This course will be based in geometric measure theory with a particular emphasis on questions concerning fractals, structure and geometric combinatorics.

Specifically, we will use iterated function systems as a medium through which to study the various notions of dimension of sets and measures and their interplay. This will include the study of Hochman's [Hoc14] results using Shannon Entropy to approach the dimension drop conjecture. Furthermore, we will discuss projection theorems including Marstrand's projection theorem and Favard length (If there is time, we will discuss generalized projections of Peres and Schlag [PS00]). Finally, we will discuss topics of pairwise distances and Kakeya sets including recent progress in these directions.

The texts of Falconer [Fal97], Bárány-Simon-Solomyak [BSS23], and Guth [Gut16]. Prerequisites: MATH 524.

## References

[BSS23] Balázs Bárány, Károly Simon, and Boris Solomyak. *Self-similar and Self-affine Sets and Measures*, volume 276. American Mathematical Society, 2023.

[Fal97] Kenneth Falconer. *Techniques in fractal geometry*. John Wiley & Sons, Ltd., Chichester, 1997.

[Gut16] Larry Guth. *Polynomial methods in combinatorics*, volume 64. American Mathematical Soc., 2016.

[Hoc14] Michael Hochman. On self-similar sets with overlaps and inverse theorems for entropy. *Annals of Mathematics*, pages 773–822, 2014.

[PS00] Yuval Peres and Wilhelm Schlag. Smoothness of projections, bernoulli convolutions, and the dimension of exceptions. 2000.