

## Princeton Discrete Math Seminar

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Thursday, September 27th

Department of Mathematics

2:15-3:15pm

Fine Hall, Room 224

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### A Product Theorem in Free Groups

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Chang (2006) proved that for some fixed  $\delta$ , any set  $A$  in a free group with  $|AAA| \leq |A|^{1+\delta}$  belongs to a cyclic subgroup.

We give a purely combinatorial proof of this result based on the theory of periodic words and their occurrences. Our proof also shows that  $\delta$  can be chosen arbitrarily close to 1, and this is optimal. This further generalizes to arbitrary virtually free groups (with the respective change in the conclusion); in particular, our result is applicable to the modular group  $PSL_2(\mathbb{Z})$ .