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Two counterexamples to a conjecture of Colin de Verdière

In 1986, Yves Colin de Verdière conjectured that the multiplicity of the first nonzero eigenvalue of the Laplacian on a closed connected Riemannian manifold is bounded by its chromatic number minus one. I will describe two hyperbolic surfaces of genus 10 and 17 that disprove this conjecture. The proof that these surfaces have large multiplicity uses the twisted Selberg trace formula to rule out low-dimensional representations of their isometry group from appearing in the first eigenspace. This is joint work with Émile Gruda-Mediavilla, Bram Petri, and Mathieu Pineault.