

# Suma y producto de conjuntos y estimaciones de sumas trigonometricas

## Programa

1. Sumas trigonométricas. Suma de Gauss.
2. Estimaciones clásicas de suma de Gauss.
3. Suma y producto de conjuntos en campos primos. Conexiones con sumas trigonométricas.
4. Estimaciones de suma y producto de conjuntos.
5. Estimaciones de Balog-Szemerédi-Gowers.
6. Aplicaciones a sumas trigonométricas.

## References

- [1] J. Bourgain, N. Katz and T. Tao, *A sum-product estimate in finite fields, and applications*, *Geom. Func. Anal.* **14** (2004), 27–57.
- [2] J. Bourgain and M. Z. Garaev, *On a variant of sum-product estimates and explicit exponential sum bounds in prime fields*, *Math. Proc. Cambridge Philos. Soc.* **146** (2009), 1-21.
- [3] J. Bourgain, A. A. Glibichuk and S. V. Konyagin, *Estimates for the number of sums and products and for exponential sums in fields of prime order*, *J. London Math. Soc. (2)* **73** (2006), 380–398.
- [4] M. Z. Garaev, *An explicit sum-product estimate in  $F_p$* , *Int. Math. Res. Notices* (2007) Vol. 2007, doi:10.1093/imrn/rnm035.
- [5] M. Z. Garaev, *The sum-product estimate for large subsets of prime fields*, *Proc. Amer. Math. Soc.* **136** (2008), 2735-2739.
- [6] M. Z. Garaev, *Sums and products of sets and estimates of rational trigonometric sums in fields of prime order*, *Russian Math Surveys*, **65** (2010), 599–658.
- [7] A. A. Glibichuk, *Combinatorial properties of sets of residues modulo a prime and the Erdos-Graham problem*, *Math. Notes*, **79** (2006), 356–365.

- [8] A. A. Glibichuk and S. V. Konyagin, *Additive properties of product sets in fields of prime order*, Centre de Recherches Mathématiques, CRM Proceedings and Lecture Notes, 43, 279–286 (2007).
- [9] N. H. Katz and Ch.-Y. Shen, *A slight improvement to Garaev’s sum product estimate*, Proc. Amer. Math. Soc. **136** (2008), 2499–2504.
- [10] N. H. Katz and Ch.-Y. Shen, *Garaev’s inequality in finite fields not of prime order*, Online Journal of Analytic Combinatorics, Issue 3 (2008), #3.
- [11] S. V. Konyagin, *Bounds of exponential sums over subgroups and Gauss sums*, 4th Intern. Conf. Modern Problems of Number Theory and Its Applications, Moscow Lomonosov State Univ., Moscow, 2002, 86-114 (in Russian).
- [12] I. Z. Ruzsa, *An application of graph theory to additive number theory*, Scientia, Ser. A **3** (1989), 97–109.
- [13] Ch.-Y. Shen, *An extension of Bourgain and Garaev’s sum-product estimates*, Acta Arith. **135** (2008), 351–356.
- [14] T. Tao and V. Vu, “Additive combinatorics” (Cambridge University Press, Cambridge, 2006).