1155-68-468 **Peter Bürgisser**, **Ankit Garg**, **W. Cole Franks*** (franks@mit.edu), **Rafael Oliveira**, **Michael Walter** and **Avi Wigderson**. *Geodesically convex optimization for invariants and moment polytopes.*

Moment polytopes are convex bodies associated to certain group actions on manifolds. When the manifold is a projective variety invariant under the action of a reductive Lie group, such as the general linear group acting on the space of 3-tensors, the moment polytope encodes asymptotic information about the the invariant polynomials and the representation theory of the coordinate ring. This talk concerns the computational complexity of deciding moment polytope membership. This question finds surprising applications ranging from algebraic complexity to real analysis. Before this work, methods included enumerating the (potentially exponentially many) facets of the polytope and evaluating highest weight polynomials (of potentially exponential degree). We will discuss new optimization-based algorithms, initially inspired by Sinkhorn's famous algorithm for matrix scaling, that do not seem to face the same hurdles. These algorithms are notable for their simplicity, their applicability to arbitrary representations, and their ability to compute preimages under the moment map, a problem of considerable practical interest. The approach goes via the Kempf-Ness criterion and connects to the exciting area of geodesically convex optimization. (Received January 20, 2020)