ABSTRACTS

Day 1: Saturday, March 9

8:30-9:30, Henri Darmon
Title: Explicit Class Field Theory
Abstract: I will discuss some recent results and approaches to explicit class field theory and attempt to compare and contrast them.

Room A - Coates 145
10:00-10:25, Bella Tobin
Title: Julia Sets and Equidistribution in Stochastic Dynamical Systems
Abstract: Stochastic dynamical systems are a Markov process in which one selects from a family of rational maps according to some probability. Just as points of low height for rational dynamical systems equidistribute according to certain canonical measures, we prove an equidistribution theorem in the setting of stochastic dynamical systems. As the height associated to a stochastic dynamical system is no longer defined over a single number field, we extend the notion of a quasi-adelic measure to a new notion of generalized adelic measures. This equidistribution theorem allows us to define a stochastic Julia set at every place and explore the properties of this set. This is joint work with John Doyle and Paul Fili.

10:25-11:50, Wades Hindes
Title: Counting points of bounded height in semigroup orbits
Abstract: We improve known estimates for the number of points of bounded height in semigroup orbits of polarized dynamical systems. In particular, we give exact asymptotics for generic semigroups acting on the projective line. The main new ingredient is the Wiener-Ikehara Tauberian theorem, which we use to count functions in semigroups of bounded degree.

10:50-11:15, Saloni Sinha
Title: The Riemann Hypothesis via the Generalized von Mangoldt function
Abstract: Gonek, Graham and Lee recently showed that Riemann hypothesis (RH) can be expressed in terms of asymptotic estimates for the twisted partial sums of the type $\sum_{n\le x}\Lambda(n)n^{-iy}$ where Λ is the von Mangoldt function. We use a slightly different approach to establish equivalence between the RH and asymptotic estimates for the generalized von Mangoldt function

$$\Lambda_k(n) := \sum_{d\,|\,n}\mu(d)\Big(\log\frac{n}{d}\Big)^k \qquad (n\in\mathbb{N}).$$

for each $k\ge 2$. We establish similar results for the function

$$\Lambda^k := \underbrace{\Lambda\star\cdots\star\Lambda}_{k\text{ copies}},$$

the k-fold convolution of the von Mangoldt function. As an example, for the case $k=2$, we conclude that RH is equivalent to the assertion that, for any fixed $\varepsilon>0$, the estimate

$$\sum_{n\le x}\Lambda_2(n)n^{-iy} = \frac{2x^{1-iy}(\log x - C_0)}{(1-iy)} - \frac{2x^{1-iy}}{(1-iy)^2} + O\big(x^{1/2}(x+|y|)^\varepsilon\big)$$

holds uniformly for all $x, y \in \mathbb{R}$, $x \geq 2$. Our method allows us to obtain the asymptotic estimates uniformly for any $x, y \in \mathbb{R}$ and the implicit constants only depending on k and ε. Moreover, because of this modified approach, we don't need to assume the simplicity of zeros of zeta function which would've been needed for cases where $k \geq 2$. Our results show that the validity of RH is governed by the distribution of almost-primes, i.e., natural numbers that have no more than k distinct prime divisors.

Room B - Coates 152

10:00-10:25, Maciej Ulas

Title: Construction of diagonal quintic threefolds with infinitely many rational points

Abstract: In this talk we present a construction of an infinite family of diagonal quintic threefolds defined over the field of rational numbers, each containing infinitely many rational points. As an application, we prove that there are infinitely many quadruples $B = (B_0, B_1, B_2, B_3)$ of co-prime integers such that for a suitable chosen integer b (depending on B), the equation $B_0X_0^5 + B_1X_1^5 + B_2X_2^5 + B_3X_3^5 = b$ has infinitely many positive integer solutions.

10:25-11:50, Amadou Tall

Title: On Diophantine Equations Involving Difference of Lucas Numbers and Powers of 2

Abstract: In this note, we find all positive integer solutions of the Diophantine equation $L_k - L_l = 2t$ and $L_n - L_m = 2a_1 + 2a_2 + 2a_3$, where (L_n) is the Lucas sequence.

