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Exceptional modular invariant partition functions are rare

Terry Gannon [*]

tgannon@math.ualberta.ca

The modular invariant partition function is basic data describing how a conformal field theory is built from its chiral halves=vertex operator algebras. Let g be a simple finite-dimensional Lie algebra and k be a positive integer. An old question is to identify all possible modular invariant partition functions for g at level k (these are the so-called Wess-Zumino-Witten models). The result for $g = sl(2)$ is the famous ADE classification of Cappelli-Itzykson-Zuber from 1987. Somewhat later, the analogous classification for $g = sl(3)$ was found; that classification is intimately connected to Jacobians for Fermat curves. Little else is known. However, recent work makes imminent the analogous classification for all Lie algebras up to at least rank 8. The key step is a bound $K(g)$ which grows like the cube of the rank of g: when the level k is greater than $K(g)$, the only modular invariant partition functions come from symmetries of the extended Dynkin diagram of g, and are well understood. My talk will introduce this modular invariant classification problem and give some idea of where the new bound comes from.

[*]Department of Mathematics, University of Alberta, CAB 632, Edmonton, AB T6G 2G1, CANADA