UMBRAL MOONSHINE

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Monstrous Moonshine asserts the existence of a natural, infinite-dimensional, graded representation of the Monster group, whose traces at the various conjugacy classes give rise to the Fourier expansions of important modular functions. Building on Borcherds' proof of the conjecture, Witten conjectured deep connections between Monstrous Moonshine and quantum gravity in three dimensions. In 2013 Gannon proved a new Moonshine for the Mathieu group M_{24}. Cheng, Duncan, and Harvey placed this phenomenon within a larger conjectural framework of Moonshines connecting the automorphism groups of each of the 24 Niemeier lattices to the Fourier coefficients of mock modular forms explicitly constructed using indefinite theta functions. This "Umbral Moonshine" conjecture was verified in joint work with John Duncan and Ken Ono.