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Ramsey Rainbow Theory

The van der Waerden theorem in Ramsey theory states that, for every k and t and sufficiently large N, every k-coloring of $[N]$ contains a monochromatic arithmetic progression of length t. Motivated by this result, Radoičić conjectured in 2001 that every equinumerous 3-coloring of $[3n]$ contains a 3-term rainbow arithmetic progression, *i.e.*, an arithmetic progression whose terms are colored with distinct colors. This conjecture initiated a serious results having rainbow structures as the common theme. One such result is that every 3-coloring of the set of natural numbers for which each color class has density more than $1/6$, contains a 3-term rainbow arithmetic progression. A similar results for colorings of $\mathbb{Z}_n$ is true.

In this presentation an overview of the current state in research directions in the rainbow Ramsey theory will be given. I will list results, problems, and conjectures related to existence of rainbow arithmetic progressions in $[n]$ and $\mathbb{N}$. A general perspective on other rainbow Ramsey-type problems will be given.