Abstract

We survey what is known about spectra of combinatorial Laplacians (or adjacency operators) of graphs on the simplest finite symmetric spaces. This work is joint with J. Angel, N. Celniker, A. Medrano, P. Myers, S. Poulos, H. Stark, C. Trimble, and E. Velasquez. For each finite field $\mathbb{F}_q$ with q odd, we consider graphs associated to finite Euclidean and non-Euclidean symmetric spaces over $\mathbb{F}_q$. We are mainly interested in three questions regarding the eigenvalues and eigenfunctions of the combinatorial Laplacian as q goes to infinity: How large is the second largest eigenvalue, in absolute value, compared with the graph's degree? (The largest eigenvalue is the degree.) What can one say about the distribution of eigenvalues? What can one say about the "level curves" of the eigenfunctions?