

# ECH capacities, Ehrhart theory, and toric varieties

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## Abstract

In symplectic geometry, it is valuable to construct obstructions to the existence of embeddings between symplectic manifolds; these typically go by the name of symplectic capacities. I will focus on a particular construction due to Hutchings that produces a sequence of obstructions for 4-manifolds – ECH capacities – and has had much success in resolving several fundamental embedding problems. I will describe how ECH capacities are tightly related to various optimisation problems in algebraic geometry, and to lattice point counts for rational polytopes in the toric case. These interpretations offer many new insights into the computation and asymptotics of ECH capacities, as well as inspire some novel constructions of purely algebraic or combinatorial nature.

**Keywords:** symplectic geometry, 4-manifold, embedding problems, lattice points, rational polytope.