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embedding factorizations in uniform hypergraphs

An old problem of Cameron asks when a partial parallelism can be extended to a complete parallelism. A specific formulation of this asks when a 1-factorization of a complete h-uniform hypergraph can be embedded in a 1-factorization of a (larger) complete h-uniform hypergraph. This was answered by Haagkvist and Hellgren: the "obvious necessary conditions" are sufficient.

We consider a generalization, asking when an r-factorization of a complete h-uniform hypergraph on m vertices can be embedded in an s-factorization of a (larger) complete h-uniform hypergraph on n vertices. While we do not have a complete characterization, we come surprisingly close. For $s = r$, the "obvious necessary conditions", together with $\gcd(m, n, h) = \gcd(n, h)$ are sufficient. For $s > r$ we need some more assumptions, but still we prove existence under a wide range of parameters.

The proof uses amalgamation-detachment, and an approach based on a group action.

This is joint work with Amin Bahmanian.