# The Evans Lectures

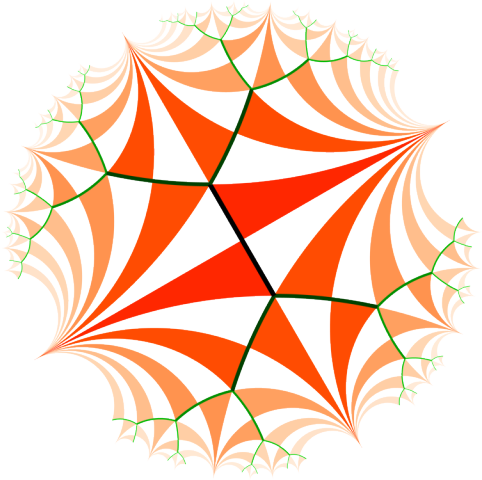
October 21–22, 2010

## **Emmanuel Breuillard**, Université Paris-Sud

### *Lecture I – The Ubiquity of Free Groups*

• Thursday, October 21 @ 4:25 PM in 406 Malott Hall •

*In 1914, Felix Hausdorff proved that there is no rotation invariant finitely additive probability measure defined on all subsets of the sphere. This non-existence proof relied on the explicit construction of a free subgroup of SO(3), that is a pair of rotations a and b that admit no relation. Hausdorff's idea led to remarkable developments in group theory throughout the 20th century starting with the Banach-Tarski paradox, von Neumann's definition of an amenable group, the Tits alternative, etc. In the talk, I will discuss some of this history and then describe several recent examples of problems arising naturally from geometry or group theory and seemingly unrelated to free groups, which, as in the case of Hausdorff's theorem, were solved precisely by constructing free subgroups.*



### *Lecture II – From Free Subgroups to Random Walks and Spectral Gaps*

• Friday, October 22 @ 2:30 PM in 406 Malott Hall •

*Since Kesten's thesis, random walks have become a key tool to study groups both from a combinatorial and geometrical point of view. The rate of decay of the probability of return to the identity of a random walk is related to the spectral gap of the averaging operator and is a measure of the non-amenability of an infinite group. Using a recent work of mine on a strengthening of the Tits alternative, I will show that random walks on finitely generated non-amenable linear groups have a uniform spectral gap. I will then describe consequences for the mixing time and fast equidistribution of random walks on finite simple groups.*

Please join us Thursday, October 21 at 3:55 PM for refreshments in the Mathematics Department lounge (532 Malott Hall).