

# Curriculum Citæ

Tomoyuki Arakawa

September 2, 2022

## Research areas:

Representation theory, vertex operator algebras and mathematical physics.

## Curriculum vitæ

First name and family name: Tomoyuki Arakawa.

Nationality: Japanese.

Professional address: Research Institute for Mathematical Sciences, Kyoto University, Kyoto Japan 606-8502.

Position: Professor.

E-mail: [arakawa@kurims.kyoto-u.ac.jp](mailto:arakawa@kurims.kyoto-u.ac.jp).

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## Academic positions

RIMS, Kyoto University, Japan, Professor, April, 2018-present.

RIMS, Kyoto University, Japan. Associate Professor, October 2010- March, 2018,

Nara Women's University, Japan, Associate Professor, April 2005-October 2010.

Nagoya University, postdoctoral position, April 1999-March 2005.

## Visiting positions

Université Paris-Saclay, LMO Chair, October-December 2021.

Sorbonne Université, Paris, Visiting Professor, Winter, 2020.

Laboratoire Paul Painlevé, France, Visiting Professor, May 8, 2019–July 13, 2019.

MIT, USA, Visiting Associate Professor, February, 2016–January, 2018.

Instituto de Matemática e Estatística/IME/USP, Visiting Professor, São Paulo, Brazil, November 15, 2015–December 14, 2015.

University of Poitiers, France, Visiting Professor, September 29, 2014–October 31, 2014.

Friedrich-Alexander-Universität Erlangen-Nürnberg, Germany, Visiting Professor, October 31, 2013–January 28, 2014.

London Mathematical Society Scheme 2, October 9–29, 2011.

The University of Sydney, Visiting Professor, April 15, 2013–May 15, 2013.

Nagoya University, Visiting Associate Professor, April 1, 2013–March 31, 2007.

## Education

Ph.D. Mathematics, Nagoya University, March 1999.

*Dissertation:* “Drinfeld functor and finite-dimensional representations of Yangian”.

*Advisor:* Tsuchiya Akihiro.

M.A. Mathematics, Nagoya University, March 1995.

B.S. Mathematics, Kyoto University, March 1993.

## Honors

2019 Colloquium “Sibe Mardešić”, University of Zagreb.

2019 JSPS Prize for Science and Technology.

2018 ICM Invited Talk, Rio de Janeiro.

2017 William J. Spencer Lecture, Kansas State University.

2017 MSJ Autumn Prize.

2013 MSJ Algebra Prize

2008 JSPS Young Scientist Prize.

2004 MSJ Takebe Takahiro Special Prize.

## Grants

JSPS Grant-in-Aid for Scientific Research (S) No. 121H04993, “Vertex algebras for the 21st century”, 2021-07-01-206-03-31 (157,690,000JPY).

JSPS Grant-in-Aid for Scientific Research (A) No. 17H01086, “W-algebras and applications”, 2017-04-01–2022-03-31(43,680,000JPY).

JSPS Grant-in-Aid Grant-in-Aid for Challenging Research (Exploratory) No. 17K18724, “Class  $\mathcal{S}$  chiral algebra and symplectic geometry”, 2017-06-30–2020-03-31 (6,370,000JPY).

JSPS Grant-in-Aid for challenging Exploratory Research No. 26610006, “Geometric methods in vertex algebras”, 2014-2016 (4,030,000JPY).

JSPS Grant-in-Aid for Scientific Research (B) No. 25287004, “New developments in representation theory of W-algebras”, 2013-2017 (14,820,000JPY).

JSPS Grant-in-Aid for challenging Exploratory Research No. 23654006, “New developments of vertex algebra theory”, 2011-2013 (3,640,000JPY).

JSPS Grant-in-Aid for Scientific Research (B) No. 20340007, “A comprehensive research of vertex algebras, especially the W-algebras”, 2008-2012 (17,030,000JPY).

JSPS Grant-in-Aid for Young Scientists (B) No. 17740006, “Field theory and representation theory”, 2005-2007 (3,500,000JPY).

