John Bergdall

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Employment

2018– **Bryn Mawr College**, Assistant Professor.

2017–18 **Michigan State University**, Visiting Assistant Professor.

2014–17 **Boston University**, NSF Postdoctoral Research Fellow.

2013–14 **Boston University**, Postdoctoral Faculty Fellow.

Education

2008–13 **Brandeis University**, Ph.D.
Advisor: Joël Bellaïche
Thesis title: *On the variation of (φ, Γ)-modules over p-adic families of automorphic forms*.

2003–08 **University of Minnesota**, B.S.

Other academic positions

2021–22 **Max-Planck-Institut für Mathematik**
Visiting researcher (1 year).

2017 **Max-Planck-Institut für Mathematik**
Visiting researcher (3 months).
Institut des Hautes Études Scientifiques
Visiting researcher (2 months).

External grants and awards

2020– **Simons Foundation Collaboration Grant for Mathematicians** (Award No. 713782)
Project: "Eigenvarieties, automorphic forms, and Galois representations".

2014–17 **National Science Foundation Mathematical Sciences Postdoctoral Research Fellowship** (Award No. DMS-1402005)
Project: "Aspects of the Langlands program via p-adic families of automorphic forms".

Peer-reviewed research articles accepted for publication

12. Reductions of 2-dimensional semi-stable representations with large $\mathcal{L}$-invariant (joint with Brandon Levin and Tong Liu)
To appear in *J. Inst. Math. Jussieu*.

11. On p-adic L-functions for Hilbert modular forms (joint with David Hansen)
To appear in *Memoirs of the Amer. Math. Soc.*

10. Reductions of some two-dimensional crystalline representations via Kisin modules (joint with Brandon Levin)
To appear in *Int. Math. Res. Not.* DOI:10.1093/imrn/rnaa240.

9. Upper bounds for constant slope p-adic families of modular forms
Selecta Math., 25 (2019), no. 4, Art. 59, pp. 24. DOI:10.1007/s00029-019-0505-8.

8. Slopes of modular forms and the ghost conjecture, II (joint with Robert Pollack)
Trans. Amer. Math. Soc., 372 (2019), no. 1, 357–388. DOI:10.1090/tran/7549.

7. Smoothness of definite unitary eigenvarieties at critical points
J. reine angew. Math. (Crelle's J.), 759 (2020), 29–60. DOI:10.1515/crelle-2017-0048.

6. Slopes of modular forms and the ghost conjecture (joint with Robert Pollack)
Int. Math. Res. Not. (2019), no. 4, 1125–1144. DOI:10.1093/imrn/rnx141.

5. An adjunction formula for the Emerton–Jacquet functor (joint with Przemyslaw Chojecki)
Israel J. Math. 223 (2018), no. 1, 1–52. DOI:10.1007/s11856-017-1611-y.

4. A remark on non-integral p-adic slopes for modular forms (joint with Robert Pollack)
C. R. Math. Acad. Sci. Paris 355 (2017), no. 3, 260–262. DOI:10.1016/j.crma.2017.01.012.

3. Paraboline variation of p-adic families of (φ, Γ)-modules
Compositio Math. 153 (2017), no. 1, 132–174. DOI:10.1112/S0010437X16007831.

2. Arithmetic properties of Fredholm series for p-adic modular forms (joint with Robert Pollack)
Proc. Lon. Math. Soc., (3) 113 (2016), no. 4, 419–444. DOI:10.1112/plms/pdw031.

1. Ordinary modular forms and companion points on the eigencurve
J. Number Theory 134 (2014), 226–239. DOI:10.1016/j.jnt.2013.07.014.

Submitted articles (ordered by preprint release date)

i. Slopes of modular forms and reducible Galois representations: an oversight in the ghost conjecture (joint with Robert Pollack)
Submitted.