10:50-11:15, Haiyang Wang

Title: Elliptic curves with potentially good supersingular reduction and coefficients of the classical modular polynomials

Abstract: Let O_K be a Henselian discrete valuation domain with field of fractions K. Assume that O_K has algebraically closed residue field k. Let E/K be an elliptic curve with additive reduction. The semi-stable reduction theorem asserts that there exists a minimal extension L/K such that the base change E_L/L has semi-stable reduction. It is natural to wonder whether specific properties of the semi-stable reduction and of the extension L/K impose restrictions on what types of Kodaira type the special fiber of E/K may have.
In this talk we will discuss the restrictions imposed on the reduction type when the extension L/K is wildly ramified of degree 2, and the curve E/K has potentially good supersingular reduction. We will also talk about the possible reduction types of two isogenous elliptic curves with these properties and its relation to the congruence properties of the coefficients of the classical modular polynomials.

11:15-12:15, Holly Swisher

Generalizations and analogues of Alder-type partition inequalities

Abstract: The Alder-Andrews Theorem, a partition inequality generalizing Euler's partition identity, the first Rogers-Ramanujan identity, and a theorem of Schur to d-distinct partitions of n, was proved successively by Andrews in 1971, Yee in 2008, and Alfes, Jameson, and Lemke Oliver in 2010. While Andrews and Yee utilized q-series and combinatorial methods, Alfes et al. proved the finite number of remaining cases using asymptotics originating with Meinardus and high-performance computing. In 2020, Kang and Park conjectured a "level 2"" Alder-Andrews type partition inequality which relates to the second Rogers-Ramanujan identity. Here, we review further work on this and more general conjectures as well as the investigation of analogues in other partition-theoretic settings.

1:45-2:45: Jonathan Bober

Title: TBA

Abstract: TBA

Room A

3:15-3:40, James Cumberbatch

Title: Smooth Numbers with Restricted Digits

Abstract: Integers whose base 10 expansion lacks a certain digit has been a recent topic of interest in analytic number theory, such as when James Maynard proved that there were infinitely many such primes. In this talk we obtain an asymptotic for the number of digitally restricted integers less than X which have no prime factor greater than Y, where Y is at least a large power of $\log X$.

3:40-4:05, Kiseok Yeon

Title: The Hasse principle for random homogeneous polynomials in thin sets

Abstract: In this talk, we first give an overall history of the problems of confirming the Hasse principle for projective hypersurfaces over $\mathbb{Q}$. Next, we provide the sketch of the classical approach via the circle method in order to confirm the Hasse principle. Lastly, we provide a motivation for establishing our main result, and we finish this talk by providing the main result at the end of the slides.

4:05-4:30, Daniel Flores

Title: Infinitely prime K-multimagic squares

Abstract: We prove an asymptotic formula for the number of K-multimagic squares of order N and through an application of the Green-Tao Theorem deduce the existence of infinitely many prime K-multimagic squares.

Room B

3:15-3:40, Melissa Emory

Title: Beyond Endoscopy via Poisson Summation for $GL(2, K)$

Abstract: Langlands proposed a strategy called Beyond Endoscopy to prove the principle of functoriality, which is one of the central questions of present day mathematics. Langlands strategy of beyond endoscopy is a two-step process where the first step isolates the packets of cuspidal automorphic representations whose L-functions (for a representation of the dual group) have a pole at $s = 1$. The second step compares this data for two different groups and aims to determine functorial transfers. This talk deals with the first step.
Altug worked over the rationals. This project generalizes Altug's result to a number field. In this talk we will emphasize some interesting differences between our work and Altug's work. This work is in progress and is joint with Malors Espinosa-Lara, Debanjana Kundu, and Tian An Wong.

3:40-4:05, Pan Yan

Title: Product of Rankin-Selberg convolutions and applications

Abstract: In this talk, I will introduce a family of integrals which represent the product of Rankin-Selberg L-functions of $GL(\ell) \times GL(m)$ and of $GL(\ell) \times GL(n)$ where $m+n < \ell$. When $n = 0$, these integrals are those defined by Jacquet–Piatetski-Shapiro–Shalika up to a shift. As an application, we obtain a new proof of Jacquet's local converse conjecture using these new integrals and Cogdell–Shahidi–Tsai's theory on partial Bessel functions. This is joint work with Qing Zhang. If time permits, I will also briefly talk about another application, to prove an algebraicity result for the special values of certain L-functions, which is joint work with Yubo Jin.

