Dan Fretwell

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Education

MMath – University of Sheffield, Mathematics, (2007-2011).

Grade: First class honours.

Prize: Awarded the T.M.Flett prize in Pure Mathematics.

PhD in Mathematics – University of Sheffield, Graduate Teaching Assistantship (2011 – 2015).

Title of thesis: “Level p paramodular congruences of Harder type.”

Supervisor: Prof. Neil Dummigan.

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Awards

* T.M.Flett prize in Pure Mathematics for outstanding performance in BSc and MMath.
* Bristol Mathematics teaching award for lectures given in Topics in Discrete Mathematics.

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Employment

* Heilbronn research fellow, University of Bristol (2015-Current)

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Academic Interests

* Eisenstein congruences for automorphic forms.
* Algebraic modular forms.
* Quadratic forms/lattices.
* Galois/automorphic representations.
* Elliptic curves.
* Cryptography.
* Algebraic number theory.

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Publications

1. (with N. Dummigan) Automorphic forms for some even unimodular lattices. Submitted to Abh. Math. Sem. Univ. Hamburg (2020).
2. (with L. Walling) Hecke operators on Hilbert-Siegel theta series. Submitted to International Journal of Number Theory (2019).
3. (with J. Bober, G. Martin and T. Wooley) Smooth values of polynomials, Journal of the Australian Maths Society (2018).
4. Generic level p Eisenstein congruences for GSp4, [J. Number Theory](http://www.sciencedirect.com/science/article/pii/S0022314X17302068),

Vol 180, p.673-693 (2017).

1. Genus 2 paramodular Eisenstein Congruences, [Ramanujan Journal](http://link.springer.com/article/10.1007/s11139-017-9884-7),

Vol 46, Issue 2, p.447-473 (2017).

1. (with N. Dummigan), Ramanujan style congruences of local origin, J. Number Theory,

Vol 143, p.248-261 (2014).

In preparation

1. (with M. Balazs and J. Jay) Blocking measure proofs of Jacobi style identities.
2. (with C. Hsu and D. Spencer) Hilbert modular Eisenstein congruences of local origin.
3. (with N. Gillespie and B. Naskrecki) Equiangular lines and an elliptic surface.
4. (with J. Bober, G. Kopp and L. Du) On the number of superirreducible polynomials over finite fields.

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Current projects

* (with J. Voight) Establishing a transfer between orthogonal modular forms for quinary lattices and genus 2 quaternionic modular forms. Linking these with Siegel theta series, generalising a conjecture of Birch.
* (with L. Walling) Extend results of Walling on links between Siegel theta series/Eisenstein series to the case of Paramodular level.
* (with N. Gillespie and B. Naskrecki) Studying special families of real equiangular lines and their link with integral points on elliptic surfaces.
* (with G. Kopp and J. Bober) Counting/asymptotics for superirreducible polynomials over finite fields.
* (with N. Dummigan) Studying Arthur parameters associated to even unimodular lattices over certain real quadratic fields. Using this information to prove Eisenstein congruences for Hilbert-Siegel modular forms.
* (with M. Balasz and J. Jay) Use the theory of blocking measures for interacting particle systems, developed by Balasz, to find probabilistic proofs of interesting infinite sum-product identities of combinatorial significance. To do this we must construct systems with built in symmetry coming from affine Lie algebras.

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Teaching

Module Coordination

* Lead module coordinator for “Topics in Discrete Mathematics” module. Oversaw lectures and gave teaching/exam guidance to the new lecturers (2019-2020)

Lecturing

* Lecturer, course design, marker and examiner for 6 week course “Topics in Discrete Mathematics” (Bristol, 2 years) (2017-2018).
* Lecturer for 10 week course “Analytic Number Theory” (Sheffield, 1 year) (2014).

Projects

* Supervision of various MSc/MMath level projects: “p-adic numbers and the Hasse-Minkowski theorem”, “The classification theorem for compact surfaces”, “Composition of quadratic forms and Bhargava cubes”, “Elliptic Curves, Modular Forms and the Modularity Theorem” and “Codes and Lattices”.
* Supervision and marking of various short masters projects for the module “Topics in Discrete Mathematics”.
* Supervision of Cambridge summer project student on the project, “Elliptic Curve Cryptography”.

Tutorials

* Lead and assistant tutorial demonstrator for a variety of pure modules including: Linear Mathematics, Advanced Calculus, Continuity and Integration, Topics in Number Theory, Numbers and Groups, Matrices and Geometry, Rings and Groups, Vector spaces and Fourier theory.

One on one tuition

* Pure Mathematics students, teaching Field theory and Nonlinear Mathematics.
* Engineering mathematics tuition.

Extra

* Voluntary teaching activities (exam sessions, lectures, summary) for both small and big class sizes.
* Extra contributions to modules such as competitions and extra teaching documents for cryptography/number theory.

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Selected academic talks

Conferences/colloquia –

International automorphic forms conference (online), “(Real Quadratic) Arthurian Tales” (2020)

Young Researchers in Algebraic Number Theory (YRANT), “Hilbert modular Eisenstein congruences” (2019)

32nd Automorphic forms workshop, Tufts, Massachusetts. Invited speaker for graduate student bootcamp, “Algebraic Modular Forms: An Introduction” (2018).