Computational research code

2021– **Github repository: Slopes of modular forms** (joint with Robert Pollack)

2017 **Website: Slopes of modular forms and Fredholm series** (joint with Robert Pollack)

Invited lecture series

2020 **p-adic L-functions and eigenvarieties** (South Bend, IN)
Four lectures on Galois representations and p-adic families.
Event reschedule for July 2022 due to COVID-19.
PIMS: Germany summer school on eigenvarieties (Vancouver, BC)
Four lectures on adic spaces and rigid analytic geometry.
Participation canceled for personal reasons prior to postponement for COVID-19.

Invited conference and workshop presentations

2020	**AMS special session on automorphic forms and Galois representations** (Virtual) "Reductions of local Galois representations for eigenforms with large $\mathcal{L}$-invariants".
2019	**Moduli spaces and modularity** (Oaxaca, MX) "Explicit $\mathfrak{S}$-modules for crystalline representations". **AMS special session on special values of L-functions and arithmetic invariants in families** (Hartford, CT) "Constant slope families of p-adic modular forms". **33rd Automorphic Forms Workshop** (Pittsburgh, PA) "Constant slope families of p-adic modular forms"
2017	**AMS special session on p-aspects of arithmetic geometry** (Buffalo, NY) "Upper bounds for constant slope p-adic families of modular forms". **p-adic methods for Galois representations and modular forms** (Barcelona, ES) "Geometric properties of p-adic families of automorphic forms (and applications)".
2016	**AMS special session on p-adic analysis in number theory** (Minneapolis, MN) "Some questions about slopes of modular forms". **Connecticut summer school in number theory** (Storrs, CT) "Geometric properties of p-adic families of automorphic forms and applications". **The p-adic Langlands program and related topics** (Bloomington, IN) "Slopes of modular forms and the ghost series".
2015	**Boston University/Keio University joint workshop in number theory** (Boston, MA) "Slopes of modular forms and the ghost conjecture". **p-adic methods in the theory of classical automorphic forms** (Montréal, CA) "Arithmetic properties of Fredholm series".
2014	**Fourth annual upstate New York number theory conference** (Buffalo, NY) "Ordinary representations on $U(3)$ and a conjecture of Breuil and Herzig".
2013	**Modular forms, p-adic L-functions and Selmer groups** (Oriahovitza, BG) "Parabolizations over families of trianguline representations".

Select colloquia & seminar presentations († indicates colloquium)

2021	Max Planck Inst.†	"Problems in the non-Archimedean theory of modular forms"	
	Boston Univ	"Reductions of certain semi-stable Galois representations"	
2020	Johns Hopkins Univ.	"Reductions of some crystalline representations"	(canceled)
	Michigan State Univ.	—	(canceled)
	University of Oregon	—	
2019	US Naval Academy	"Explicit problems in the p-adic theory of modular forms"	
	Bryn Mawr College	—	
	Boston University	"Reductions of some crystalline representations"	
	Univ. of Notre Dame†	"Explicit problems in the p-adic theory of modular forms"	
	Inst. for Adv. Study	"Upper bounds for constant slope p-adic families"	
2018	Harvard Univ.	—	
	Univ. of Pennsylvania	—	
	Univ. of Arizona	—	

Select colloquia & seminar presentations, cont.

2018	Haverford College†	"Approximating roots: from Newton to the ghost conjecture"
	Purdue Univ.	"Upper bounds for constant slope p-adic families"
2017	Univ. of Michigan	"Critical p-adic L-functions for Hilbert modular forms"
	Michigan State Univ.	"Introduction to the arithmetic of modular forms" (3 talks)
	Max Planck Inst.	"Slopes of modular forms and the ghost conjecture"
	Max Planck Inst.†	"p-adic variation of Hecke eigenforms"
	Univ. Paris-Sud	"On p-adic L-functions for Hilbert modular forms"
	IHÉS	—
2016	Boston Univ.	"On p-adic L-functions for finite slope modular forms"
	UC-Santa Cruz	"Slopes of modular forms and the ghost conjecture"
	Harvard Univ.	—
	Univ. of Connecticut	—
	Indiana Univ.	—
2015	Univ. of Chicago	"Arithmetic properties of Fredholm series"
	Northwestern Univ.	—
	Boston University	"On the mod p reduction of Fredholm determinants"
	Oxford Univ.	—

Seminars, colloquiua, and workshops organized

2019–20	**Co-organizer**: Bi-College math colloquium
2019–	**Co-organizer**: Philadelphia area number theory seminar
2013–17	**Co-organizer**: Boston University number theory seminar
2015	**Co-organizer**: Boston University/Keio University workshop 2015
2014–15	**Organizer**: Boston University graduate student learning seminars *Topics*: The local Langlands conjectures, p-adic Hodge theory.