4:05-4:30, Manami Roy

A Classification of Discriminant Ideal Twins

Abstract:Isogenous elliptic curves have the same conductor but not necessarily the same minimal discriminant ideal. In this talk we will discuss recent progress towards getting an explicit classification of n-isogenous elliptic curves defined over a number field with the same minimal discriminant ideal, i.e., a classification of isogenous discriminant ideal twins. We will first discuss the prime isogeny case and then p^2-isogeny case. The classification depends on considering parameterization for n-isogenous elliptic curves.

4:30-5:40, Jeffery Lagarias

Title: TBA

Abstract: TBA

Day 2: Sunday, March 10

8:30-9:30, John Voight

Title: Sato-Tate groups and modularity for (atypical) abelian surfaces

Abstract: We discuss in detail what modularity means for an abelian surface over a number field. The explicit description of this modular form depends on its real Galois endomorphism type, or equivalently on a refinement of its Sato-Tate group. For atypical abelian surfaces defined over the rational numbers, this description can involve classical, Bianchi, or Hilbert modular forms. This is joint work with Andy Booker, Jeroen Sijsling, Drew Sutherland, and Dan Yasaki.

Room A

10-10:25, Nimish Kumar Mahapatra

Title: Class numbers of certain families of totally real biquadratic fields and a result of Mollin

Abstract: Lower bounds for the class numbers of real quadratic fields of Richaud-Degert type have been extensively studied by Mollin. Additionally, he estimated the lower bounds for the class number of totally real biquadratic fields of the form $\mathbb{Q}(\sqrt{D^2+4d}, \sqrt{D^2+\alpha d})$, where $D > 0$, d divides D, $\alpha \in \{1, 2\}$ and both $D^2 + 4d > 1$ and $D^2 + \alpha d > 1$ are square-free. In this talk, we discuss the lower bounds for the class numbers of totally real biquadratic fields of the form $\mathbb{Q}(\sqrt{n^2+2}, \sqrt{n^2+4})$. We show that the bounds we have obtained represent an improvement over the previously known bounds provided by Mollin (Proc Am Math Soc 101(3):439–444, 1987). Additionally, we demonstrate that the obtained bounds can be further improved by a factor of two under certain mild assumptions.

10:25-10:50, Ayla Gafni

Title: Counting Number Fields and Polynomials

Abstract: Number fields are a central topic of number theory, and yet they are surprisingly difficult to count. We will discuss the history of progress toward counting number fields, and give a new bound on number fields of degree less than 94. The improved bound is achieved through a combination of harmonic analysis and modified sieve methods. If time permits, we'll also discuss how similar techniques have been useful in bounding the exceptional set in Hilbert's irreducibility theorem; that is, at counting the number of irreducible polynomials without full Galois group.

10:50-11:15, Deepesh Singhal

Title: Maximum number of points on an algebraic set over finite field

Abstract: Consider a finite field F_q and positive integers d, m, r with $1 \leq r \leq \binom{m+d}{d}$. Let $S_d(m)$ be the F_q vector space of all homogeneous polynomials of degree d in $X_0, \ldots, X_m$. Let $e_r(d, m)$ be the maximum number of F_q-rational points in the vanishing set of W as W varies through all subspaces of $S_d(m)$ of dimension r. Ghorpade, Datta and Beelen had conjectured an exact formula of $e_r(d, m)$ when $q \geq d + 1$. We prove that their conjectured formula is true when q is sufficiently large in terms of m, d, r. The problem of determining $e_r(d, m)$ is equivalent to the problem of computing the r^{th} generalized hamming weights of projective the Reed Muller code $PRM_q(d, m)$. It is also equivalent to the problem of determining the maximum number of points on sections of Veronese varieties by linear subvarieties of codimension r.

Room B

10-10:25, Swati

Title: Congruence properties modulo prime powers for a class of partition functions

Abstract: Let p be prime, and let $p_{[1,p]}(n)$ denote the function whose generating function is $\prod(1-q^n)^{-1}(1-q^{pn})^{-1}$. This function and its generalizations $p_{[c^\ell,d^m]}(n)$ are the subject of study in several recent papers. Let $\ell \geq 5$ be prime, and let $j \geq 1$ be an integer. In this paper, we prove that the generating function for $p_{[1,p]}(n)$ in the progression $\beta_{p,\ell,j}$ modulo ℓ^j with $24\beta_{p,\ell,j} \equiv p+1 \pmod{\ell^j}$ lies in a Hecke-invariant subspace of the type $\{\eta(Dz)\eta(Dpz)F(Dz) : F(z) \in M_s(\Gamma_0(p),\chi)\}$ for suitable $D \geq 1$, $s \geq 0$, and character χ. When $p \in \{2,3,5\}$, we use the Hecke-invariance of these subspaces to prove, for distinct primes ℓ and $m \geq 5$ and $j \geq 1$, congruences of the form

$$p_{[1,p]}\left(\frac{\ell^j m^k n+1}{D}\right) \equiv 0 \pmod{\ell^j}$$

for all $n \geq 1$ with $m \nmid n$, where k is an explicitly computable constant depending on the modular forms in the invariant subspace.

