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Binomial Coefficients and Roots of Unity in Topology

Abstract: In 1913, Fleck used roots of unity to prove a theorem about sums of binomial coefficients. His ideas have interesting applications to spaces of matrices and related groups called homotopy groups. We will introduce some topological concepts from scratch, including definitions of n -dimensional spheres and homotopy groups, and will describe some specific calculations of homotopy groups. We will also define the space $SU(n)$ of special unitary matrices, and will discuss how ideas in Fleck's theorem can allow one to deduce facts about homotopy groups of $SU(n)$. This is joint work with Zhi-Wei Sun.

This talk is intended for students who have had some exposure to groups. No knowledge of topology is necessary.