Courses taught

2018– (BMC)	**MATH B102**: Calculus II **MATH B290**: Elementary number theory **MATH B303-4**: Algebra I,II **MATH B317**: Topics in advanced mathematics: elliptic curves **MATH B398**: Senior conference: mathematics and democracy **MATH B399**: Senior conference: mathematical cryptography **MATH B503-4**: Graduate algebra I, II
2017–18	**MTH 132-3**: Calculus I,II (MSU)
2013–17 (BU)	**MA 841**: Topics in number theory **MA 123**: Calculus I **MA 341**: Elementary Number Theory **MA 541**: Abstract algebra
2015	**PROMYS**, Instructor Complex analysis in number theory (high school students)

Student advising and research (degree bearing)

2020–21 **Sandy Chen** (AB, Bryn Mawr College '21)
Thesis: *The distribution of greatest common divisor of* $\mathbf{Z}[\sqrt{2}]$.

2019–21 **Elsa Magness** (MA, Bryn Mawr College '21)
Thesis: *An Exposition of the Sato–Tate Conjecture for Elliptic Curves with Complex Multiplication.*

2019–20 **Sophia Schein** (AB/MA, Bryn Mawr College '20)
Thesis: *Hecke operators on linear representations over finite fields*.

2015–16 **Alexander Peraire-Bueno** (Boston University Academy thesis)
Thesis: *Counting with partitions*.

Other student research, mentorship, and service

2019 **Summer Science Research (Bryn Mawr College)**
Students: Sandy Chen and Sophia Schein.

PROMYS research project writer
Students: Eric Tang, Aryaman Srikant, Emily Huang, and Aidan Griffin.
Title: *Representation theory and Dickson's theorem*.

2016 **PROMYS research project mentor**
Students: David Amirault, Vanshika Jain, Roshan Padaki, and Sabir Shaik.
Title: *Slopes of Newton polygons*.

Student committee service (math students unless specified)

Ph.D. preliminary exam committee(s)
2020 Elsa Magness.
Olivia McCauley (Physics, outside chair).

MA thesis committee(s)
2019 Lindsay Dever.

AB/MA thesis committee(s)
2019 Aisha Mechery.
Sichen Zhang.

Professional development

2020 **Teaching and Learning Institute partnership**
Partners: Sara Grossman, Kirtee Ramo, Yeipyeng Kwa.

Online Teaching Institute (Bryn Mawr College)

2019 **Cornell Interactive Theater Ensemble workshop**
Theme: "Hang in There and Be Tough".

Posse Plus Retreat
Theme: "The State of our Union".

2018-19 **Teaching and Learning Institute partnership**
Partner: Jake Ogata Bernstein.

Service at Bryn Mawr College

2019– **Committee on Undergraduate Awards and Fellowships**

2020 **Graduate Council**
Director of Graduate Studies in Mathematics

Non-college professional service

2016– **Peer reviewer**
Journals (12 total): American J. Math., Duke. Math. J., Inventiones Math., J. Algebra, J. Num. Thy.-Bordeaux, Manuscripta Math., Math. Annalen, Proc. American Math. Society, Proc. London Math. Society, Ramanujan Jour., Research in Math. Sci., Research in Num. Theory.

2020 **Panel: Cross Atlantic representation theory and other topics online**
Topic: "How individuals are dealing with the pandemic".

2019 **Panel: Philadelphia Undergraduate Mathematics Conference**
Topic: Professional development.

2016 **Panel: Boston College mathematics graduate student association**
Topic: Professional development.

Professional membership

2020– **Mathematical Association of America**

2008– **American Mathematical Society** (gap 2014-15)