10:25-10:50, Aritram Dhar

Title: On partitions with bounded largest part and fixed integral GBG-rank modulo primes

Abstract: In 2009, Berkovich and Garvan introduced a new partition statistic called the GBG-rank modulo t which is a generalization of the well-known BG-rank. In this paper, we use the Littlewood decomposition of partitions to study partitions with bounded largest part and fixed integral value of GBG-rank modulo primes. As a consequence, we obtain new elegant generating function formulas for unrestricted partitions, self-conjugate partitions, and partitions whose parts repeat finite number of times.

10:50-11:15, Brian Grove

Title: Explicit Modularity Results Via Hypergeometric Methods

Abstract: One of the first applications of hypergeometric functions over finite fields was the observation that the trace of Frobenius for a Legendre elliptic curve can be expressed as a special value of a finite field ${}_2F_1$ function. This observation connects finite field ${}_2F_1$ functions and the weight two newforms that the Modularity Theorem guarantees. A similar connection, now between finite field ${}_4F_3$ functions and certain weight four newforms is given by the resolution of conjectures made by Rodriguez-Villegas. However, the connections between finite field ${}_3F_2$ functions and weight three newforms are only known in a few cases. Recently, Dawsey and McCarthy conjectured fifteen new relations between finite field ${}_3F_2$ functions and weight three newforms.
In this talk, we discuss progress on the conjectures of Dawsey and McCarthy and then mention some of the key tools used in our approach. This is joint work with Michael Allen, Ling Long, and Fang-Ting Tu.

11:15-12:15, Mirela Çiperiani

Title: Trace relations on elliptic curves and quadratic twists of positive even analytic rank

Abstract: We consider elliptic curves defined over the rationals with cyclic rational two torsion. Given a quadratic extension $K/\mathbb{Q}$. We will study how often one can guarantee that the two torsion subgroup lies in the image of the all the local trace maps related to $K/\mathbb{Q}$, respectively the global one. This work allows us to draw new results on the number of quadratic twists of our elliptic curve of positive even analytic rank.

1:45-2:45, Katherine Stange
Title: Local-to-global failures in thin orbits: Apollonian circle packings and continued fractions
Abstract: In analogy to Diophantine geometry, where one studies the Hasse (local-to-global) principle and its failure, one can ask Diophantine questions for orbits of "thin" subgroups of algebraic groups. Two well-known examples are the curvatures of Apollonian circle packings and the denominators of rationals in terms of constrained continued fractions. Analytic number theory has provided significant progress toward "local-to-global" conjectures for thin groups, including in both these contexts. Recently, in joint work with Haag-Kertzer-Rickards and with Rickards, we describe failures of the local-to-global principle that arise from reciprocity laws. I will give an overview of the arithmetic of thin group orbits and then discuss these new examples.

Room A
3:15-3:40, Daniel Keliher
Title: Dominant Galois Groups for Large Degree Number Fields
Abstract: Via Hilbert Irreducibility, 100% of the time, the Galois group of a "random" degree n polynomial is S_n. One might then ask if a "random" degree n extension of $\mathbb{Q}$ is likely to have Galois group S_n. While the answer can be extracted for small n from various number field counts, this talk will address this question for large n. We prove, assuming a conjecture of Bhargava, that the density of degree n S_n-extensions among all degree n extensions is 0 as n, supported on a finite set of primes, goes to infinity. Under other standard conjectures, we also prove that extensions with Galois group $S_t \wr G$ with $t \ll \log(n)^2$ has density 1 among all degree n extensions as $n \to \infty$. This is joint work-in-progress with Jiuya Wang (UGA).

