Separation coordinates and moduli spaces of stable curves
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We establish a surprising link between two a priori completely unrelated objects: The space of isometry classes of separation coordinates for the Hamilton-Jacobi equation on an n-dimensional sphere one one hand and the Deligne-Mumford moduli space $\bar{\mathcal{M}}_{0,n+2}$ of stable algebraic curves of genus zero with $n + 2$ marked points on the other hand. This relation is proved by realising separation coordinates as maximal abelian subalgebras in a representation of the Kohno-Drinfeld Lie algebra. We use the rich combinatorial structure of $\bar{\mathcal{M}}_{0,n+2}$ and the closely related Stasheff polytopes in order to classify the different canonical forms of separation coordinates. Moreover, we infer an explicit construction for separation coordinates and the corresponding quadratic integrals from the mosaic operad on $\bar{\mathcal{M}}_{0,n+2}$.