## Publications (articles, lecture notes, preprints)

### REFEREED PAPERS

1. (with K. Kawasetsu and J. Sebag) A question of Joseph Ritt from the point of view of vertex algebras, *J. Algebra*, Volume 588, 15 December 2021, Pages 118-128.
2. (with J. van Ekeren) Rationality and Fusion Rules of Exceptional W-Algebras, to appear in *J. Eur. Math. Soc.*
3. (with C. Jiang and A. Moreau) Simplicity of vacuum modules and associated varieties, *J. Éc. polytech. Math*, Tome 8 (2021), pp. 169-191.
4. (with H. Yamada and H. Yamauchi)  $\mathbb{Z}_k$ -code vertex operator algebras, *J. Math. Soc. Japan*, Volume 73, Number 1 (2021), 185-209.
5. (with E. Frenkel) Quantum Langlands duality of representations of W-algebras, *Compos. Math.* V. 155, Issue 12, December 2019, 2235-2262.
6. (with T. Creutzig and A. Linshaw) W-algebras as coset vertex algebras, *Invent. Math.*, Volume 218, Issue 1, 145–195.

7. (with A. Moreau) Arc spaces and chiral symplectic cores, *Publ. Res. Inst. Math.*, Special issue dedicated to Masaki Kashiwara on the occasion of his 70th birthday, Volume 57, Issue 3/4, 2021, pp. 795–829.
8. Representation theory of W-algebras and Higgs branch conjecture, *Proc. Int. Cong. of Math. 2018 Rio de Janeiro*, Vol. 1 (1261-1278).
9. (with A. Linshaw) Singular support of a vertex algebra and the arc space of its associated scheme, In: Gorelik M., Hinich V., Melnikov A. (eds) Representations and Nilpotent Orbits of Lie Algebraic Systems. Progress in Mathematics, vol 330. Birkhäuser, Cham.
10. Associated Varieties and Higgs Branches (A Survey), *Contemp. Math.* 711(2018), 37-44.
11. (with A. Premet) Quantizing Mishchenko-Fomenko subalgebras for centralizers via affine W-algebras, *Trans. Moscow Math. Soc.* 2017, 217-234.
12. (with C. Jiang) Coset Vertex Operator Algebras and W-Algebras, *C. Sci. China Math.* (2017). <https://doi.org/10.1007/s11425-017-9161-7>.
13. (with C.-H. Lam and H. Yamada) Parafermion vertex operator algebras and W-algebras, *Trans. Amer. Math. Soc.*, 371 (2019), 4277-4301.
14. (with J. van Ekeren) Modularity of relatively rational vertex algebras and fusion rules of regular affine W-algebras, *Comm. Math. Phys.* (2019), 370(1), 205–247.
15. (with K. Kawasetsu) Quasi-lisse vertex algebras and modular linear differential equations, In: V. G. Kac, V. L. Popov (eds.), Lie Groups, Geometry, and Representation Theory, *A Tribute to the Life and Work of Bertram Kostant*, *Progr. Math.*, 326, Birkhauser, 2018.
16. (with A. Moreau) On the irreducibility of associated varieties of W-algebras, *J. Alg.* 500, 15 April 2018, Pages 542-568.
17. (with A. Moreau) Sheets and associated varieties of affine vertex algebras, *Adv. Math.*, Volume 320, 7 November 2017, Pages 157–209.
18. (with T. Creutzig and A. Linshaw) Cosets of Bershadsky-Polyakov algebras and rational W-algebras of type A, *Sel. Math. New Ser.*, October 2017, Volume 23, Issue 4, pp 2369–2395.
19. (with K. Kawasetsu, T. Creutzig and A. Linshaw) Orbifolds and cosets of minimal  $\mathcal{W}$ -algebras, *Comm. Math. Phys.* October 2017, Volume 355, Issue 1, pp 339–372.
20. (with V. Futorny and L.-E. Ramirez) Weight representations of admissible affine vertex algebras, *Comm. Math. Phys.*, 353 (2017), no.3, 1151-1178.

