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On the Nonexistence of 3-Phase Barker Arrays

A 3-phase Barker array is a matrix of third roots of unity for which all out-of-phase aperiodic autocorrelations have magnitude 0 or 1. The only known truly two-dimensional 3-phase Barker arrays have size 3×3. We prove the nonexistence of $s \times t$ 3-phase Barker arrays for infinitely many values of (s, t). As an example, we show that a 3-phase Barker array of size $s \times 3^k q$, where $k \geq 1$ and $(3, q) = 1$, must satisfy $s \leq 2k + 1$. In the case $q = 1$ and $s > 1$, we completely settle the nonexistence unless $s = 3^k = 3$. Using an exhaustive search, we also rule out the nonexistence of certain small 3-phase Barker arrays.

This is joint work with Jonathan Jedwab and Kai-Uwe Schmidt.