

# Chul-hee Lee

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## Education

Ph.D. Mathematics, University of California, Berkeley, May 2012 (advisor: Richard Borcherds)

B.S. Mathematics, Seoul National University, Aug 2006

## Positions

Research Fellow, School of Mathematics, Korea Institute for Advanced Study, Feb 2018-present

Lecturer, School of Mathematics and Physics, University of Queensland, Sep 2017-Dec 2017

Research Fellow, School of Mathematics and Physics, University of Queensland, Sep 2014-Aug 2017 (host: Ole Warnaar)

Research Fellow, Department of Mathematical Sciences, Seoul National University, Mar 2014-Aug 2014

Research Fellow, Max-Planck-Institut für Mathematik, Oct 2012-Dec 2013

## Research Interests

Representations of Lie algebras and quantum groups

Modularity from Lie theory and mathematical physics

Computer algebra systems and experimental mathematics

## Research Outputs

### *Publication lists*

Product formula for the limits of normalized characters of Kirillov-Reshetikhin modules, to appear in **International Mathematics Research Notices**

Linear recurrence relations in  $Q$ -systems via lattice points in polyhedra, **Transformation Groups** (2019) 24: 429

Positivity and periodicity of  $Q$ -systems in the WZW fusion ring, **Advances in Mathematics** Vol. 311 (2017)

Linear recurrence relations in  $Q$ -systems and difference L-operators, **J. Phys. A: Math. Theor.** Vol. 48, No. 19 (2015), 195201

Nahm's conjecture and  $Y$ -systems, **Communications in Number Theory and Physics** Vol. 7, No.1 (2013), 1-14

A proof of the KNS conjecture :  $D_r$  case, **J. Phys. A: Math. Theor.** Vol. 46, No. 16 (2013), 165201

A Note on Nahm's Conjecture in Rank 2 Case (with An Huang), **Communications in Number Theory and Physics** Vol. 4, No. 4 (2010), 609-622

Algebraic structures in modular  $q$ -hypergeometric series, Ph.D. dissertation, U.C. Berkeley, (2012)

### *preprints*

On polyhedral formula for Kirillov-Reshetikhin modules, arXiv:1901.00104 (*submitted*)

Computation of Gross-Keating invariants, arXiv:1809.10323

### *notes*

Minor corrections to Nipp's tables of quaternary quadratic forms, arXiv:1902.08459

## Honors and Fellowships

Samsung Scholarship, 2006-2010

## Conferences and Workshops attended

Cluster Algebras 2019, RIMS, Kyoto University, Kyoto, Japan, Jun. 3-14, 2019

Infinite Analysis 19 : Quantum symmetries and integrable systems, University of Tokyo, Tokyo, Japan, Mar. 5-7, 2019

Workshop on W-algebras, University of Melbourne, Melbourne, Australia, Nov. 28-Dec. 2, 2016

Number Theory Down Under, Newcastle, Australia, Sep. 23-26, 2016

Geometric and categorical representation theory, Mooloolaba, Australia, Dec. 14-18, 2015

The Mathematics of Conformal Field Theory, Australian National University, Canberra, Australia, Jul. 13-17, 2015

Regulators, Mahler measures, and special values of L-functions, Centre de recherches mathématiques, Montreal, Canada, Feb. 16-20, 2015

Infinite Analysis 14 : New Perspectives in Integrable Systems and Representation Theory, University of Tokyo, Tokyo, Japan, Mar. 4-7, 2014

Oberwolfach Seminar: Cluster Algebras and Representation Theory, Oberwolfach, Germany, Oct. 13 -19, 2013

Amplitudes and Periods, Institut des Hautes Études Scientifiques, Bures-sur-Yvette, France, Dec. 3-7, 2012

Joint Introductory Workshop: Cluster Algebras and Commutative Algebra, Mathematical Sciences Research Institute, Berkeley, US, Aug. 27- Sep. 07, 2012

Cluster Algebras and Statistical Physics, Institute for Computational and Experimental Research in Mathematics, Providence, US, Aug. 15-19, 2011

Mock modular forms in combinatorics and arithmetic geometry, American Institute of Mathematics, Palo Alto, US, Mar. 8-12, 2010

Mock theta functions and applications in combinatorics, algebraic geometry, and mathematical physics, Max Planck Institute for Mathematics, Bonn, Germany, May 25-29, 2009

## Talks and Presentations

Finite-dimensional representations of quantum affine algebras (as part of intensive lecture series), Seoul National University, Seoul, Korea, Jul. 17-19, 2019

Linear regression for computing with Macdonald polynomials, Sungkyunkwan University, Suwon, Korea, May 17, 2019

String functions and quantum affine algebras, Sogang University, Seoul, Korea, Mar. 19, 2019

