1135-20-342 **Samuel DeHority**, **Xavier Gonzalez**, **Neekon Vafa** and **Roger Van Peski*** (rpeski@princeton.edu), 3792 Frist Center, Princeton University, Princeton, NJ 08544.
Moonshine for all finite groups.

In recent literature, moonshine has been explored for some groups beyond the Monster, for example the sporadic O'Nan and Thompson groups. This collection of examples may suggest that moonshine is a rare phenomenon, but a fundamental and largely unexplored question is how general the correspondence is between modular forms and finite groups. For every finite group G, we give constructions of infinitely many graded infinite-dimensional $\mathbb{C}[G]$-modules where the McKay-Thompson series for a conjugacy class $[g]$ is a weakly holomorphic modular function properly on $\Gamma_0(\mathrm{ord}(g))$. As there are only finitely many normalized Hauptmoduln, groups whose McKay-Thompson series are normalized Hauptmoduln are rare, but not as rare as one might naively expect. We give bounds on the powers of primes dividing the order of groups which have normalized Hauptmoduln of level $\mathrm{ord}(g)$ as the graded trace functions for any conjugacy class $[g]$, and completely classify the finite abelian groups with this property. In particular, these include $(\mathbb{Z}/5\mathbb{Z})^5$ and $(\mathbb{Z}/7\mathbb{Z})^4$, which are not subgroups of the Monster. (Received August 26, 2017)