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Bounded gaps between primes and the length spectra of arithmetic hyperbolic 3-orbifolds

In 1992, Reid posed the question of whether hyperbolic 3-manifolds with the same geodesic length spectra are necessarily commensurable. While this is known to be true for arithmetic hyperbolic 3-manifolds, the non-arithmetic case is still open. Building towards a negative answer to Reid's question, Futer and Millichap have recently constructed infinitely many pairs of non-commensurable, non-arithmetic hyperbolic 3-manifolds which have the same volume and whose length spectra begin with the same first n geodesic lengths. In the present talk, we show that this phenomenon is surprisingly common in the arithmetic setting. In particular, given any arithmetic hyperbolic 3-orbifold derived from a quaternion algebra and any finite subset S of its geodesic length spectrum, we produce, for any $k \geq 2$, infinitely many k-tuples of arithmetic hyperbolic 3-orbifolds which are pairwise non-commensurable, have geodesic length spectra containing S, and have volumes lying in an interval of (universally) bounded length. The main technical ingredient in our proof is a bounded gaps result for prime ideals in number fields lying in Chebotarev sets. This talk is based on joint work with B. Linowitz, D. B. McReynolds, and P. Pollack.