The Orbital Diameter of Primitive Permutation Groups

Kamilla Rekvenyi
Imperial College London, London, United Kingdom
k.rekvenyi19@imperial.ac.uk

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Let G be a group acting transitively on a finite set Ω. Then G acts on $\Omega \times \Omega$ componentwise. Define the orbitals to be the orbits of G on $\Omega \times \Omega$. The diagonal orbital is the orbital of the form $\Delta = \{(\alpha, \alpha) | \alpha \in \Omega\}$. The others are called non-diagonal orbitals. Let Γ be a non-diagonal orbital. Define an orbital graph to be the non-directed graph with vertex set Ω and edge set $(\alpha, \beta) \in \Gamma$ with $\alpha, \beta \in \Omega$. If the action of G on Ω is primitive, then all non-diagonal orbital graphs are connected. The orbital diameter of a primitive permutation group is the supremum of the diameters of its non-diagonal orbital graphs.

There has been a lot of interest in finding bounds on the orbital diameter of primitive permutation groups. In my talk I will outline some important background information and the progress made towards finding specific bounds on the orbital diameter. In particular, I will discuss some results on the orbital diameter of the groups of simple diagonal type and their connection to the covering number of finite simple groups. I will also discuss some results for affine groups, which provides a nice connection to the representation theory of quasisimple groups.