Curriculum Vitae
Ivan Chi-Ho IP

Personal Details

Address:	Department of Mathematics,	**Phone:**	(852) 2358–7431
	Hong Kong University of Science and Technology,	**E-mail:**	ivan.ip@ust.hk
	Clear Water Bay, Hong Kong	**URL:**	`www.math.ust.hk/~ivanip`
Date of Birth:	1984–01–01	**Citizenship:**	Hong Kong, Canada

Employment

2021–current   **Hong Kong University of Science and Technology**, Hong Kong
Associate Professor, Department of Mathematics

2018–2021   **Hong Kong University of Science and Technology**, Hong Kong
Assistant Professor, Department of Mathematics

2015–2018   **Kyoto University**, Japan
Assistant Professor, Department of Mathematics

2012–2015   **Kavli IPMU, The University of Tokyo**, Japan
Project Researcher (Mathematics)

Education

2008–2012	Ph. D in Mathematics	Yale University
2004 Spring	Exchange Student	UCLA
2002 - 2005	B. Sc. in Mathematics & Physics	HKUST

- **Dissertation Title:** *Positive Representation and Harmonic Analysis of Split Real Quantum Groups*

- **Dissertation Adviser:** Igor B. Frenkel

Major Research Interests

Representation theory of split real quantum groups, and its applications to cluster algebra, quantum Teichmüller theory, C^*-algebra, canonical basis, Langlands duality, harmonic analysis and integrable systems.

Grants Awarded

2020–2022	Hong Kong RGC Early Career Scheme, #26303319 Project title: *Positive Representations and its Applications*	907,244 HKD
2019–2021	Hong Kong UGC School-Based Initiatives Funding, #SBI19SC03 Project title: *Quantum Parallel Transport of Positive Representations*	99,570 HKD
2018–2023	HKUST Start-up Fund	500,000 HKD
2016–2018	JSPS Grant-in-Aid for Young Scientists (B)[1], #16K17571 Project title: *Positive Representations*	3,640,000 JPY
2014–2016	JSPS Grant-in-Aid for Young Scientists (B)[1], #26800004 Project title: *Positive Representations*	2,860,000 JPY
2013	Institutional Program for Young Researcher Overseas Visits	1,480,000 JPY
2012–2015	Kavli IPMU Start-up Grant	1,500,000 JPY

Honors and Awards

2019	Early Career Award (傑出青年學者獎)	Hong Kong RGC
2018	ICCM Distinguished Paper Award (若琳獎)	ICCM 2018 Annual Meeting
2005	Academic Achievement Award	HKUST
2005	Sir Youde Memorial Scholarship	
2004	Sir Youde Memorial Scholarship	
2003	So Hok Scholarship	HKUST
2002	Bronze Medal (HK Team)	International Mathematical Olympiad
2002	Bronze Medal (HK Team)	Asian Pacific Mathematical Olympiad

Research Publications

[1] I. Ip, *On tensor products decomposition of positive representations of $\mathcal{U}_{q\tilde{q}}(\mathfrak{sl}(2,\mathbb{R}))$*,
Letters in Mathematical Physics, **111** (39), (2021).

[2] I. Ip, *Positive representations of split real simply-laced quantum groups*,
Publications of the Research Institute of Mathematical Science, **56** (3), (2020):603–646.

[3] I. Ip, *Cluster realization of positive representations of split real quantum Borel subalgebra*,
Theoretical and Mathematical Physics, **198**(2), (2019):246-272.

[4] I. Ip, R. Penner and A. Zeitlin, *On Ramond decorations*,
Communications in Mathematical Physics, **371**, (2019):145–157.

[5] I. Ip, *Cluster realization of $\mathcal{U}_q(\mathfrak{g})$ and factorization of universal R Matrix*,
Selecta Mathematica New Series, **24**(5), (2018):4461-4553.

[6] I. Ip, R. Penner and A. Zeitlin, *$\mathcal{N} = 2$ super-Teichmüller theory*,
Advances in Mathematics, **336**, (2018):409-454.