AMS Regional Meeting, UNT, Texas, “Hilbert-Siegel Eisenstein congruences” (2017).

31st Automorphic forms workshop, ETSU, Tennessee, “Genus 2 Eisenstein congruences” (2017).

30th Automorphic forms workshop, Wake Forest, North Carolina, “Elliptic local origin congruences of level p” (2016).

British Mathematics Colloquium, “Towards a problem of Cohn” (2016).

Building bridges: 2nd EU/US workshop on automorphic forms and related topics, “Level p paramodular congruences of Harder type” (2014).

Max Planck Institute, Bonn –

Seminar series on Eisenstein Cohomology, “Level p paramodular congruences of Harder type” (2014).

Sheffield –

Talk on “Hilbert modular Eisenstein congruences” at YRANT (2018).

Number theory seminar, “Level p paramodular congruences of Harder type” and “Integer- valued polynomials“ (2014, 2015).

Postgraduate seminar, “The Sato-Tate conjecture”, “The 290 theorem”, “The Leech lattice and two remarkable results” and “Hearing the shapes of drums” (2011-2014).

Durham –

Number theory seminar, “Level p paramodular congruences of Harder type” (2014).

Bristol –

Linfoot number theory seminar, “Eisenstein congruences of local origin for GSp4”, “Local origin congruences for elliptic modular forms” and “Integer valued polynomials” (2015- 2018).

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Conferences attended

Young Researchers in Algebraic Number Theory (YRANT), Warwick, November 6th-8th, 2019.

p-adic modular forms and Galois representations, Sheffield, July 15th-19th, 2019.

The p-adic Langlands correspondence and related topics, Kings, May 13th-17th, 2019.

Young Researchers in Algebraic Number Theory (YRANT), Sheffield, November 8th-9th, 2018.

Srinivasa Ramanujan: FRS centenary meeting, London, October 15th-16th, 2018.

Perspectives on the Riemann Hypothesis, Bristol, June 4th-7th, 2018.

32nd Automorphic forms workshop, Tufts, Massachusetts, March 19th-22nd, 2018.

AMS Regional Meeting, UNT, Texas, 9th-10th September, 2017.

31st Automorphic forms workshop, ETSU, Tennessee, March 6th-9th, 2017.

Explicit Methods in Number Theory: John Cremona’s 60th Birthday, 4th-8th April, 2016.

British Mathematics Colloquium, Bristol, 21st-24th March, 2016.

30th Automorphic forms workshop, Wake Forest, North Carolina, 7th-10th March, 2016.

Automorphic forms: theory and computation, Kings College, London, 5th-9th September 2016.

Frontiers in Serre’s conjecture, Luxembourg, 14th – 20th June, 2015.

John Coates 70th birthday conference, Cambridge, 25th – 27th March, 2015.

Workshop on Bianchi and Siegel Modular forms, Sheffield, 14th – 16th July, 2014.

Building bridges: 2nd EU/US Workshop on automorphic forms and related topics, Bristol, 7th – 11th July, 2014.

Higher rank automorphic forms and L-functions, Warwick, 29th April – 3rd May, 2013.

British Mathematics Colloquium, Sheffield, 25th – 28th March, 2013.

Explicit methods for modular forms, Warwick, 18th – 22nd March, 2013.

LMS Regional meeting: Arithmetic of L-functions, Bristol, 1st – 3rd October, 2012.

Visits

* Funded research visits of Kimball Martin, David Spencer and Catherine Hsu to Bristol (2016-2018).
* Visited to Max Planck Institute to work with G. Harder (2014).

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Administration/Service

Seminars/Conferences

* Current joint organiser of YRANT conference (to be held in Bristol 2021).
* Organiser of the Heilbronn number theory seminar in Bristol (2016-current).
* Organiser of study group “Automorphics Anonymous” in Bristol, an informal study group developed to encourage interaction between local researchers of automorphic forms (2016-current).
* Organiser and judge for postgraduate speed talk session in Bristol (2017).
* Organiser of the Pure Postgrad seminar in Sheffield (2014-2015).
* Organiser of various postgraduate study groups on “Galois Representations”, “Iwasawa Theory”, “Elliptic Curves” and “Class Field Theory”.

Misc

* Referee for Journal of Number Theory.
* Reviewer for the AMS “Math Reviews” on MathSciNet.
* Pure Mathematics representative of the Postgrad Research Committee in Sheffield.

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Outreach

* Public talk about error correcting codes in the “Pint of Science” series at the “Hen and Chicken” pub in Bristol. (2018).
* Interdisciplinary collaboration with artist Luke Jerram on the project “Treasured City” (<https://www.lukejerram.com/treasuredcity>). TV appearance on BBC’s “The One Show” and project featured in various media (<http://www.bbc.co.uk/news/uk-england-humber-38884100>). (2016-2017)
* Colloquiua given to undergraduate/postgraduate students in Bristol, “Password Hacking, the De Bruijn way” (2019), “Escher and the Droste effect”. (2017)
* Talk to Cambridge Part III students (“The magic of modular forms”) (2014).
* Talk to Y9 students at St. Bernard’s School, Rotherham (“The Eulerian quandary”) (2014).