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On Pisier type problems

A subset $A \subseteq \mathbb{Z}$ of integers is free if for every two distinct subsets $B, B' \subseteq A$ we have

$$\sum_{b \in B} b \neq \sum_{b' \in B'} b'.$$

Pisier asked if for every subset $A \subseteq \mathbb{Z}$ of integers the following two statement are equivalent:

(i) A is a union of finitely many free sets;

(ii) There exists $\varepsilon > 0$ such that every finite subset $B \subseteq A$ contains a free subset $C \subseteq B$ with $|C| \geq \varepsilon |B|$.

In a more general framework, the Pisier question can be seen as the problem of determining if statements (i) and (ii) are equivalent for subsets of a given structure with prescribed property. We study the problem for several structures including B_h-sets, arithmetic progressions, independent sets in hypergraphs and configurations in the Euclidean space. This is joint work with Jaroslav Nešetřil and Vojtech Rödl.