21. (with A. Molev) Explicit generators in rectangular affine W-algebras of type A, *Lett. Math. Phys.* 107(1), 47-59, 2017.
22. (with A. Moreau) Joseph ideals and lisse minimal W-algebras, *J. Inst. Math. Jussieu*, 17 (2018), no. 2, 397–417.
23. (with W. Wang) Modular affine vertex algebras and baby Wakimoto modules, *Proceedings of Symposia in Pure Mathematics*, Vol. 92 (2016), 1-16.
24. (with H. Yamada and H. Yamauchi) Vertex operator algebras associated with  $\mathbb{Z}/k\mathbb{Z}$ -codes, in Springer Proceedings in Mathematics & Statistics, Vol. 191.
25. Rationality of admissible affine vertex algebras in the category  $\mathcal{O}$ , *Duke Math. J.*, Volume 165, Number 1 (2016), 67-93.
26. Rationality of W-algebras: principal nilpotent cases, *Ann. Math.* 182 (2015), 565-604.
27. (with T. Kuwabara and F. Malikov) Localization of affine W-algebras, *Comm. Math. Phys.*, April 2015, Volume 335, Issue 1, 143-182.
28. Associated varieties of modules over Kac-Moody algebras and  $C_2$ -cofiniteness of W-algebras, *Int. Math. Res. Notices* (2015) Vol. 2015 11605-11666.
29. Two-sided BGG resolutions of admissible representations, *Represent. Theory* 18 (2014), 183-222.
30. (with C.-H. Lam and H. Yamada) Zhu's algebra,  $C_2$ -algebra and  $C_2$ -cofiniteness of parafermion vertex operator algebras, *Adv. Math.*, vol. 264 (2014), 261-295.
31. Rationality of Bershadsky-Polyakov vertex algebras, *Comm. Math. Phys.*, October 2013, Volume 323, Issue 2, 627-633.
32. W-algebras at the critical level, *Contemp. Math.*, 565, 1-14, 2012.
33. A remark on the  $C_2$ -cofiniteness condition on vertex algebras, *Math. Z.* vol. 270, no. 1-2, 559-575, 2012.
34. (with P. Fiebig) The linkage principle for restricted critical level representations of affine Kac-Moody algebras, *Compos. Math.*, 148, 1787-1810, 2012.
35. (with F. Malikov) A chiral Borel-Weil-Bott theorem, *Adv. Math.*, 229 (2012) 2908-2949.
36. (with P. Fiebig) On the restricted Verma modules at the critical level, *Trans. Amer. Math. Soc.* 364 (2012), 4683-4712.

37. (with D. Chebotarov and F. Malikov) Algebras of twisted chiral differential operators and affine localization of  $\mathfrak{g}$ -modules, *Sel. Math. New Ser.*, vol.17, no. 1, 1-46, 2011.
38. Representation theory of W-algebras, II, *Adv. Stud. Pure Math.* 61(2011), 51-90.
39. Representation Theory of W-Algebras, *Invent. Math.*, Vol. 169 (2007), no. 2, 219-320.
40. A New Proof of the Kac-Kazhdan Conjecture, *Int. Math. Res. Not.* 2006, Art. ID 27091, 5 pages.
41. Representation Theory of Superconformal Algebras and the Kac-Roan-Wakimoto Conjecture, *Duke Math. J.*, Vol. 130 (2005), No. 3, 435-478.
42. Vanishing of cohomology associated to quantized Drinfeld-Sokolov reduction, *Int. Math. Res. Not.* 2004, no.15, 730-767.
43. Drinfeld functor and finite-dimensional representations of Yangian, *Comm. Math. Phys.* 205 (1999), no. 1, 1-18.
44. (with T. Suzuki) Duality between  $\mathfrak{sl}_n(\mathbb{C})$  and the degenerate affine Hecke algebra, *J. Algebra* 209 (1998), no. 1, 288-304.
45. (with T. Suzuki and A. Tsuchiya) Degenerate double affine Hecke algebra and conformal field theory. Topological field theory, primitive forms and related topics (Kyoto, 1996), 1-34, *Progr. Math.*, 160, Birkhauser, 1998.
46. (with T. Nakanishi, K. Oshima and A. Tsuchiya) Spectral decomposition of path space in solvable lattice model. *Comm. Math. Phys.* 181 (1996), no. 1, 157-182.

