

Jan Schröer



Academic career

1997	Dr. math., University of Bielefeld (advisor: C.M. Ringel)
1997 - 1998	Research Fellow, University of Bielefeld
1998 - 1999	DAAD Postdoctoral Fellow, National Autonomous University of Mexico, Mexico City, Mexico
1999 - 2000	Research Fellow, University of Bielefeld
2000 - 2005	Lecturer/Reader, University of Leeds, England, UK (Temporary leave: 2003-2004)
2003 - 2004	DFG Research Fellow, University of Leeds, England, UK
Since 2005	Professor (W2), University of Bonn

Offers

2008	University of Dortmund (W3)
2009	University of Bielefeld (W3)

Invited Lectures

2000	Plenary lecture at the ICRA, Beijing, China
2002	Plenary lecture at the ICRA, Toronto, ON, Canada
2004	Plenary lecture at the ICRA, Pátzcuaro, Mexico
2005	Morning Speaker at the British Mathematical Colloquium, Liverpool, England, UK
2011	Lecture at the Abel Symposium, Balestrand, Norway
2013	Mathematisches Kolloquium, Bern, Switzerland
2014	Lecture series at the ICRA, Sanya, China
2015	Lecture at the Mittag-Leffler Institute, Stockholm, Sweden

Research Projects and Activities

DFG Collaborative Research Center Transregio SFB/TR 45 "Periods, Moduli Spaces and Arithmetic of Algebraic Varieties"
Principal Investigator

Research profile

My research area is the representation theory of finite-dimensional algebras and quivers. I focus particularly on the numerous deep connections to the representation theory of Kac-Moody Lie algebras. Various crucial geometric constructions (Nakajima quiver varieties, Kashiwara-Saito's geometric crystal graphs, semicanonical bases for enveloping algebras, generic bases for cluster algebras) can only be realized for symmetric Kac-Moody Lie algebras. In an extensive project with Geiss and Leclerc, we are currently developing a general framework for all of the above (using quivers with loops and relations) which covers all symmetrizable, non-symmetric cases. This should also trigger a new research field inside the classical representation theory of finite-dimensional algebras, namely the study of generalized modulated graphs. I'm also interested in classical homological conjectures for finite-dimensional algebras.

The project described above will keep us busy for several years. A related topic of future investigation is the representation theory of wild quivers or more generally of wild algebras. Roughly speaking these are finite-dimensional algebras whose module category contains all module categories of all finite-dimensional algebras via suitable embedding functors. This fractal behaviour of module categories is quite common and should also occur in many other areas of

mathematics. As a research group we would like to “start again from zero” and develop a vision for the future of this research area. The methods will include Schofield induction, Kerner bijections and Auslander-Reiten Theory.

Research Area DE My research group works on the representation theory of finite-dimensional algebras and quivers. In an extensive joint work with Geiss and Leclerc, we introduced a new class of quivers with relations (see [2]) which yields a strong link to the representation theory of symmetrizable Kac-Moody Lie algebras. For example, in a current preprint arXiv:1702.07570 [1] we use these quivers with relations to obtain a geometric realization of the crystal graph of any symmetrizable Kac-Moody algebra. (Such results were before only available for the symmetric case.) We also laid the groundwork for a new direction in the representation theory of modulated graphs, working not only with bimodules over division rings but over more general rings. Jasso (long term postdoc in Bonn) developed together with Külshammer a theory of Higher Nakayama algebras, contributing to the development of Higher Auslander-Reiten theory, initiated by Iyama and others involved in the categorification project of Fomin-Zelevinsky cluster algebras.

Supervised theses

Master theses: 29, currently 7

Diplom theses: 16

PhD theses: 7, currently 2

Selected PhD students

Jan Geuenich (January/February 2017): “Quiver Mutations and Potentials”, afterwards Postdoc, University of Bielefeld

Sondre Kvamme (October 2017): “Comonads and Gorenstein Homological Algebra”, now Postdoc, Département de Mathématiques d’Orsay

Selected publications

- [1] Christof Gei, Bernard Leclerc, and Jan Schröer. Quivers with relations for symmetrizable cartan matrices iv: Crystal graphs and semicanonical functions. *eprint, arXiv:1702.07570*, 2017.
- [2] Christof Geiss, Bernard Leclerc, and Jan Schröer. Quivers with relations for symmetrizable cartan matrices i: Foundations. *Invent. Math.*, 209(1):61–158, 2017.
- [3] Christof Geiß, Daniel Labardini-Fragoso, and Jan Schröer. The representation type of jacobian algebras. *Adv. Math.*, 290:364–452, 2016.
- [4] Christof Geiß, Bernard Leclerc, and Jan Schröer. Quivers with relations for symmetrizable cartan matrices iii: Convolution algebras. *Represent. Theory*, 20:375–413, 2016.
- [5] C. Geiß, B. Leclerc, and J. Schröer. Cluster structures on quantum coordinate rings. *Selecta Math. (N.S.)*, 19(2):337–397, 2013.
- [6] Christof Geiss, Bernard Leclerc, and Jan Schröer. Generic bases for cluster algebras and the chamber ansatz. *J. Amer. Math. Soc.*, 25(1):21–76, 2012.
- [7] Christof Geiß, Bernard Leclerc, and Jan Schröer. Kac-moody groups and cluster algebras. *Adv. Math.*, 228(1):329–433, 2011.
- [8] Christof Geiß, Bernard Leclerc, and Jan Schröer. Rigid modules over preprojective algebras. *Invent. Math.*, 165(3):589–632, 2006.
- [9] Christof Geiss, Bernard Leclerc, and Jan Schröer. Semicanonical bases and preprojective algebras. *Ann. Sci. 'Ecole Norm. Sup. (4)*, 38(2):193–253, 2005.
- [10] William Crawley-Boevey and Jan Schröer. Irreducible components of varieties of modules. *J. Reine Angew. Math.*, 553:201–220, 2002.
- [11] Jan Schröer. On the infinite radical of a module category. *Proc. London Math. Soc. (3)*, 81(3):651–674, 2000.