Sum Complexes and their Applications
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The Sum Complex $X_{A,k}$ associated with a subset $A$ of the cyclic group $\mathbb{Z}_n$ and an integer $1 \leq k \leq n$ is the $(k-1)$-dimensional simplicial complex on the vertex set $\mathbb{Z}_n$ whose maximal simplices are the sets $\sigma \subset \mathbb{Z}_n$ of cardinality $k$ such that $\sum_{x \in \sigma} x \in A$. Sum complexes may be viewed as high dimensional analogues of Cayley graphs over $\mathbb{Z}_n$ and are relevant to a number of problems in topological combinatorics. In this talk, we will describe the homology of sum complexes as well as some of their applications, including:

1. Construction of high dimensional trees from sum complexes.

2. Upper bounds on Betti numbers in terms of links, and nearly matching lower bounds via sum complexes.

3. Uncertainty inequalities for the finite Fourier transform and their connections to the topology of sum complexes.

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