[7] I. Ip, *On tensor products of positive representations of split real quantum Borel subalgebra $\mathcal{U}_{q\tilde{q}}(\mathfrak{b}_{\mathbb{R}})$*,
Transactions of the American Mathematical Society, **370** (6), (2018):4177-4200.

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[1]For researchers under the age of 39, but otherwse equivalent to HKRGC General Research Fund with a limit of 5,000,000 JPY.

[8] I. Ip, *Positive Casimir and central characters of split real quantum groups*,
Communications in Mathematical Physics, **344** (3), (2016):857-888.

[9] I. Ip, *Gauss-Lusztig decomposition of $GL_q^+(N, \mathbb{R})$ and representations by q-tori*,
Journal of Pure and Applied Algebra, **219** (12), (2015):5650-5672.

[10] I. Ip, M. Yamazaki, *Quantum dilogarithm identities at root of unity*,
International Mathematics Research Notices, **2016**(3), (2016):669–695.

[11] I. Ip, *Positive representations of non-simply-laced split real quantum groups*,
Journal of Algebra, **425**, (2015):245-276.

[12] I. Ip, *Positive representations os split real quantum groups:the universal R operator*,
International Mathematics Research Notices, **2015** (1), (2015):240-287.

[13] I. Frenkel, I. Ip, *Positive representation of split real quantum groups and future perspectives*,
International Mathematics Research Notices, **2014**(8), (2014):2126-2164.

[14] I. Ip, A. Zeitlin, *Q-operator and fusion relations for $C_q^{(2)}(2)$*,
Letters in Mathematical Physics, **104** (8), (2014):1019-1043.

[15] I. Ip, A. Zeitlin, *Supersymmetry and the modular double*,
Contemporary Mathematics, **623**, (2014):81-91.

[16] I. Ip, *The classical limit of representation theory of the quantum plane*,
International Journal of Mathematics, **24** (4), (2013):1350031.

[17] I. Ip, *Representation of the quantum plane, its quantum double and harmonic analysis on $GL_q^+(2, \mathbb{R})$*,
Selecta Mathematica New Series, **19**(4), (2013):987-1082.

Conference Proceedings and Survey Articles:

[18] I. Ip, *Overview of the parabolic positive representations of $\mathcal{U}_q(\mathfrak{g}_{\mathbb{R}})$*,
Proceedings of 2020 RIMS Conference "Recent advances in combinatorial representation theory", (2021).

[19] I. Ip, *On the parabolic positive representations of split real quantum groups*,
Proceedings of "Symposium on Representation Theory 2020", (2021).

[20] I. Ip, *Positive representations: recent developments*,
Proceeding of ICCM 2018, (2019).

[21] I. Ip, *Positive representations, multiplier Hopf algebra, and continuous canonical basis*,
Proceeding of 2013 RIMS conference "String theory, integrable systems and representation theory", (2014).

[22] I. Ip, *Positive representation of split real quantum groups*,
Proceeding of "The 29th International Colloquium on Group-Theoretical Methods in Physics", Symmetries and Groups in Contemporary Physics, Nankai Series in Pure, Applied Mathematics and Theoretical Physics, **Vol 11**, World Scientific Company, ISBN 978-981-4518-54-3, (2013).

[23] I. Ip, *Igor Frenkel's contributions to the representation theory of split real quantum groups and modular doubles*,
On the work of Igor Frenkel in honor of his 60th birthday, Contemporary Mathematics, **610**, (2013):1-21.

Research Preprints:

[24] I. Ip, G. Schrader, A. Shapiro, *Positive Peter-Weyl theorem*, (in preparation).

[25] I. Ip, *Parabolic positive representations of $\mathcal{U}_q(\mathfrak{g}_{\mathbb{R}})$*, submitted, arXiv:2008.08589, (2020).

[26] I. Ip, *The graphs of quantum dilogarithm*, arXiv:1108.5376, (2011).