A classical introduction to Gross-Keating invariants, Mini Workshop on the Representations of Quadratic Forms, Gwangju (Gyeonggi), Korea, Feb. 19-20, 2019

Quadratic forms over 2-adic integers with computers, Annual Number Theory Conference, Seoul, Korea, Feb. 9, 2019

Computation of Gross-Keating invariants, Conference on the Arithmetic Theory of Quadratic Forms, Seoul, Korea, Jan. 8, 2019

An IMO problem, and fusion ring computations, Pohang Mathematics Workshop, Yeosu, Korea, Nov. 23, 2018

Computer implementation of Katsurada's formula for Siegel-Eisenstein series, Postech, Pohang, May. 23, 2018

KR modules and Ehrhart theory, Seoul National University, Seoul, Korea, May. 11, 2018

An explicit introduction to the Siegel-Weil formula, Sinchon Workshop on Algebraic Geometry, Sinchon Workshop on Algebraic Geometry, Seoul, Korea, Apr. 27, 2018

An IMO problem, Coxeter groups and fusion rings, Korea University, Seoul, Korea, Apr. 19, 2018

Dilogarithm function in arithmetic and geometry, Seoul National University of Science and Technology, Seoul, Korea, Mar. 26 & Apr. 2, 2018

On fusion product of affine integrable representations, Seoul National University, Seoul, Korea, Dec. 27-28, 2016

Nahm's conjecture and representation theory of classical and quantum affine algebras, International Conference for the 70th Anniversary of Korean Mathematical Society, Seoul, Korea, Oct. 23, 2016

Computation in Weyl groups, Seoul National University, Seoul, Korea, Jul. 19, 2016

Linear recurrence relations in  $Q$ -systems, Australian National University, Canberra, Australia, Mar. 15, 2016

Linear recurrence relations in  $Q$ -systems via lattices points in polyhedra, KAIST, Daejeon, Korea, Feb. 12, 2016

On some properties of solutions of constant  $Y$ -systems, Geometric and categorical representation theory conference, Mooloolaba, Australia, Dec. 18, 2015

On dilogarithm identities from conformal field theory, The Mathematics of Conformal Field Theory conference, Australian National University, Canberra, Australia, Jul. 13, 2015

Jacobi's theta function from a representation theoretic viewpoint, Seoul National University, Seoul, Korea, Jun. 11, 2015

On dilogarithm identities from conformal field theory, Centre de Recherches Mathématiques, Montreal, Canada, Feb. 19, 2015

Nahm's conjecture and related algebraic structures, KAIST, Daejeon, Korea, Feb. 20, 2015

Nahm's conjecture and related algebraic structures, Number Theory Down Under, Newcastle, Australia, Oct. 25, 2014

Kirillov-Reshetikhin modules and the WZW fusion ring, University of Melbourne, Melbourne, Australia, Oct. 10, 2014

Q-systems and the WZW fusion ring, University of Queensland, Brisbane, Australia, Oct. 7, 2014

What is a Coxeter number?, Seoul National University, Seoul, Korea, Jun. 24, 2014

Kirillov-Reshetikhin modules and the WZW fusion ring, RIMS, Kyoto, Japan, May. 10, 2014

Bethe ansatz for beginners, Korea Institute for Advanced Study, Seoul, Korea, Apr. 7, 2014

When Kirillov-Reshetikhin modules meet the fusion ring, Infinite Analysis 14, University of Tokyo, Japan, Mar. 5, 2014

Kirillov-Reshetikhin modules and fusion rings from conformal field theory, Dublin Institute for Advanced Studies, Dublin, Ireland, Sep. 26, 2013

Nahm's conjecture and related algebraic structures I and II, Lecture series on  $q$ -series and modular forms, Korea Institute for Advanced Study, Seoul, Korea, Jul. 24-25, 2013

Kirillov-Reshetikhin modules and fusion rings from conformal field theory, Seminar on Algebra, Geometry and Physics, Max-Planck-Institut für Mathematik, Bonn, Germany, Jul. 9, 2013

On the boundary of  $Q$ -systems : introduction to the KNS conjecture, Séminaire d'Algèbre, Paris, France, Dec. 3, 2012

Around Nahm's conjecture, Max-Planck-Institut für Mathematik, Bonn, Germany, Nov. 15, 2012

Around Nahm's conjecture, Mathematisches Institut der Universität zu Köln, Germany, Nov. 13, 2012

## Teaching Experiences

### *Graduate Student Instructor at the University of California, Berkeley*

GSI (teaching assistant) for courses in Calculus, Multivariable Calculus, Linear algebra and Differential equations, Analytic Geometry and Calculus, 2008-2012

### *Instructor at the University of Queensland*

Math 3306 (Set Theory and Mathematical Logic), Semester 2, 2017

Math 3405 (Differential Geometry), Semester 2, 2017

Math 4304 (Number Theory), Semester 2, 2016