John Bergdall

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Employment

2022– **The University of Arkansas**, Assistant Professor.

2018–22 **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.
On the variation of (φ, Γ)-modules over p-adic families of automorphic forms.
Advisor: Joël Bellaïche

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).

National grants and fellowships

2023– **National Science Foundation** (Award No. DMS-2302284)
Project: "Slopes of modular forms and moduli stacks and Galois representations"

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".

University awards and fellowships

2023–24 **University of Arkansas Robert C. and Sandra Connor Endowed Faculty Fellowship**

2022-23 **University of Arkansas New Faculty Commendation for Teaching Commitment**

Peer-reviewed research articles accepted for publication

13. Slopes of modular forms and reducible Galois representations, an oversight in the ghost conjecture (joint with Robert Pollack)
Proc. Amer. Math. Soc. Ser. B, 9 (2022), 432–444. DOI:10.1090/bproc/136.

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*. DOI:10.1017/S1474748022000081

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)
Int. Math. Res. Not. (2022), no. 4, 3170—3197. 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.

Preprints (ordered by release date)

2. "A p-adic adjoint L-function and the ramification locus of Hilbert modular eigenvarieties" (joint with Baskar Balasubramanyam and Matteo Longo)

1. "$\mathcal{L}$-invariants via p-adic L-functions: computations and a distribution conjecture" (joint with Robert Pollack)

Book chapters

1. "Huber rings and valuation spectra". To appear in *Münster Lectures in Mathematics* published by the European Mathematical Society.

Computational research code

2023– **Github repository: $\mathcal{L}$-invariants of modular forms** (joint with Robert Pollack)

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

2023 **Spring school on non-Archimedean geometry and eigenvarieties** (Heidelberg, DE)
Four graduate-level lectures on adic spaces.

2022 **Graduate school on p-adic L-functions and eigenvarieties** (South Bend, IN)
Four graduate-level lectures on Galois representations and eigenvarieties.

Conference and workshop presentations

2023 **TORA XII: Tex.–Okla. Representations and Automorphic Forms** (Norman, OK)
"p-adic distributions of modular forms".

2022 **PCMI: Number theory informed by computation** (Park City, UT)
"p-adic distributions of modular forms".
p-adic L-functions and eigenvarieties (South Bend, IN)
"p-adic distributions of modular forms".

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".

Conference and workshop presentations, cont.

2016	**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".

Recent colloquia & seminar presentations († indicates colloquium or other special presentation)

2023	Rice University	"p-adic slope distributions of modular forms"
	University of Arkansas	—
	University of Pittsburgh†	—
	University of Arkansas	"Huber rings and valuation theory" (3 lectures)
2022	Université de Lille	"Recent investigations of $\mathcal{L}$-invariants of modular forms."
	Univ. du Luxembourg	—
	Max Planck Inst.	—
	Universität Heidelberg	—
	Indian Inst. Sci. (IISc)	—
	Université Laval	—
2021	Max Planck Inst.†	"Problems in the non-Archimedean theory of modular forms"
	Boston Univ	"Reductions of certain semi-stable Galois representations"
2020	University of Oregon	"Reductions of some crystalline representations"
2019	Boston University	—
	US Naval Academy	"Explicit problems in the p-adic theory of modular forms"
	Univ. of Notre Dame†	—
	Inst. for Adv. Study	"Upper bounds for constant slope p-adic families"
2018	Harvard Univ.	—
	Univ. of Pennsylvania	—
	Univ. of Arizona	—
	Haverford College†	"Approximating roots: from Newton to the ghost conjecture"
	Purdue Univ.	"Upper bounds for constant slope p-adic families"

Workshop and conference organization

2024	**Co-organizer**: Modular forms, L-functions, and eigenvarieties (Paris, France)
2015	**Co-organizer**: Boston University/Keio University workshop 2015 (Boston, MA)

Other organized events

2019–20 **Co-organizer**: Bi-College math colloquium

2019–20 **Co-organizer**: Philadelphia area number theory seminar

2013–17 **Co-organizer**: Boston University number theory seminar

2014–15 **Organizer**: Boston University graduate student learning seminars
Topics: The local Langlands conjectures, p-adic Hodge theory.

Courses taught

2022– (UArk)
MATH 619V: Topics in algebra — elliptic curves
MATH 3-4113: Introduction to Abstract Algebra I, II
MATH 3203: Number Theory

2018–20 (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*.

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

2023– **Curriculum committee** (Univ. Ark. Math.)

2020 **Graduate Council** (Bryn Mawr Coll.)
Director of Graduate Studies in Mathematics (Bryn Mawr Coll., Math.)

2019–20 **Committee on Undergraduate Awards and Fellowships** (Bryn Mawr Coll.)

Non-college professional service

2016– **Peer reviewer**
Journals (13 total): Algebra and Number Theory, 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.

2023 **TORA XII Graduate Student Q & A session**
Facilitated question and answer session for graduate student conference participants.

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)