## LECTURE NOTES

1. Introduction to W-algebras and their representation theory, In: Callegaro F., Carnovale G., Caselli F., De Concini C., De Sole A. (eds) *Perspectives in Lie Theory*. Springer INdAM Series, vol 19. Springer.

## PREPRINTS

1. (with J. van Ekeren and A. Moreau) Singularities of nilpotent Slodowy slices and collapsing levels of W-algebras, arXiv:2102.13462 [math.RT].
2. (with J. van Ekeren and A. Moreau) On the nilpotent orbits arising from admissible affine vertex algebras, arXiv:2010.08429 [math.RT].
3. (with T. Creutzig and B. Feigin) Urod algebras and Translation of W-algebras, arXiv:2010.02427 [math.RT].
4. Chiral algebras of class  $\mathcal{S}$  and Moore-Tachikawa symplectic varieties, arXiv:1811.01577 [math.RT].

### Advanced lectures and mini-courses (outside Japan)

- December, 2020 “Introduction to vertex algebras and their representations (3 lectures)”, Discussion Meeting on Representation Theory 2020, Department of Mathematics, Indian Institute of Science, Bengaluru, India (online).
- March, 2020 “Introduction to vertex algebras”, 3 lectures, Institut Henri Poincaré, Paris.
- August 5 – August 8, 2019: “W-algebras”, Program on Vertex Operator Algebras and Related Topics, Sichuan University, Chengdu, China (12 hours lecture).
- April 23 – April 24, 2019: “4d/2d Duality and Representation Theory”, 4 lectures at International Conference “Vertex Algebras and Geometry of Moduli Spaces”, HSE, Moscow.
- November 28 - December 2, 2016: invited as a mentor for the “Workshop on W-algebras”, University of Melbourne.
- December 2014-January 2015: “Introduction to W-algebras and their representation theory” (12 hours lectures), *Vertex algebras, W-algebras, and applications*, The Centro di Ricerca Matematica Ennio De Giorgi, Pisa, Italy.
- April 2013: “Introduction to representation theory of W-algebras”, a mini-course lecture, the University of Sydney.
- December 2012: “Affine category  $\mathcal{O}$  and representation theory of W-algebras (3 lectures)”, *Category  $\mathcal{O}$  : geometry and categorification*, Centre International de Rencontres Mathématiques, Luminy.
- December 2012: “Recent development in representation theory of W-algebras”, *Algebraic Structures in Integrable Systems (3 lectures)*, Moscow University.
- June 2005: “Representation theory of W-algebras”, mini-course lecture, Schroedinger Institute, Vienna, June 2005.

### International Conference talks

1. “4D/2D duality and VOA theory”, Quantum Field Theories and Quantum Topology Beyond Semisimplicity, BIRS (Banff International Research Station), November 2, 2021 (online).
2. “R-filtration and Vogan filtration”, Pure Spinors, Superalgebras, and Holomorphic Twists, Heidelberg University, October 6. 2021 (online).
3. “4D/2D duality and representation theory”, Randomness, Integrability and Representation Theory in Quantum Field Theory 2021, March 24, 2021 (online).

