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**CRAIG SUTTON**, Dartmouth College

*On hearing the length spectrum of a compact Lie group*

It is a long-standing folk-conjecture that the length spectrum of a compact Riemannian manifold is encoded in its Laplace spectrum. This conjecture is known to hold for sufficiently “bumpy” Riemannian manifolds; however, little is known when the manifold possess a “large” isometry group. We demonstrate that for a generic bi-invariant metric on a compact Lie group the singular support of the trace of its associated wave group coincides with the length spectrum of the metric. Consequently, the length spectrum of a generic bi-invariant metric can be recovered from its Laplace spectrum. We also exhibit a substantial collection  $\mathcal{G}$  of compact Lie groups  $U$  having the property that the conjecture holds for every bi-invariant metric carried by  $U$ . Finally, in all the cases considered above, we find that the spectrum of the bi-invariant metric also encodes the rank of its underlying compact Lie group.