

The second largest eigenvalue of normal Cayley graphs on symmetric groups generated by cycles

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Aldous' Spectral Gap Conjecture states that the second largest eigenvalue of each connected Cayley graph on the symmetric group S_n with respect to a set of transpositions is attained by the standard representation of S_n . This celebrated conjecture, which was proposed in 1992 and completely proved in 2010, has inspired much interest in determining the second largest eigenvalue of Cayley graphs on S_n . Let $C(n, k)$ be the set of k -cycles of S_n . We find that the (strictly) second largest eigenvalue of $\text{Cay}(S_n, C(n, I))$ can only be achieved by at most four irreducible representations of S_n , where $I \subseteq \{2, 3, \dots, n\}$ and $C(n, I) = \cup_{k \in I} C(n, k)$. This talk is based on collaborative work with Binzhou Xia and Sanming Zhou.