4. “Associated varieties and 4D/2D correspondence”, String Math 2020, online conference, July 28, 2020.
5. “Coset construction of W-algebras and applications”, Workshop “Geometry and representation theory” Institut Henri Poincare, Paris, January 29, 2020.
6. “4D/2D duality and Moore-Tachikawa varieties”, Workshop “Rikkyo Math-Phys 2020”, Research Center for Mathematical Physics. January 10, 2020.
7. “4D/2D duality and representation theory”, Conference on Lie and Jordan Algebras, Their Representations and Applications- IX, Tianyuan Mathematical Center in Southwest China, January 9, 2020.
8. “4d/2d Duality and Representation Theory, International Symposium on “Advances and Perspectives in Representation Theory””, Shandong University, October 15, 2019.
9. “4D/2D duality and Moore-Tachikawa symplectic varieties”, Representation theory and integrable systems, On the occasion of the 60th birthday of Vitaly Tarasov and the 70th birthday of Alexander Varchenko, ETH, Zurich, Switzerland, August 14, 2019.
10. “Quantum Langlands duality of representations of W-algebras”, Representation Theory XVI, Inter-University Centre, Dubrovnik, Croatia, June 25, 2019.
11. “4d/2d duality and Moore-Tachikawa symplectic varieties”, The Mathematical Foundations of Conformal Field Theory and Related Topics -A conference in honor of Yi-Zhi Huang-, Chern Institute of Mathematics, Nankai University, China, June 12, 2019.
12. “4d/2d duality and W-algebras”, Geometric and automorphic aspects of W-algebras, University of Lille, May 27, 2019.
13. “Rationality and fusion rules of exceptional W-algebras”, Workshop on Finite Groups, vertex algebras and algebraic combinatorics, National Cheng Kung University, Taiwan, March 26, 2019.
14. “Chiral algebras of class  $\mathcal{S}$  and Moore-Tachikawa symplectic varieties”, Taipei Conference in Representation Theory VI, January 8, 2019, Academia Sinica, Taiwan.
15. “Chiral algebras of class  $\mathcal{S}$  and Moore-Tachikawa symplectic varieties” Vertex Algebras and Gauge Theory, December 17, 2019, The Simons Center for Geometry and Physics, New York, USA.
16. “Chiral algebras of class  $\mathcal{S}$  and related problems”, Workshop on vertex algebras and infinite-dimensional Lie algebras, November 23, 2018, Split, Croatia.



17. “Moore-Tachikawa variety and 4d/2d duality”, Perspectives in algebraic analysis, November 12, 2018, RIMS, Kyoto University.
18. “Chiral algebras of class S and symplectic varieties”, Theoretical Physics Symposium 2018, November 7, 2-18, DESY Hamburg, Germany.
19. “4d/2d duality and class S theory” Geometric and Categorical Aspects of CFTs, September 24, 2018, The Casa Matemática Oaxaca (CMO), Mexico.
20. “Higgs branch conjecture for class S theory”, Workshop on Mathematical Physics, August 11, 2018, ICTP-SAIFR, São Paulo, Brazil.
21. “Representation theory of W-algebras and Higgs branch conjecture”, The International Congress of Mathematicians 2018, August 2, 2018, Rio de Janeiro, Brazil.
22. “Higgs branch conjecture for class S theory”, Vertex algebras, factorization algebras and applications, July 18, 2018, Kavli IPMU, Japan.
23. “Representation theory of W-algebras and Higgs branch conjecture”, RIMS Workshop “Vertex Operator Algebras and Symmetries”, July 10, 2018, RIMS, Kyoto University.
24. “Coset construction and quantum geometric Langlands program”, Vertex Operator Algebras, Number Theory, And Related Topics A Conference In Honor Of Geoffrey Mason, 11-15 June, 2018, Sacramento California, USA.
25. “On recent development of representation theory of W-algebras and related topics”. Gauge Theory, Geometric Langlands And Vertex Operator Algebras, March 24, 2018, Perimeter Institute for Theoretical Physics, Canada.
26. “Chiralization of Moore-Tachikawa 2d TQFTs”, The 3rd KTGU Mathematics Workshop for Young Researchers, February 17, 2018, Kyoto University.
27. “Higgs branch conjecture for Class S theories, Affine, Vertex and W-algebras, December 14, 2017, Rome, Italy.
28. “W-algebras”, Autumn Prize Winner talk, MSJ meeting, Yamagata University, September 12, 2017.
29. “Higgs branch conjecture for Class S theories” Affine, Vertex and W-algebras, Roma, Istituto Nazionale di Alta Matematica, December 11-15, 2017.
30. “Joseph ideals and Higgs branches”, Algebraic Modes of Representations The Canicular Days in honor of Anthony Joseph’s 75th birthday, The Weizmann Institute of Science, Israel, July 16-18, 2017.

