MODULI, TOPOLOGY, AND ARITHMETIC

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I work on the interface of algebraic geometry and algebraic topology. Much of my research has focused on studying the geometry of moduli spaces of Riemann surfaces. Here are two potential research directions for a PhD student:

- In recent joint work with Bergström–Diaconu–Westerland and Miller–Patzt–Randal-Williams we computed the stable homology of certain moduli spaces of algebraic curves, and used the results to derive asymptotic formulas in analytic number theory over function fields. There are many natural follow-up questions at this point. Can one apply similar techniques to other related spaces? Can one prove more refined versions of these asymptotic formulas by more sophisticated techniques?
- Logarithmic models for operads. A few years ago, Vaintrob introduced a model for the topological operad parametrizing gluing of surfaces with boundary in terms of logarithmic algebraic geometry. This makes the operad "motivic". It is then natural to ask if other mathematical objects closely related to this operad can be similarly logarithmically enhanced. Two examples would be factorization homology of surfaces, and the Goldman–Turaev Lie bialgebra.