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Corner loci of piecewise polynomials, and polynomially weighted tropical varieties

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SUMMARY

Counting Euler characteristics of the discriminant of the quadratic equation in terms of Newton polytopes in two different ways, G. Gusev found an unexpected relation for mixed volumes of two polytopes and the convex hull of their union.

We give an elementary proof of this equality, deducing it from the following fact, conjectured by A. G. Khovanskii: the mixed volume of a collection of polytopes only depends on the product of their support functions (rather than on the individual support functions). This dependence is essentially a certain specialization of the isomorphism between two well-known combinatorial models for the cohomology of toric varieties. We provide a new description of this isomorphism, which also may be of interest because of a new object and operation (tropical variety with polynomial weights and its corner locus) that appears in our construction.

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