

# Topology Seminar

**Allen Yuan**

of MIT will be speaking on

## On the higher Frobenius

on March 9 at 4:30 in  
MIT Room 2-131

Algebraic topology is the study of spaces via algebraic invariants. Given such an invariant of a space  $X$ , one can ask: how much of  $X$  is captured by that invariant? For instance, can one recover  $X$  itself (up to homotopy)?

This question was first addressed in work of Quillen and Sullivan on rational homotopy theory in the 1960's and in work of Dwyer-Hopkins and Mandell on  $p$ -adic homotopy theory in the 1990's. They showed that various algebraic enhancements of the notion of *cohomology* allow one to recover various approximations to a space  $X$ , such as its *rationalization* or  *$p$ -completion*.

In this thesis, we describe how to unify these ideas and recover a space in its entirety, rather than up to an approximation, using deeper invariants. The approach is centered around an insight of Nikolaus and Scholze, who demonstrate that the classical Frobenius endomorphism for rings in characteristic  $p$  naturally generalizes to a phenomenon in higher algebra (more precisely, for  $\infty$ -ring spectra), which we call the *higher Frobenius*. Our main result is that there is an action of the circle group on (a certain subcategory of)  $p$ -complete  $\infty$ -rings whose monodromy is the higher Frobenius. Using this higher Frobenius action, we give a fully faithful model for a simply connected finite complex  $X$  in terms of Frobenius-fixed  $\infty$ -rings.

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