3:40-4:05, Vittoria Cristante
Title: Lower Bounds for $GL_2(\mathbb{F}_\ell)$ Number Fields
Abstract: Let $F_n(G; X)$ denote the set of number fields of degree n with absolute discriminant no larger than X. This set is known to be finite for any finite permutation group G and $X \geq 1$; a conjecture of Malle predicts a lower bound for its size. In this talk, we give a lower bound for when G is $GL_2(F_\ell)$ and $PGL_2(F_\ell)$ for prime $\ell \geq 11$. We also provide a method to compute lower bounds for other permutation representations of these groups.

4:05-4:30, Shilin Lai
Title: Frobenius fields of Abelian Varieties
Abstract:For a non-CM abelian variety with connected monodromy groups, we prove that the number field generated by its Frobenius eigenvalues at a prime is isomorphic to a fixed number field for a density 0 set of primes. This is joint work with Ashay Burungale and Haruzo Hida.

Room B

3:15-3:40, Ajith Nair

Title: Composition identities for higher composition laws

Abstract: In the first of a series of four papers on higher composition laws, Bhargava generalized Gauss composition of binary quadratic forms to 2x2x2 cubes, using which he further obtained four new composition laws. Each of these composition laws is proved by establishing bijections between the orbits of the corresponding space of forms under a natural group action and certain ideal classes in quadratic rings. In this talk, we will describe how to formulate the higher composition laws in a manner similar to Gauss' formulation of composition of binary quadratic forms. We will focus on examples and the techniques used to obtain the composition identities.

3:40-4:05, Anjelica Babei

Title: Supercongruences arising from Ramanujan-Sato series

Abstract: Joint work with Manami Roy, Holly Swisher, Bella Tobin and Fang-Ting Tu. Ramanujan-Sato series are series converging to $1/\pi$ arising from modular forms. Their truncations are known to exhibit interesting congruence properties. In this talk, we prove supercongruences connected with 11 Ramanujan-Sato series we previously derived in collaboration with Lea Beneish. We do this by associating these series with certain elliptic curves with complex multiplication.

4:05-4:30, Mohit Tripathi

Title: Gaussian Hypergeometric Function and Modular Forms

Abstract:In this talk, I will discuss the relation between Gaussian Hypergeometric Function and Modular Forms.

4:30-5:40, Weng-Ching Winnie Li

Title: Hypergeometric functions, Galois representations, and modular forms

Abstract: Historically, the hypergeometric functions were studied through the lens of differential equations. When the parameters are rational numbers, Katz introduced ℓ-adic Galois representations and developed a theory parallel to that in the classical setting. These Katz representations can be realized on cohomological groups of algebraic varieties, and hence they are expected to be automorphic according to Langlands' philosophy. In this talk we use recent results in this area to showcase the interconnections among hypergeometric functions, Galois representations, and automorphic/modular forms.

Day 3: Monday, March 11

8:30-9:30, Lea Beneish

Title: How often does a cubic hypersurface have a rational point?

Abstract: A cubic hypersurface in $\mathbb{P}^n$ defined over $\mathbb{Q}$ is given by the vanishing locus of a cubic form f in $n+1$ variables. It is conjectured that whenever $n \geq 3$, a cubic hypersurface has only possibly local obstructions to solubility; this is now known to hold on average when $n \geq 4$ due to recent work of Browning, Le Boudec, and Sawin. Using this result, we determine the proportion of cubic hypersurfaces ordered by height with a rational point for $n \geq 4$ explicitly as a product over primes p of rational functions in p. In particular, we find that this proportion is equal to 1 for hypersurfaces in $\mathbb{P}^9$. For 100% of cubic hypersurfaces, this recovers a celebrated result of Heath-Brown that non-singular cubic forms in at least 10 variables have rational zeros. This talk is based on joint work with Christopher Keyes.

9:30-10, Isabella Negrini

Title: TBA

Abstract: TBA

Room A

10-10:25, Jiseong Kim

Title: Shifted sums of multiplicative functions

Abstract: The objective of this talk is to discuss asymptotic results for shifted sums (binary case) of various multiplicative functions, such as Fourier coefficients of automorphic forms. First, we briefly discuss correlations of multiplicative functions, which are non-binary cases (having finite complexity) initially. Then, we will talk the binary cases. For the binary cases, we apply some arguments from a paper by Matomaki, Radziwill and Tao.

