

**Eigenfunctions, perfect colorings and related structures for hypergraphs**

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Perfect colorings (equitable partitions) of graphs have many applications in algebraic combinatorics. We say that a coloring of vertices of a hypergraph is *perfect* if any two vertices of the same color have the same set of color ranges of incident hyperedges.

In this talk, we establish that perfect colorings of hypergraphs have almost the same algebraic and spectral properties as those for graphs. Moreover, we show that certain combinatorial structures can be represented as perfect colorings of specific hypergraphs or as eigenfunctions of multidimensional circulant matrices generated by an abelian group.

The talk is based on [1] and on recent joint work with Vladimir Potapov.

**References**

- [1] A .A. Taranenko, *Perfect colourings of hypergraphs*, Linear and Multilinear Algebra, vol. 73, no. 9, 2025, pp. 1566-1590.