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## Growth Without Groups (Growth in Nonsymmetric Graphs: Computation and Asymptotics)

### Abstract for the Colloquium Talk March 9, 2000

The ball growth  $b(n)$  from a vertex  $v$  in a graph  $G$  counts the number of vertices that can be reached from  $v$  by paths of length  $n$  or less; the sphere growth  $s(n)$  is defined similarly with paths of length exactly  $n$ . If  $G$  is the Cayley graph for a group  $A$  with finite generating set  $X$ , the asymptotic equivalence class for  $b(n)$ , given a somewhat unusual definition of asymptotic equivalence, is independent of the choice of generating set and is called the growth of the group  $A$  (Milnor, Bass, Gromov, et al.). The theory for growth in vertex transitive graphs parallels that for groups (Trofimov, Imrich, Seifert, et al.). This joint work with Tomo Pisanski begins a study of growth in general graphs. To provide specific computational examples, ways of combining graphs are introduced that are analogous to group constructions, such as free products. To provide a foundation for asymptotic analysis, the two natural kinds of asymptotic equivalence are compared. A mild condition is introduced that ensures asymptotic equivalence for sphere growth from different vertices. Connections to isoperimetric inequalities and transience in random walks on graphs are also discussed.

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