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Complexity of log-concave inequalities in matroids

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A sequence of nonnegative real numbers $a_1, a_2, \ldots, a_n$, is log-concave if $a_i^2 \geq a_{i-1}a_{i+1}$ for all i ranging from 2 to $n-1$. Log-concavity naturally arises in various aspects of mathematics, each characterized by different underlying mechanisms. Examples range from inequalities that are readily provable, such as the binomial coefficients $a_i = \binom{n}{i}$, to intricate inequalities that have taken decades to resolve, such as the number of independent sets a_i in a matroid M with i elements (otherwise known as Mason's conjecture). It is then natural to ask if it can be shown that the latter type of inequalities is intrinsically more challenging than the former. In this talk, we provide a rigorous framework to answer this type of questions, by employing a combination of combinatorics, complexity theory, and geometry. This is joint work with Igor Pak and is intended for a general audience.

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