The Euler Characteristic of Out(F_n) and the Hopf Algebra of Graphs

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In their 1986 work, Harer and Zagier gave an expression for the Euler characteristic of the moduli space of curves, M_gn, or equivalently the mapping class group of a surface. Recently, in joint work with Karen Vogtmann, we performed a similar analysis for Out(Fn), the outer automorphism group of the free group, or equivalently the moduli space of graphs. This analysis settles a 1987 conjecture on the Euler characteristic and indicates the existence of large amounts of homology in odd dimensions for Out(Fn). I will illustrate these results and explain how the Hopf algebra of graphs, based on the works of Kreimer, played a key role to transform a simplified version of Harer and Zagier's argument, due to Kontsevich and Penner, from M_gn to Out(Fn). This combined technique can be interpreted as a renormalized topological field theory. I will also report on more recent results on the integer Euler characteristic of Out(Fn).

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