

BRANDEIS UNIVERSITY

Everytopic Seminar

**Thursday, November 12**

in room 226 at 3:30pm

Be careful: unusual day and time!

Rademacher sums, moonshine and  
black holes

**John Duncan**  
(Cambridge University)

In 1939 Rademacher derived a conditionally convergent series expression for the modular  $j$ -invariant, and used this expression—the first Rademacher sum—to verify its modular invariance. We will explain how to attach Rademacher sums to an arbitrary group commensurable with the modular group, and how the automorphy of the resulting functions reflects the geometry of the group in question.

In the case of a group of genus zero the relationship is particularly striking. On the other hand, of all the properties of the groups of isometries of the hyperbolic plane that arise in moonshine, the genus zero property is perhaps the most elusive. We will illustrate how Rademacher sums shed light on this property.

A physical interpretation of the Rademacher sums comes into view when we consider black holes in the context of three dimensional quantum gravity. This observation amounts to a new connection between moonshine and physics, and promises applications in both directions.