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Constructing surfaces with large first Steklov eigenvalue multiplicity

Recently, the study of the behavior of Steklov eigenvalues' multiplicity has seen great advances. These new approaches use both refining of existing methods coming from the study of the Laplacian and interesting novel ideas. Notably, during the last decade, the works of A. Fraser, R. Shoen, P. James, M. Karpukhin, G. Kokarev and I. Polterovich brought multiple results on upper bounds of the multiplicity. These bounds rely on the topology and the number of boundary components of studied surfaces. This raises the following question: is there a universal bound on the multiplicity, independent of these two properties? To disprove it would be to show the existence of surfaces with first nonzero Steklov eigenvalue of arbitrarily large multiplicity.

The objective of this talk is to provide such a construction. The method is based on a technique, developed by Bruno Colbois to get a similar result in the context of the Laplacian eigenvalues. The main idea is to build a surface around the Cayley graph of a given group to get a specific subgroup of isometry. The goal would then be to use the irreducible representations of this subgroup in conjunction with the surface's finer geometry to show that the first non-trivial eigenspace is of large dimension.