Algebra
Seminar

Number Theory of Moonshine

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Abstract: The classical theory of monstrous moonshine describes the unexpected connection between the representation theory of the monster group M, the largest of the simple sporadic groups, and certain modular functions, called Hauptmodln. For example, the nth Fourier coefficient of Klein's $j(\tau)$ function is the dimension of the grade n part of a special infinite dimensional representation V of the monster group. Similar phenomena have been shown to hold for the Matthieu group M_{24}, but instead of modular functions, mock modular forms must be used. This has been conjecturally generalized even further, to umbral moonshine, which associates to each of 23 Niemeier lattices a finite group, infinite dimensional representation, and mock modular form. We use generalized Borcherds products to relate monstrous moonshine and umbral moonshine. Namely, we show that twisted traces of classical moonshine functions are equal to coefficients of umbral mock modular forms. We also show that certain umbral coefficients have p-adic properties.

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