Bodan Arsovski

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EDUCATION & EMPLOYMENT

- Senior research fellow at *University College London* (current).
- Member of the *Institute for Advanced Study* in Princeton, New Jersey (for 11 months).
- Research associate at the *University of Sheffield* (for 3 months).
- PhD in mathematics from *Imperial College London* (obtained in 2019).

  Thesis: "On the locally reducible part of the eigencurve" doi.org/10.25560/68086

  My PhD was in theoretical mathematics. I was awarded the "President's PhD scholarship", which is a competitive scholarship that fully funded my PhD studies.

- BSc & MMath in mathematics from the *University of Oxford.*

  I graduated with "First-class honours" in all four years, which is the top possible grade in the UK system. I received the "Junior mathematical prize" for ranking top 3 in my generation on the final exams in mathematics. I was awarded the "Reach Oxford scholarship", which is a competitive scholarship that fully funded my undergraduate studies. I also received the "Clothworkers' scholarship", which is a prize awarded by St. Catherine's College.

PUBLICATIONS

9 "The p-adic Kakeya conjecture"
J. Amer. Math. Soc. **37** (2024), 69–80 doi.org/10.1090/jams/1021

The classical *Kakeya conjecture* states that all compact subsets of $\mathbb{R}^n$ containing a line segment of unit length in every direction have full Hausdorff dimension. In this article I prove the natural analogue of the classical Kakeya conjecture over the p-adic numbers — more specifically, that all compact subsets of $\mathbb{Q}_p^n$ containing a line segment of unit length in every direction have full Hausdorff dimension — a conjecture which was first discussed in the 1990s by James Wright. In fact, more generally I prove the p-adic analogue of the *Kakeya maximal conjecture,* which is a functional version of the Kakeya conjecture proposed by Jean Bourgain in the 1990s.

The reason this is interesting is that the Kakeya conjecture boils down to the highly combinatorial question of packing thin tubes as tightly as possible, and in all known cases (such as n=2, where the optimal packing volume is precisely known) tubes can be packed exactly as tightly in $\mathbb{Q}_p^n$ as in $\mathbb{R}^n$ (because the ways in which thin tubes can intersect are similar in both settings).

This result was mentioned in *Quanta Magazine* in the articles "A question about a rotating line helps reveal what makes real numbers special" and "The year in math". I gave a talk at the Institute for Advanced Study titled "Non-archimedean harmonic analysis" discussing the history of the problem and future directions.

8 “On the Minkowski dimension of certain Kakeya sets”
Mat. Bilten **46** (2022), 77–82 doi.org/10.37560/matbil22462077a

7 “Limiting measures of supersingularities”
Preprint latest link

6 “On the reductions of certain two-dimensional crystalline representations, III”
Preprint latest link

5 “On the reductions of certain two-dimensional crystalline representations, II”
Preprint latest link

4 “On the reductions of certain two-dimensional crystalline representations”
Doc. Math. **26** (2022), 1929–1979 doi.org/10.25537/dm.2021v26.1929-1979

3 “On the reductions of certain two-dimensional crystabelline representations”
Res. Math. Sci. **8** (2022), #12 doi.org/10.1007/s40687-020-00231-6

Articles 3–7 make up the math I worked on for my PhD thesis. In them, I make progress toward a conjecture by Fernando Gouvêa from 2001, I prove a special case of a conjecture by Breuil&Buzzard&Emerton from 2005, and I disprove a conjecture by Buzzard&Gee from 2015 and classify all small counterexamples. Plus, the articles contain a bunch of nice computations of representations associated with modular forms.

2 “Additive bases via Fourier analysis”
Combin. Probab. Comput. **30** (2021), 930–941 doi.org/10.1017/S0963548321000109

1 “A proof of Snevily’s conjecture”
Israel J. Math. **182** (2011), 505–508 doi.org/10.1007/s11856-011-0040-6

In this article I prove a conjecture by Hunter Snevily. Snevily’s conjecture comprises section 9.3 of the book “Additive Combinatorics” by Terence Tao and Van Vu. At the time, the conjecture was 10 years old, and partial results had been obtained by Noga Alon and Dasgupta&Károlyi&Serra&Szegedy. I gave a talk at the Isaac Newton Institute for Mathematical Sciences titled “On a Conjecture of Snevily” discussing the proof.

TEACHING EXPERIENCE

- *UCL MATH0014:* I have taught problem classes in linear algebra for second year undergraduates at *University College London.* These were classes in a typical classroom setting, for an audience of ≈20.
- *UCL MATH0008:* I have covered lectures in applied mathematics for first year undergraduates at *University College London.* These were lectures in a lecture hall setting, for an audience of ≈200.
- I have given invited lectures at institutes such as the *Isaac Newton Institute for Mathematical Sciences* and the *Institute for Advanced Study,* invited talks organized by US universities such as *UCLA* and *Rutgers University,* and invited talks at UK universities such as the *University of Edinburgh* and the *University of Bristol*.