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On an application of higher energies to Sidon sets

We show that for any finite set A and an arbitrary $\varepsilon > 0$ there is $k = k(\varepsilon)$ such that the higher energy $\mathrm{E}_k(A)$ is at most $|A|^{k+\varepsilon}$ unless A has a very specific structure. As an application we obtain that any finite subset A of the real numbers or the prime field either contains an additive Sidon-type subset of size $|A|^{1/2+c}$ or a multiplicative Sidon-type subset of size $|A|^{1/2+c}$.