31. “Moore-Tachikawa conjecture and vertex algebras”, Representation Theory XV IUC, Dubrovnik, Croatia, June 18–25, 2017.
32. “Moore-Tachikawa conjecture and chiral algebras of class S”, 7th Seminar on Conformal Field Theory, Technische Universität Darmstadt, Germany, February 3, 2017 .
33. “Associated varieties of vertex algebras”, “Construction of genus zero chiral algebras of class S” (two talks), Exact operator algebras in superconformal field theories, Perimeter Institute for Theoretical Physics, Canada, December 14-16, 2016.
34. “Moore-Tachikawa conjecture and chiral algebras of class S”, plenary talk, 60th Annual Meeting of the Australian Mathematical Society, Australian National University, Canberra, December 5–8, 2016.
35. “On the 2d TQFT associated with vertex algebras”, *Conference in Finite Groups and Vertex Algebras dedicated to Robert L. Griess on the occasion of his 71st birthday*, August 26, 2016, Academia Sinica, Taipei, Taiwan.
36. “Equivariant affine W-algebras”, *Nilpotent Orbits and Representation Theory*, June 16, 2016, Centro di Ricerca Matematica Ennio De Giorgi (CRM), Pisa, Italy.
37. “Deligne exceptional series, Feigin-Frenkel conjecture, and W-algebras”, *Representation theory and symplectic singularities in honour of Sasha Premet’s 60th birthday*, April 4, 2016, ICMS, Edinburgh, UK.
38. “Modular invariance of trace functions of Kac-Wakimoto admissible representations” *Lie and Jordan algebras, Their representations and Applications VI, dedicated to Efim Zelmanov’s 60th birthday*, December 13-19, 2015, Bento Goncalves, Brazil.
39. “Sheets and affine vertex algebras”, *Vertex operator algebra and Related Topics*, September 10, 2015, Sichuan University, Chengdu, China.
40. “Joseph ideals and lisse minimal W-algebras”, *Summer School and Workshop on Lie Theory and Representation Theory IV*, July 2, 2015, East China Normal University, Shanghai, China.
41. “Admissible representations and minimal models of W-algebras I, II”, *Representation Theory XIV*, July 23 and 25, 2015, Dubrovnik, Croatia.
42. “Trace functions of Kac-Wakimoto admissible representations”, *Taitung Workshop on finite groups, VOA and algebraic combinatorics*, March 8, 2015.
43. “Minimal models of W-algebras”, *Algebraic Lie theory and representation theory*, International Centre for Mathematical Sciences (ICMS), Edinburgh, UK, September 1, 2014.

44. “Feigin-Frenkel, Adamovic-Milas, and Frenkel-Kac-Wakimoto”, *Workshop “Lie theory and mathematical physics”*, Centre de recherches mathématiques, Université de Montréal, Canada, May 22, 2014.
45. “The Frenkel-Kac-Raul-Wang conjecture and quantized Drinfeld-Sokolov reduction”, *Hualien Workshop on Finite Groups, VOA, Algebra Combinatorics and Related Topics*, National Dong Hua University, Taiwan, March 22, 2014.
46. “W-algebras and Vinberg’s problem for centralizers”, *Symmetries in Mathematics and Physics II in honor of Prof. Victor Kac’s 70th birthday*, IMPA, Rio de Janeiro, Brazil, June 28, 2013.
47. “An application of affine W-algebras”, *Taitung Workshop on group theory, VOA and algebraic combinatorics*, Taitung University, Taiwan, March 27, 2013.
48. “Nilpotent orbits and the Kac-Wakimoto conjecture”, *Conference on Groups, VOAs and Related Structures in Honor of Masahiko Miyamoto*, University of Tsukuba, Japan, September 11, 2012.
49. “Rationality of W-algebras”, *The XXIX International Colloquium on Group-Theoretical Methods in Physics*, Chern Institute of Mathematics Tianjin, China, August 20, 2012.
50. “Rationality of admissible affine vertex algebras in the category O”, *Conference on Vertex Operator Algebras, Finite Groups and Related Topics*, Academia Sinica, Taiwan December 18, 2011.
51. “Localization of affine W-algebras at the critical level”, *Perspectives in Algebraic Lie Theory*, Isaac Newton Institute for Mathematical Sciences, September 15, 2011.
52. “Rationality and smoothness of W-algebras”, *Representation Theory of Algebraic Groups and Quantum Groups*, Nagoya, Japan, August 2, 2010.
53. “Varieties of nilpotent orbits, Kac-Moody algebras, and W-algebras”, *Workshop and Summer School on Lie Theory and Representation Theory II*, East China Normal University, Shanghai, China, July 20, 2009.
54. “Representation Theory of W-algebras”, *joint AMS-TMS meeting*, Tung-hai University, Taichung, Taiwan, December 15, 2005.
55. “Representation theory of W-algebras”, *International Conference on Algebra in Memory of Kostia Beidar*, National Cheng Kung University, Tainan, Taiwan, March 2005.
56. “Representation theory of -algebras and superconformal algebras”, *International conference on infinite-dimensional Lie theory*, Morningside center of Mathematics Chinese academy of Science, Beijing, China, July 2004.

