science Writing Competition in Taiwan (joint with Ying-Shin Chen and Yu-Sheng Wu), Selection Award, 2012. Ministry of Science and Technology, Taiwan.
- Champion, Robotic Soccer Competition, RoboCupJunior Taiwan, 2009.

PROJECTS

- Mail server maintenance assistant, Department of Mathematics (Nov 2021-).
- Independently designed and implemented *Dynamic Floating Window Management* for StumpWM, an X window manager. Common lisp (2021). https://github.com/stumpwm/stumpwm/pull/885.
- Independently designed and implemented *CL-schedule*, an enhanced cron manager for CL, based on *Clon* by github/igorpikman. Common lisp (2021). https://github.com/jcguu95/cl-schedule
- Implemented $(q,t)-6j$ *symbol calculator*, a doubly-variated deformation of Wigner $6j$ symbol (angular momenta), based on the work of S. Arthamonov & S. Shakirov. SageMath & Python (2019).
- Implemented *Buchberger algorithm*, an algorithm for computing Grobner basis. Joint with Long-Shin, Lee. MATLAB (2016).

OTHERS

- (Research in Biology) *The architecture of cuttlefish bones and its compressive strength*, Jin-Cheng Guu, Ying-Shin Chen, Vibert Thio, Yi-Shin Lee, Jia-Qi Qian, Yu-Guang Hu, Kai-Rong Ji, Chuan-Jin Jiao, submitted and presented in Congress of Animal Behavior and Ecology in Taiwan 2012.
- (Teaching) Instructor. Summer 2018: Proficiency Algebra. Summer 2019: Mathematical Thinking. Summer 2020: Fundamental Concepts of Math. Summer 2021: Differential Equations with Applications (Calc IV). Teaching Assistant. Fall 2018: Calculus B, R04 R05. Spring 2019: Advanced Linear Algebra, R01. Fall 2019: Calculus A, R40 R45. Spring 2020: Applied Algebra, R01. Stony Brook University.
- (IT skills) Common Lisp, Python, SageMath, Shell, LaTeX, Linux.
- (Languages) Mandarin (native), English (fluent), French, and Japanese.
- (Interests) Lisp & Emacs enthusiast! Go (Board Game), amateur 1D ("shodan"), Taiwan. Acoustic Guitar & Technical Vocal Techniques.

Last updated: November 26, 2021 .