Group divisible designs with blocksize 3 and 5 groups.

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A group divisible design with block size three (GDD) is a triple $(X, G, B)$, where $X$ is a set of points, $G$ is a partition of $X$ into subsets called groups and $B$ is a set of 3-element subsets of $X$ (called triples) such that every pair of points is either in a triple or a group but not both. If there are $n_i$ groups of size $g_i$, $i = 1, 2, \ldots, r$ we say that the type of the GDD is $g_1^{n_1}g_2^{n_2}g_3^{n_3}\cdots g_r^{n_r}$ and denote such a design by $3-GDD(g_1^{n_1}g_2^{n_2}g_3^{n_3}\cdots g_r^{n_r})$. They are equivalent to a $K_3$-decomposition of the complete multipartite graph whose partite sets are the groups.

In this talk we show that a $3-GDD(g^3u^2)$s exist if and only if $g$ and $u$ have the same parity and $3|u$.

This is joint work with Charles Colbourn and Melissa Keranen.

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