# On strong Sidon sets of integers

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Given a constant $\alpha$ with $0 \leq \alpha < 1$, a set $S \subset \mathbb{N}$ is called an *$\alpha$-strong Sidon set* if

$$|(x+w)-(y+z)| \geq w^{\alpha} \tag{1}$$

for every $x, y, z, w \in S$ with $x < y \leq z < w$.

When $\alpha = 0$, such a set $S$ is called a *Sidon set*.

The motivation of strong Sidon sets is related to Sidon sets. Briefly speaking, a strong Sidon set generates many Sidon sets by altering each element a bit. This infer that a dense strong Sidon set will guarantee a dense Sidon set contained in a sparse random subset of $\mathbb{N}$.

We prove, among other results, the following

**Theorem 1** *For $0 \leq \alpha \leq 0.001$, there exists an $\alpha$-strong Sidon set $S \subset \mathbb{N}$ such that*

$$S(n) := |S \cap [n]| \geq n^{(\sqrt{2}-1-o(1))/(1+5\sqrt{36\alpha})}. \tag{2}$$

This is a joint work with Yoshiharu Kohayakawa, Sang June Lee and Vojtěch Rödl.