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Abelian repetitions and crucial words

In 1961, Erdős asked whether or not there exist words of arbitrary length over a fixed finite alphabet that avoid patterns of the form XX' where X' is a permutation of X (called *abelian squares*). This problem has since been solved in the affirmative in a series of papers from 1968 to 1992. Much less is known in the case of *abelian k-th powers*, i.e., words of the form $X_1X_2\cdots X_k$ where X_i is a permutation of X_1 for $2 \leq i \leq k$.

In this talk, I will discuss *crucial words* for abelian k-th powers, i.e., finite words that avoid abelian k-th powers, but which cannot be extended to the right by any letter of their own alphabets without creating an abelian k-th power. More specifically, I will consider the problem of determining the minimal length of a crucial word avoiding abelian k-th powers. This problem has already been solved for abelian squares by Evdokimov and Kitaev (2004). I will present a solution for abelian cubes (the case $k = 3$) and state a conjectured solution for the case of $k \geq 4$.

This is joint work with Bjarni V. Halldórsson and Sergey Kitaev (Reykjavík University).