INVITED CONFERENCE TALKS AND SEMINARS

Invited Lectures (3+ Hours):

2021 March	Online School on Quantum Geometry and Representation Theory, *Positive Representations of Split Real Quantum Groups* (Zoom based)
2014 July	Summer School on Quantum Groups and Integrability, University of Hamburg, *Positive Representations and Quantum Higher Teichmüller Theory*
2013 Nov	Infinite Analysis 13 Autumn School, University of Osaka, *Positive Representations: Motivation, Construction and Braiding Structure*
2013 April	Geometric Representation Theory and Quantum Integrable System, University of Tokyo, *Positive Representations: Motivation, Construction and Braiding Structure*

Invited Conference Talks:

2020 Nov	2020 Symposium on Representation Theory, Japan, *Parabolic Positive Representations* (Zoom based)
2020 Oct	Representation Theory and its Combinatorial Aspects 2020, RIMS, Kyoto University, *Parabolic Positive Representations* (Zoom based)
2019 Nov	HKUST-KAIST-NUS Joint Workshop in Mathematics, National University of Singapore, *Positive Peter-Weyl Theorem*
2019 July	Workshop on Classical Quantum Integrable System (CQIS) 2019, Euler Institute, *Positive Peter-Weyl Theorem*
2019 June	Cluster Algebra 2019 (CA19), RIMS, Kyoto University, *Positive Peter-Weyl Theorem*
2019 June	The 8th International Congress of Chinese Mathematicians (ICCM) 2019, Tsinghua University, *Positive Peter-Weyl Theorem*
2018 Nov	Workshop on Crystal Bases, Cluster Algebras, and Poisson Geometry, Hong Kong University, *Cluster Realization and Tensor Product Decomposition of Positive Representations*
2018 Nov	"Introduction to Modern Mathematics" Series Colloquium Talk, Yau Mathematical Sciences Center of Tsinghua University, *Generalized Teichmüller Theory, Spin Structures, and Ptolemy Relations*
2018 March	MathPhys 2018, Rikkyo University, *Cluster realization and tensor product decomposition of positive representations*
2017 Nov	Infinite Analysis 17, Osaka City University, *Cluster realization and tensor product decomposition of positive representation*
2017 Sept	Mathematics Society of Japan Autumn Meeting 2017, *On tensor product decomposition of positive representations*
2017 July	Workshop on Representation Theory of Lie Superalgebras and Related Topics, Academia Sinica, Taipei, *Generalized Teichmüller spaces, spin structures, and Ptolemy transformations*

2017 July	Workshop on Classical and Quantum Integrable Systems (CQIS), Bogoliubov Laboratory of Theoretical Physics, JINR, Dubna, *Positive representations and cluster realization of quantum groups*
2017 March	Mathematics Society of Japan Spring Meeting 2017, **Special Invited Lecture** (日本数学会特別講演): *Positive Representations and Cluster Realization of $\mathcal{U}_q(\mathfrak{g})$*
2017 March	Mathematics and Superstring Theory - Unlocking the Mysteries of the Accelerating Universe through Superstring Theory and Astrophysical Observations -, Kavli IPMU, *$\mathcal{N} = 2$ Super Teichmüller theory*
2016 Sept	Mathematics Society of Japan Autumn Meeting 2016, *Positive representations of split real quantum groups*
2016 June	The 24th International Conference on Integrable Systems and Quantum Symmetries, ČVUT, Prague, *Split real quantum groups*
2014 July	RIMS Project 2014 on Geometric Representation Theory, RIMS, Kyoto University, *Positive representations and quantum higher Teichmüller theory*
2014 July	The 30th International Colloquium on Group-Theoretical Methods in Physics, Ghent University, *Positive representations and quantum higher Teichmüller theory*
2014 July	International Conference "Mathematics Days in Sofia", Institute of Mathematics and Informatics Bulgarian Academy of Sciences, Bulgaria *Positive representations and quantum higher Teichmüller theory*
2013 Aug	String Theory, Integrable Systems and Representation Theory, RIMS, Kyoto University, *Braiding structure of positive representation of split real quantum groups*
2013 March	Infinite Analysis: Past, Present and Future, Kyoto University, *Positive representations of split real quantum group*
2012 Aug	The 29th International Colloquium on Group-Theoretical Methods in Physics Chern Institute, Nankai University, *Positive representations of split real quantum group*
2011 Oct	Workshop in Master Class, QGM, Aarhus, *Positive representations of split real quantum group*

