

## **Exceptional Vinberg representations and moduli spaces**

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One of the significant ingredients in Bhargava's work on Selmer groups of elliptic curves was a family of representations of Lie groups such that the quotient was a moduli space of elliptic curves, but the space itself had a family of torsors. These representations came from gradings on larger Lie algebras, and as such are special cases of a more general construction considered by Vinberg. I'll discuss work (mainly with Steven Sam) towards understanding three particularly nice cases in which the ambient Lie algebra is exceptional. In each case, it was known that the quotient is (over  $\mathbb{Q}$ ) a moduli space of (higher genus) curves, but I'll explain how to extend this to  $\mathbb{Z}$  and how various (twisted) moduli spaces of sheaves arise naturally from the group theory.