1145-00-2547 **Daniel A Spielman*** (daniel.spielman@yale.edu), 17 Hillhouse Ave., room 340, Yale University, New Haven, CT 06520. *Miracles of Algebraic Graph Theory.*

I will never forget the feeling of awe I experienced as a student when I first learned that important properties of graphs are revealed by the eigenvalues and eigenvectors of their associated matrices. This talk should convey some of that feeling, but also provide some understanding and intuition.

We begin by thinking of graphs as networks of springs and by using Laplacians matrices to model them. Hall (1970) and Tutte (1963) showed that eigenvectors of and linear equations in the Laplacian can be used to obtain nice pictures of many graphs. A nice picture must encode important properties.

More intuition comes from considering the matrices that model random walks on graphs. Cheeger's inequality (1970) for graphs relates eigenvalues of the walk matrix to the conductance of a graph. The conductance of a graph measures how easily it can be partitioned, and is the foundation of some of the most important ways of discovering graph structure.

Babai, Grigoryev, and Mount (1982) showed how to efficiently use a graph's eigenvectors to determine whether or not it is isomorphic to another graph, provided that no eigenspace has large dimension.

We will survey these results, explain some fascinating proof techniques used to prove them, and describe some advances in this area. (Received September 25, 2018)