Seminar Talks:

2021 March	Geometry, Number Theory, and Representation Theory Seminar, University of Alberta *Parabolic Positive Representations*
2019 March	MAXIMALS Algebra Seminar, Edinburgh University, *Positive Peter-Weyl Theorem*
2018 May	Representation Theory Seminar, RIMS, Kyoto University, *Positive Peter-Weyl theorem*
2017 May	Scientific Seminar, Perimeter Institute, *Positive representations of split real quantum groups*

2017 April	Geometric Representation Theory Seminar, University of Toronto, *Positive representations of split real quantum groups*
2016 Nov	Kyoto Operator Algebra Seminar, Kyoto University *Positive representations: a bridge between Drinfeld-Jimbo quantum group and C^*-algebra*
2016 May	Mathematical Physics and Geometric Analysis Seminar, KIAS, Korea, *Positive Casimir and central characters of split real quantum groups*
2016 March	Columbia Symplectic Geometry, Gauge Theory, and Categorification Seminar, Columbia University, *Positive Casimir and central characters of split real quantum groups*
2016 March	Geometry, Symmetry and Physics Seminar, Yale University, *Positive Casimir and central characters of split real quantum groups*
2015 Sept	Geometry Seminar, Hong Kong University, *Quantum dilogarithm identities at root of unity*
2015 July	Seminar on Pure Mathematics, HKUST, *Quantum dilogarithm identities at root of unity*
2013 Dec	Algebra/Geometry/Topology Seminar, University of Melbourne, *Positive representations of split real quantum groups*
2013 July	Mathematics Seminar, KIAS, Korea, *Positive representations: motivation, construction and perspective from C^* algebra*
2013 Feb	Geometry, Symmetry and Physics Seminar, Yale University, *Universal R-operator for split real quantum groups*
2013 Feb	Lie Theory Seminar, HKUST, *Positive representations of split real quantum group*
2013 Jan	Informal Mathematical Physics Seminar, Columbia University *Positive representations of split real quantum group*
2012 Nov	Maths and Physics Seminar, Rikkyo University *Positive representations of split real quantum group*
2011 April	Geometry, Symmetry and Physics Seminar, Yale University, *Positive representations of split real quantum group*
2011 Feb	Graduate Student Seminar, Yale University, *The quantum double construction*
2010 Feb	Graduate Student Seminar, Yale University, *Special functions in representation theory*
2008 Dec	Graduate Student Seminar, Yale University, *The mysterious dilogarithm*
2007 Nov	Graduate Student Seminar, Yale University, *What is noncommutative geometry?*

TEACHING

Hong Kong University of Science and Technology:

2021 Fall	MATH5111	Advanced Algebra I	(Scheduled)
2021 Fall	MATH3043	Honors in Mathematical Analysis II	(Scheduled)
2020 Spring	MATH2043	Honors in Mathematical Analysis I	
2020 Spring	MATH2023	Multivariable Calculus	
2020 Fall	MATH2131	Honors in Linear Algebra and Abstract Algebra I	
2020 Spring	MATH1024	Honors Calculus II	
2019 Fall	MATH6150I	Introduction to Cluster Algebra	
2019 Fall	MATH1023	Honors Calculus I	
2019 Summer	MATH4983L	Independent Study: Quantum Groups	
2019 Spring	MATH2023	Multivariable Calculus	
2018 Fall	MATH5111	Advanced Algebra I	
2003 Summer	MATH005	Pre-Calculus for Early Admission Scheme Students	

Kyoto University:

2017 Fall	N160001	Linear Algebra B
2017 Spring	MATH4123	Advanced Algebra II : Introduction to Cluster Algebra

Yale University:

2012 Spring	MATH120b	Multivariable Calculus, Problem Sessions
2011 Fall	MATH120a	Multivariable Calculus
2010 Fall	MATH112a	Single Variable Calculus I
2009 Fall	MATH120a	Multivariable Calculus
2008 Fall	MATH120a	Multivariable Calculus
2007 Fall	MATH120a	Multivariable Calculus
2006 Fall	MATH230a	Vector Calculus and Linear Algebra, TA

RESEARCH STUDENTS (HKUST)

Research Postgraduate Students:

2021–current	M.Phil.	Li, Yunhe
2021–current	M.Phil.	Ye, Jeff York
2021–current	M.Phil.	Choy, Ka Hei
2020–current	Ph.D.	Gao, Kailong
2019–2021	M.Phil.	Wong, Chun Wai
2018–2020	M.Phil. (graduated)	So, Chi Long Ivan
		Thesis: *Partition function from cluster algebra over 3-manifold*
		Admitted by Ph.D. program in Department of Mathematics,
		Michigan State University, USA
		Awardees of The Joseph Needham Merit Scholarship

Undergraduate Research Opportunity Project:

UROP1100	Fu, Wanying	*Cluster Algebra and Laurent Phenomenon*
UROP1100	Man, Ryuichi	*Cluster Expansion Formulas and Perfect Matchings*
UROP1100	Au, Kam Cheong Pisco	*Functional equations of classical and quantum dilogarithm*
UROP1100	Choy, Sin Hang Sonia	*Cluster Algebra and Expansion Formula for Cylinder*
UROP1100	Foo, Peace	*Cluster Algebra and Expansion Formula for Annulus*
UROP1100	Samin, Thanic Nur	*Cluster Algebra and Expansion Formula for Torus*
UROP1100	Wemp, Pachero	*Quantum Groups and Topological Invariants*
UROP2100	Man, Ryuichi	*On the Structure and Properties of D_4-Type Cluster Algebra*
		*Finalist - 2021 Mr Armin and Mrs Lillian Kitchell Undergraduate Research Award
UROP2100	Thanic, Samin Nur	*Cluster Algebra: F-polynomials and Jones Polynomials*
UROP2100	Choy, Sin Hang Sonia	*On Cluster Mutation and Continued Fractions*
UROP3100	Man, Ryuichi	*Quantum Dilogarithm Identities and Maximal Green Sequences*
UROP3100	Thanic, Samin Nur	*Cluster Algebra: Dilogarithm Identities, Braids and Complex Volume*
UROP3100	Choy, Sin Hang Sonia	*Cluster algebra and complex volume of knots*

Guided Study on Research:

SCIE1500	(Introductory Talk)	*Symmetry, Group and Representation Theory*
SCIE2500	Ye, Jeff York	*Cluster Algebras and Double Bruhat Cells*
SCIE2500	Tang, Ran	*Cluster Algebra and Laurent Phenomenon*
SCIE2500	Wemp, Pachero	*Integrable cluster dynamics of directed networks and pentagram maps*
SCIE2500	Thanic, Samin Nur	*Cluster Algebra: Periodicities and Dilogarithm Identities*
SCIE2500	Choy, Sin Hang Sonia	*Cluster algebra periodicity and dilogarithm identities*
SCIE3500	Ye, Jeff York	*Greedy Basis in Cluster Algebras*
SCIE3500	Tang, Ran	*Cluster Expansion Formulas and Perfect Matchings*
SCIE3500	Man, Ryuichi	*Postnikov Diagrams and the Cluster Structure of Flag Varieties*
SCIE3500	Wemp, Pachero	*Categorification of Quantum Groups and Topological Invariants*
SCIE4500	So, Chi Long Ivan	*Cluster Algebra Formulation of Quantum Field Theory*
SCIE4500	Tang, Ran	*Cluster Algebras and Jones Polynomial*

Capstone Projects:

MATH4991	(Group Project)	*Maximal Green Sequences from Surfaces*
		Classification of Finite Type Cluster Algebra
MATH4999	Long, Zhong	*Cluster Algebra and Generalized Associahedron*
MATH4999	Choy, Ka Hei	*Quantum Groups and its Application: Topological Quantum Field Theory*
MATH4999	Ye, Jeff York	*Canonical Basis of Cluster Algebra*
MATH4999	Vu, Xuan Trung	*On the braided category of modules over affine Lie algebra*

Summer Research Program:

2020 Summer	Li, Yunhe	Sichuan University, China
2019 Summer	Gao, Kailung	Nankai University, China

SERVICES AND PUBLIC OUTREACH

University Services at HKUST:

2019 May 2021 May	SSCI JUPAS Interviews
2019 April	HKUST UG Math Competition -Proposal of questions
2019 April	Administer of PhD Qualifying Examination -Algebra Oral Exam for Yanze Chen (Advisor: Yongchang Zhu)
2018 Dec 2020 May	Administer of PhD Qualifying Examination -Algebra Written Exam
2018 Nov	MPhil Thesis Committee (Internal) -Zhiming Li (Advisor: Yongchang Zhu)
2018 Sept	Helper on HKUST Info Day

Events Organizer:

2018 Feb	Co-organizer of 3rd KTGU Mathematics Workshop for Young Researchers	Kyoto University
2017 Feb	Co-organizer of 2nd KTGU Mathematics Workshop for Young Researchers	Kyoto University
2016 Feb	Co-organizer of Math Buzz Salon -Weekly English speaking event for mathematics students	Kyoto University
2016 Feb	Co-organizer of 1st KTGU Mathematics Workshop for Young Researchers	Kyoto University
2013–2015	Co-organizer of GTM Seminar -Bi-weekly seminar for mathematicians on general topics	Kavli IPMU

Online Courses:

2017 Nov	Course advisor and moderator of Massive Open Online Course "*More Fun with Prime Number*" -Instructor: Prof. Tetsushi Ito, Platform: www.edX.org	Kyoto University
2016 Jan	Course advisor and moderator of Massive Open Online Course "*Fun with Prime Number: The Mysterious World of Mathematics*" -Instructor: Prof. Tetsushi Ito, Platform: www.edX.org	Kyoto University

Public Outreach:

2021 June	Hang Lung Mathematics Awards Online Workshop *Abstraction in Modern Mathematics*	HLMA
2021 May	Inspiring Science Lecture *Math Problems that Worth a Million US Dollars*	CCC Kei Long College
2020–current	HKUST Science Focus Magazine Scientific Advisor	HKUST
2020 Jan	Secondary School Science Talk *Foundational Crisis of Mathematics & Gödel's Incompleteness Theorem*	St. Joseph's College
2019 Aug	Enrichment Workshops and Experiments (Science Summer Camp) Lab Session Person In Charge	HKUST
2019 July	HKUST Admission Talk and Inspiring Science Lecture *Abstract Algebra - The Past and Present of Equation Solving*	St. Stephen's Girl's College
2019 April	Sichuan University UG Visit Introductory Talk *What is Cluster Algebra?*	HKUST
2019 Mar–July	HKUST - HKFYG Mentorship Program Mentor for high school students	HKUST
2019 Jan	Secondary School Science Talk - STEM Month *Mathematics Beyond Equation Solving*	St. Joseph's College
2019–current	Sharing at Department of Mathematics Info Session	HKUST
2018–current	Sharing at Science Majors Week	HKUST

Other:

2016 July	Coordinator of International Mathematical Olympiad 2016	HKUST
2016–2018	Member of Kyoto Top Global University (KTGU) Project - Mathematics Unit	Kyoto University
2016–2018	Member of Mathematics Society of Japan	

Journals Refereed

Glasgow Mathematical Journal
IMRN (International Mathematics Research Notices)
Journal of Algebra
Journal of London Mathematical Society
Journal of Physics A
Letter in Mathematical Physics
Modern Physics Letters A
Publications Mathématiques de l'IHES
PRIMS (Publications of the Research Institute for Mathematical Sciences)
SIGMA (Symmetry, Integrability and Geometry: Methods and Applications)