### Colloquium talks

1. “4D/2D duality and representation theory”, Yau Mathematical Sciences Center, Tsinghua University, November 26, 2021 (online).
2. “4D/2D duality and representation theory”, Penn Mathematics Colloquium, Department of Mathematics, University of Pennsylvania, November 3, 2021 (online).
3. “4d/2d Duality and Representation Theory”, Osaka City University, November 20, 2019.
4. “4d/2d Duality and Representation Theory”, Shanghai Jiao Tong University, September 13, 2019.
5. “4d/2d duality and representation theory”, Colloquium “Sibe Mardešić”, University of Zagreb, May 22, 2019.
6. “4d/2d duality and representation theory” University of Lille, March 8, 2019.
7. “Coset construction and quantum geometric Langlands program”, RIMS, Kyoto University, April 18, 2018.
8. “Vertex algebras and symplectic varieties” University of Alberta, March 29, 2018.
9. “Vertex Algebras and Symplectic Varieties”, William J. Spencer Lectures, *Kansas State University*, November 28, 2017.
10. “Vertex operator algebras and symplectic varieties”, *UCSC*, USA, March 7, 2017.
11. “Moore-Tachikawa conjecture and chiral algebras of class S”, *Sydney-UNSW Joint Colloquium*, Australia, November 25, 2016.
12. “Vertex algebras and symplectic varieties”, *the University of Poitiers*, France, November 2, 2016.
13. “Vertex algebras and symplectic varieties”, *University of Texas at Arlington*, USA, September 30, 2016.
14. “The Adamović-Milas conjecture and application”, *University of Zagreb*, Croatia, June 1, 2016.
15. “Pentagonal number theorem and representation theory”, *University of Virginia*, USA, April 21, 2016.
16. “W-algebras and Frenkel- Kac-Wakimoto conjecture”, *Academia Sinica*, Taiwan, March 12, 2015.

17. “W-Algebras as Generalization of Infinite-Dimensional Lie Algebras”, *Friedrich-Alexander-Universität Erlangen-Nürnberg*, Germany, December 3, 2013.
18. “Chiral Hamiltonian reduction and representation theory”, *Nagoya*, Japan, May 11, 2011.
19. “BRST reduction and representation theory of W-algebras”, *RIMS, Kyoto University*, Japan, October 13, 2010.
20. “Character formulae of W-algebras”, *Osaka University*, Osaka, Japan, December 3, 2008.
21. “Quantum BRST reduction and representation theory”, *University of Virginia*, USA, April 5, 2007.
22. “Vertex algebras associated with Slodowy slices”, *RIMS, Kyoto University*, Japan, November 27, 2006.
23. “W-Algebras and their representations”, *Tohoku University*, Sendai, Japan, October 23, 2006.