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Title of talk: Inverse Problem for Upper Banach Density

Abstract:

The research project has been about applying methods of nonstandard analysis to additive number theory. As the faculty PI Renling Jin recently developed a general scheme with the help of nonstandard methods for deriving theorems about Banach density parallel to every existing theorem about Shnirelman density or lower density (see R. Jin, "Nonstandard methods for upper Banach density problems," *The Journal of Number Theory*, 91 (2001), 20–38), there are many interesting concrete questions about Banach density remaining to be solved using the scheme. For an infinite set A of natural numbers, one can measure its size by various densities. Several important theorems in recent decades indicate an inverse phenomenon, according to which if the size of $A+A$ is small, then the set A must have some rigid structure. However, all these theorems are either about Shnirelman density, lower density, or finite sets. With the help of nonstandard methods, the project investigators have clarified the structure of a set A when the Banach density of $A+A$ is small.