

My research is in the general area of *number theory*. I use a wide variety of methods across number theory including sieve methods, the determinant method of Heath-Brown and Salberger, arithmetic invariant theory, and geometry of numbers. More recently, I have begun to investigate problems in arithmetic geometry, inspired by the recent breakthrough of B. Lawrence and A. Venkatesh.

For my thesis I worked largely on extending the p -adic determinant method, a novel new method in diophantine geometry introduced by Heath-Brown into the setting of *weighted projective varieties*, and with this extension I was able to give improvements for power-free values of binary forms [1]. This improvement of the determinant method uses a significant number of tools from algebraic geometry.

Subsequently, I have worked on problems involving representation of integers by various polynomials. In particular, together with C.L. Stewart, we solved a long-standing conjecture on the density of integers represented by a binary form F of degree at least three [8]. Our work in this area uses tools from both algebraic and analytic number theory.

On the more algebraic side, I have worked on counting problems for $GL_2(\mathbb{Z})$ -equivalence classes of binary forms which has applications in counting certain kinds of number fields. This work is with C. Tsang (see [10] [11]). The influence behind our work in this area is the seminal work of Bhargava and Shankar, as well as Melanie Wood in arithmetic invariant theory and geometry of numbers. However, significant technical innovation and new ideas are needed to achieve progress in our papers. More recently, I have done work on the negative Pell equations and generalizations to other roots of unity with Erick Knight.

References

Articles by me

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- [2] *On binary cubic and quartic forms*, arXiv:1610.09208 [math.NT], to appear in Journal de Theorie des Nombres de Bordeaux.
- [3] *Square-free values of decomposable forms*, Canadian Journal of Mathematics **70** (2018), 1390-1415.
- [4] *Binary quartic forms with vanishing J -invariant*, arXiv:1712.09091 [math.NT], submitted to International Mathematics Research Notices.
- [5] *On monic abelian cubics*, arXiv:1906.08625 [math.NT], submitted to Compositio Mathematicae.

Co-authored articles

- [6] K. Lapkova, S. Y. Xiao, *The density of k -free values of polynomials*, Mathematika (4) **65** (2019), 1038-1050.
- [7] P. C. Lam, D. Schindler, S. Y. Xiao, *On prime values of binary quadratic forms with a thin variable*, arXiv:1809.10755 [math.NT], submitted to Journal of the London Mathematical Society.
- [8] C. L. Stewart, S. Y. Xiao, *On the representation of integers by binary forms*, Mathematische Annalen **375** (2019), 133-163.
- [9] C. L. Stewart, S. Y. Xiao, *On the representation of k -free integers by binary forms*, arXiv:1612.00487 [math.NT], to appear in Revista Matematica Iberoamericana.
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- [11] C. Tsang, S. Y. Xiao, *The number of quartic D_4 -fields with monogenic cubic resolvent ordered by conductor*, arXiv:1712.08552 [math.NT], submitted to Transactions of the American Mathematical Society.
- [12] S. Y. Xiao, S. Yamagishi, *Zeros of polynomials in many variables with prime inputs*, arXiv:1512.01258 [math.NT], to appear in Canadian Journal of Mathematics.

Preprints

[13] E. Knight, S. Y. Xiao, *On the ζ_3 -Pell equation*

[14] B. Nasserden, S. Y. Xiao, *Uniformity of period mappings and solutions to the S -unit equation*