Office: Rm 441 in Sci. Bldg. A
Phone: +81 (0) 52–789–5595 (ext. 5595)
Email: yanagida@math.nagoya-u.ac.jp
Web-site: http://www.math.nagoya-u.ac.jp/~yanagida/index.html
Membership of Academic Societies:
The Mathematical Society of Japan

Research Interest:

- Algebraic Geometry
- Representation Theory
- Mathematical Physics

Research Summary:

My research areas are algebraic geometry and representation theory, in particular the topics related to mathematical physics.

My interest in algebraic geometry is mainly on the derived category of sheaves on algebraic varieties. Two keywords may be named: Fourier-Mukai transforms and Bridgeland stability conditions. As for Fourier-Mukai transforms, we proved in [1] affirmatively the conjecture of Mukai (1980), which says that under some generic condition stable sheaves on abelian surfaces have a resolution consisting of semi-homogeneous sheaves. As for Bridgeland stability, we studied in [2], stability conditions for abelian and K3 surfaces, in particular focusing on the chamber structure of the space of stability conditions and its application to Fourier-Mukai transforms.

My interest in representation theory is mainly on quantum algebras, in particular quantum groups, Hall algebras and vertex algebras. In [3] we investigated the quantum integrable system associated to Macdonald symmetric functions using representation theory of $\mathfrak{gl}_1$ quantum toroidal algebra (also called the Ding-Iohara-Miki algebra).

In [4], I proved that Bridgeland's Hall algebra of complexes is in general the Drinfeld double of the corresponding Ringel-Hall algebra. In [6], we studied Toën's derived Hall algebra for the Jordan quiver, and showed that it has an infinite number of q-Heisenberg algebras as subalgebras. In the preprint [7], I gave a geometric formulation of Toën's derived Hall algebra. It is a derived analogue of Lusztig's formulation of Ringel-Hall algebra in terms of the constructible sheaves on the moduli space of representations. In the derived case the corresponding moduli space is the one of complexes appears, which is realized as a derived stack.

As an intersection of algebraic geometry and representation theory, I have studied the AGT relation in [5], which states a surprising relationship between the geometry of instanton moduli spaces and W algebras, a typical class of vertex algebra.

Recently I gave a derived treatment of vertex algebras in [8]. This study is motivated by vertex algebras of class S, proposed by physicists.

Major Publications:

[1] S. Yanagida, K. Yoshioka, *Semi-homogeneous sheaves, Fourier-Mukai transforms and moduli of stable sheaves on abelian surfaces*, J. Reine Angew. Math. **684** (2013), 31–86.

[2] H. Minamide, S. Yanagida, K. Yoshioka, *The wall-crossing behavior for Bridgeland's stability conditions on abelian and K3 surfaces*, J. Reine Angew. Math. **735** (2018), 1–107.

[3] B. Feigin, K. Hashizume, A. Hoshino, J. Shiraishi, S. Yanagida, *A commutative algebra on degenerate* CP^1 *and Macdonald polynomials*, J. Math. Phys. **50** (2009), no. 9, 095215, 42 pp.

[4] S. Yanagida, *A note on Bridgeland's Hall algebra of two-periodic complexes*, Math. Z. **282** (2016), Issue 3, 973–991.

[5] S. Yanagida, *Whittaker vector of the deformed Virasoro algebra in terms of Macdonald symmetric polynomials*, Lett. Math. Phys. **106** (2016), Issue 3, 395–431.

[6] R. Shimoji, S. Yanagida, *A study of symmetric functions via derived Hall algebra*, to appear in Com. Alg.; arXiv:1812.06033.

[7] S. Yanagida, *Geometric derived Hall algebra*, preprint, arXiv:1912.05442.

[8] S. Yanagida, *Derived gluing construction of chiral algebras*, preprint, arXiv:2004.10055.

Education and Appointments:

2012	Ph.D. Mathematics at Kobe University
2012	JSPS PD at RIMS, Kyoto University
2012	Assistant Professor, RIMS, Kyoto University
2016	Associate Professor, Nagoya University

Message to Prospective Students:

Undergraduate students interested in algebraic geometry or (algebraic) representation theory will be welcomed. The reading seminar will be on standard texts such as the textbooks 4 or 5 below.

I also welcome graduate students who are willing to study Bridgeland stability conditions and related topics, or geometric representation theory of quantum algebras. For examples of particular topics, please see the books 2, 3 and 6 below.

1. R. Hartshorne, *Algebraic Geometry*, Graduate Texts in Mathematics **52**, Springer (1977).
2. D. Huybrechts, *Fourier-Mukai transforms in algebraic geometry*, Oxford University Press (2006).
3. D. Huybrechts, M. Lehn, *The geometry of moduli spaces of sheaves*, Cambridge University Press (2010).
4. T. Kobayashi, T. Osima, *Lie groups and representation theory* (in Japanese), Iwanami-shoten (2005).
5. T. Tanisaki, *Lie algebras and quantum groups* (in Japanese), Kyoritsu-syuppan (2002).
6. E. Frenkel, D. Ben-Zvi, *Vertex algebras and algebraic curves*, 2nd edition, Mathematical Surveys and Monographs **88**, American Mathematical Society (2004).