Hodge theory in combinatorics

Eric Katz
University of Waterloo

Abstract:
Three important theorems in algebraic geometry, the hard Lefschetz theorem, the Hodge-Riemann bilinear relations, and the Hodge index theorem constrain the topology of algebraic variety. I will discuss two applications of these theorems to combinatorics: Stanley's g-theorem on the face numbers of polytopes and the Huh-Katz proof of the log-concavity of the characteristic of a representable matroid. I will try to find common ground between these theorems by relating them to Stanley-Reisner rings situate them in a broader combinatorial theory involving ideas from tropical geometry. I may also mention recent work with Karim Adiprasito and June Huh.