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Toric degenerations of Grassmannians and their associated polytopes

Toric varieties are popular objects in algebraic geometry, as they can be modelled on polytopes and polyhedral fans. This is mainly because there is a dictionary between their geometric properties and the combinatorial invariants of their polytopes. This dictionary can be extended from toric varieties to arbitrary varieties through toric degenerations. In this talk, I will introduce the notion of toric degenerations which generalizes the fruitful correspondence between toric varieties and polytopes, to arbitrary varieties. There are prototypic examples of toric degenerations (of Grassmannians) which are related to Young tableaux and Gelfand-Cetlin polytopes. I will describe how to obtain such degenerations using the theory of Gröbner fans and tropical geometry. In this talk, I focus on particular combinatorial types of cones in tropical Grassmannians indexed by matching fields, whose corresponding degenerations are toric. Moreover, I will show how their associated Newton-Okounkov bodies (polytopes) are connected by combinatorial mutations. I will present several combinatorial conjectures and computational challenges around this problem.