Torsion subgroups of rational elliptic curves over the compositum of all cubic fields.

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Abstract: Let $E/Q$ be an elliptic curve and let $Q(3^\infty)$ denote the compositum of all cubic extensions of $Q$. While the group $E(3^\infty)$ is not finitely generated, one can show that its torsion subgroup is finite; this holds more generally for any Galois extension of $Q$ that contains only finitely many roots of unity. I will describe joint work with Daniels, Lozano-Robledo, and Najman, in which we obtain a complete classification of the 20 torsion subgroups that can and do occur, along with an explicit description of the elliptic curves $E/Q$ that realize each possibility (up to twists). This is achieved by determining the rational points on a corresponding set of modular curves and relies on several recent results related to the mod-$n$ Galois representations attached to elliptic curves over $Q$.

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