

NUMBER THEORY
DEFENSE

Connections between mock modular forms and vertex operator algebras

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Abstract: The results in this dissertation come in two flavors, first we aim to strengthen the analogy between monstrous and umbral moonshine using vertex operator algebras, and second we derive structural results on vertex operator algebras using mock modular forms.

Towards strengthening the analogy between umbral and monstrous moonshine, we reframe Mathieu moonshine by repackaging the Mathieu moonshine mock modular forms in a few different ways, verifying the existence of corresponding modules, and giving various applications including connections with arithmetic. We produce vertex operator algebra constructions of some of these modules.

Using results from orbifold theory and from the theory of mock modular forms, we derive new structural results on vertex operator algebras. In joint work with Victor Manuel Aricheta, we study the asymptotic structure sequences of G -modules where G are finite automorphism groups of certain vertex operator algebras (in particular this holds for umbral moonshine modules). And in joint work with Michael Mertens, we use Weierstrass mock modular forms to relate a dimension formula for certain vertex operator algebras to the arithmetic of modular curves.

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