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

2024 **National Science Foundation** (Award No. DMS-2401152)
Project: "Conference: Modular forms, L-functions, and Eigenvarieties"

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

14. Huber rings and valuation spectra
    To appear in *Münster Lectures in Mathematics*.

13. On p-adic L-functions for Hilbert modular forms (with David Hansen)
    Memoirs of the American Math. Soc., 298 (2024), pp. iv+126.

12. Reductions of 2-dimensional semi-stable representations with large $\mathcal{L}$-invariant (with Brandon Levin and Tong Liu)
    J. Inst. Math. Jussieu, 22 (2023), no. 6, p. 2619–2644. DOI:10.1017/S1474748022000081

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

10. Reductions of some two-dimensional crystalline representations via Kisin modules (with Brandon Levin)
    Int. Math. Res. Not. (2022), no. 4, 3170—3197. DOI:10.1093/imrn/rnaa240.

9. 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.

8. 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.

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

6. Slopes of modular forms and the ghost conjecture (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 (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 (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 (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

2. New phenomena arising from $\mathcal{L}$-invariant of modular forms (with Robert Pollack)

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

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".

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".

Conference and workshop presentations, cont.

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".

Workshop and conference organization

2023–24	**Co-organizer**: Modular forms, L-functions, and eigenvarieties (Paris, France)
2014–15	**Co-organizer**: Boston University/Keio University workshop 2015 (Boston, MA)

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

2024	Oklahoma University	"Slopes and $\mathcal{L}$-invariants"
	Oklahoma University†	"Some distributions arising in algebra and number theory"
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.	"Upper bounds for constant slope p-adic families"
	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"
2017	Univ. of Michigan	"Critical p-adic L-functions for Hilbert modular forms"
	Michigan State Univ.	"Introduction to the arithmetic of modular forms" (3 lectures)
	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	—

Recent colloquia & seminar presentations, cont.

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.	—
	Boston University[†]	"Aspects of the Langlands program in families of modular forms"
2015	Univ. of Chicago	"Arithmetic properties of Fredholm series"
	Northwestern Univ.	—
	Boston University	"On the mod p reduction of Fredholm determinants"
	Oxford Univ.	—
2014	MIT	"Smoothness in families of p-adic automorphic forms"
	Amherst Coll.	"Representations in the cohomology of definite unitary groups"
	Brandeis Univ.	—

Colloquiua and seminars organized

2022–23	**Organizer**: University of Arkansas graduate student learning seminars *Topics*: Algebraic number theory
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.

Teaching

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)

Degree bearing student advising and research

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

2024 **Inspiring Inquiry and Preparing Lifelong Learners** (Certificate provided by the Association of College and University Educators (ACUE))

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.

College and university service

2023– **Ad-hoc graduate qualifying exam committee** (Univ. Ark. Math.)
Media committee (Univ. Ark. Math.)
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)