10:50-11:15, Chao Liu

Title: The Davenport constant and the structure of extremal zero-sum free sequences

Abstract: Let G be a finite abelian group, the Davenport constant $D(G)$ has been studied since the 1960s, and it naturally occurs in various branches of combinatorics, number theory, and geometry. $d(G) = D(G) - 1$ is the maximal length of a zero-sum free sequence over G. We want to introduce some results on the structure of extremal zero-sum free sequences.

11:15-11:45, Alex Rice

Title: The sum-product problem for small sets

Abstract: Introduced by Erdos and Szemerédi in 1983, a central question of arithmetic combinatorics is the extent to which a set of positive integers can simultaneously determine few distinct sums $a+b$ and few distinct products ab. To this end, for a positive integer k, let $SP(k)$ denote the minimum possible size of the larger of $A+A$ and AA, where A is a set of k positive integers. Previous work has focused on the asymptotic behavior of $SP(k)$ as k tends to infinity. Here we instead pursue the more modest and elementary goal of precisely determining $P(k)$ for small values of k, succeeding up to $k=9$. Our proofs rely on classification results of Freiman for sets of small doubling, as well as estimates on the sumset of the union of two geometric progressions with the same common ratio. This is joint work with five current and former Millsaps College undergraduates.

Room B

10-10:25, Edmund Y. Chiang

Title: Weyl-algebraic orthogonality: a case study

Abstract: Recent studies from holonomic D-modules suggest that there are special functions written in terms of interpolation bases. New special polynomials that have been discovered in this connection are also written as sums of these interpolation bases. We present a Weyl-algebraic theory in a case study to prove that not only they but also their classical counterparts are orthogonal in a unified manner.

10:50-11:15, Jingbo Liu

Title: An algorithm for g-invariant on unary Hermitian lattices over imaginary quadratic fields

Abstract: "Let $E = \mathbb{Q}(\sqrt{-d})$ be an imaginary quadratic field for a square-free positive integer d, and let $\mathcal{O}$ be its ring of integers. For each positive integer m, let I_m be the free Hermitian lattice over $\mathcal{O}$ with an orthonormal basis, let $\mathfrak{S}_d(1)$ be the set consisting of all positive definite integral unary Hermitian lattices over $\mathcal{O}$ that can be represented by some I_m, and let $g_d(1)$ be the least positive integer such that all Hermitian lattices in $\mathfrak{S}_d(1)$ can be uniformly represented by $I_{g_d(1)}$. The main results of this work provide an algorithm to calculate the explicit form of $\mathfrak{S}_d(1)$ and the exact value of $g_d(1)$ for every imaginary quadratic field E, which can be viewed as a natural extension of the Pythagoras number in the lattice setting."

11:15-11:45, Gauree Wathodkar

Title: Partition Regularity in Commutative Rings

Abstract: Let $A \in M_{m\times n}(\mathbb{Z})$ be a matrix with integer coefficients. The system of equations $A\vec{x} = \vec{0}$ is said to be *partition regular* over $\mathbb{Z}$ if for every finite partition $\mathbb{Z} \setminus \{0\} = \cup_{i=1}^{r} C_i$, there exists a solution $\vec{x} \in \mathbb{Z}^n$, all of whose components belonging to the same C_i. For example, the equation $x + y - z = 0$ is partition regular. In 1933 Rado characterized completely all partition regular matrices. He also conjectured that for any partition $\mathbb{Z} \setminus \{0\} = \cup_{i=1}^{r} C_i$, there exists a partition class C_i that contains solutions to *all* partition regular systems. This conjecture was settled in 1975 by Deuber. We study the analogue of Rado's conjecture in commutative rings, and prove that the same conclusion holds true in any integral domain.

11:45-12:45, Lola Thompson

Title: Preimages of the sum of proper divisors function

Title: Let $s(n)$ denote the sum of proper divisors of an integer n. The function $s(n)$ has been studied for thousands of years, due to its connection with the perfect numbers. In 1992, Erdos, Granville, Pomerance, and Spiro (EGPS) conjectured that if $\mathcal{A}$ is a set of integers with asymptotic density zero then $s^{-1}(\mathcal{A})$ also has asymptotic density zero. This has been confirmed for certain specific sets $\mathcal{A}$, but remains open in general. In this talk, we will give a survey of recent progress towards the EGPS conjecture. This talk is based on joint work with Paul Pollack and Carl Pomerance, and also on joint work with Kubra Benli, Giulia Cesana, Cecile Dartyge, and Charlotte Dombrowsky.