Geometric t-designs and t-cubature and their relations to sphere packings and coverings

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Combinatorialists, numerical analysts, and lately quantum information theorists have been interested in geometric t-designs, which are also known as t-cubature formulas. Ever since the work of Delsarte, Goethals, and Seidel, it has been understood that t-designs are dual to sphere packings. In some cases this duality is very precise, more so than the rough duality between . In this talk I will discuss several results, both asymptotic upper bounds and lower bounds, that come from relations among t-cubature formulas, sphere packings, and sphere coverings. The cubature formulas are mostly geometric on spaces such as the cube and the simplex; the spheres considered will be both combinatorial (on the Hamming cube and integer lattice) and geometric.