# PROJECTION CONSTANTS OF SPACES OF POLYNOMIALS VIA REPRESENTATION THEORY

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Abstract. Projection constants quantify how well a finite-dimensional Banach space can sit as a complemented subspace of larger spaces: one seeks projections onto the space of smallest possible norm. Although classical invariants of Banach space theory, they also arise naturally in approximation theory, convex geometry, harmonic analysis, and operator theory.

In this talk I will discuss the determination of projection constants for classical spaces of polynomials on finite-dimensional Banach spaces, with particular emphasis on their high-dimensional asymptotics. I will also indicate how my interest in these questions grew out of problems related, in a broad sense, to complex analysis in several variables.

A central theme is the use of symmetries. Representation theory of compact groups identifies the relevant invariant subspaces, yields canonical minimal projections, and reduces projection constants to explicit integral formulas involving reproducing kernels or characters.

The examples range from Fourier analysis on the torus, through spherical harmonic analysis on real and complex Euclidean spheres, to genuinely noncommutative harmonic analysis on the unitary group, where representation theory becomes indispensable. For all these families, one obtains precise high-dimensional asymptotics at the square-root-of-dimension scale.

I will focus in particular on the noncommutative case of homogeneous polynomials on the Banach space of operators on an $n$-dimensional Hilbert space, showing how these harmonic-analytic methods yield both exact formulas and sharp asymptotic results.

The talk is mainly based on joint work with D. Galicer, M. Mansilla, M. Mastyło, S. Muro and P. Zadunaisky.

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