Algebra Seminar

Title: **Neural Codes and Oriented Matroids**

Speaker: Dr. Zvi Rosen

Time and Venue: 3/29/2023 at 4 pm, in SE 215.

Abstract: In the 1970's, neuroscientists discovered that the hippocampus of a rat contains a virtual map of its environment. When the rat is in region 1, neuron 1 fires an electric impulse, when it moves to region 2, neuron 2 fires, and in the intersection, both neurons fire. In the decades since, algebraists have begun to model this situation abstractly as follows: Fix *n* convex subsets of Euclidean space, representing stimuli; then, record all possible subsets of *[n]* whose intersection is nonempty and not covered by other sets. This combinatorial object is called a "convex neural code."

In this talk, we relate the emerging theory of convex neural codes to the established theory of oriented matroids, which generalize systems of signed linear relations. By way of this connection, we prove that all convex codes are related to some representable oriented matroid, and we show that deciding whether a neural code is convex is NP-hard.