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Spherical Designs and the Independence Number of a Subset of an Abelian Group

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A finite subset X on the unit sphere S^d in R^{d+1} is a *spherical t-design* if for every polynomial f: S^d -%gt; R of degree at most t, the average value of f over Sd equals the average of f on X. Spherical designs have been studied extensively via combinatorics, approximation theory, and other fields.

Let G be an additive abelian group. We say that S (a subset of G) is a t-*independent set* in G if for all non-negative integers k and l with k+l ⇐ t, the sum of k (not necessarily distinct) elements of S does not equal the sum of l (not necessarily distinct) elements of S unless the two sums contain the same terms. This concept extends the well studied concepts of sum-free sets and Sidon sets.

In this talk we give some exact values and asymptotic bounds for the maximum size of a t-independent set in the cyclic group and in other abelian groups. As an application, we show how 3-independent sets can be used to construct spherical 3-designs.