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Barker sequences, Wieferich pairs, and Compute Canada

A *Barker sequence* is a finite sequence of integers, each ± 1 , whose off-peak aperiodic autocorrelations are all at most 1 in absolute value. Very few Barker sequences are known, and it has long been conjectured that no additional ones exist. Many arithmetic restrictions have been established that severely limit the allowable lengths of Barker sequences, so severely that no permissible lengths were even known. Using computational resources of Compute Canada, we identify the smallest plausible value for the length of a new Barker sequence, and we compute a number of permissible lengths up to a sizable bound. This work involves a substantial search for Wieferich prime pairs (q, p) , which are defined by the property that $q^{p-1} \equiv 1 \pmod{p^2}$. This is joint work with Peter Borwein.