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Abelian powers in automatic sequences are not always automatic

An abelian square is a word of the form xx' , where x' is a permutation of x , such as the English word "reappear". This is generalized to abelian m 'th powers. In this talk I prove that, for all integers $m \geq 2$, the occurrences of abelian m th powers in a particular automatic sequence (the regular paperfolding word) is not automatic. It follows that abelian repetitions cannot be expressed in the logical theory $(\mathbb{N}, +, <, V_k)$, where $V_k(n)$ is the highest power of k dividing n .