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# A Measure on the Supermoduli Space with Ramond Punctures

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An essential ingredient in perturbative string theory is a certain measure on the moduli space $\mathcal{M}_g$ of curves. This measure is defined in terms of the Mumford isomorphism, which relates the canonical line bundle on $\mathcal{M}_g$ to the determinant of cohomology of the pushforward of the relative canonical line bundle on the universal curve. This pushforward, and thus also its determinant, has a natural hermitian metric given by integration. This metric can be expressed in terms of the period map. In superstring theory, this generalizes to a measure on the supermoduli space $\mathfrak{M}_g$. The super Mumford isomorphism relates the canonical bundle on $\mathfrak{M}_g$ to the fifth power of the Berezinian of the pushforward of the relative canonical bundle on the universal supercurve. However, in the super case, there is no Hermitian metric given by integration. Instead, the metric is defined in terms of the period map. Furthermore, in contrast to the classical case, the super period map is non-holomorphic and develops a pole along the bad locus. Deligne recently proved that the supermeasure extends smoothly over the bad locus.
In joint work with Ron Donagi, we define a measure on $\mathfrak{M}_{g,0,2r}$, the supermoduli space with Ramond punctures, using the super Mumford isomorphism and super period map, adapted to the case of Ramond punctures. We show that in $\mathfrak{M}_{g,0,2r}$, the analogous bad locus has codimension 2 or higher for $r > 1$, allowing us to extend the measure using a Hartog-like argument.

**Presenter:** OTT, Nadia (University of Southern Denmark)