1. Contact information

The instructor for this course is me, Ben Williams. I may be reached at `tbjw@math.ubc.ca`.

The course website is `http://www.math.ubc.ca/~tbjw/A1Homotopy/index.html`.

2. Meeting Times

The class meets twice a week, Tuesdays and Thursdays, in ESB 4127 (the AV room in PIMS) from 10am to 11:30am. The first meeting will be on Tuesday 3 January.

3. Sources

There is no textbook in $\mathbf{A}^1$ homotopy theory. The only reference in some cases is a single paper in which a certain idea originally appeared. In other cases, we have the advantage or two or more presentations of the same idea. This is particularly helpful in this subject, where the prospect of error is never very far away owing to the complexity of the ideas and the novelty of the theory.

Since I hope to add to the bibliography as the course progresses, I have not given it here. Instead, a guide to the literature on $\mathbf{A}^1$ homotopy theory will appear on the course website.

4. Overview of Topics We Hope to Consider

The aim of the course is to teach the basics of $\mathbf{A}^1$-homotopy theory with a view to applications. For reasons of time, the unstable theory will be emphasized.

4.1. **Classical Homotopy.** Since we assume very little background in classical homotopy, and since $\mathbf{A}^1$-homotopy draws heavily on this subject, we will cover at least the following topics at the start of the term:

- The Whitehead theorem.
- Fibrations, and the long exact sequence of a fibration.
- The representability of cohomology theories.

4.2. **Introduction to $\mathbf{A}^1$-homotopy.** While this course can be thought of as following on naturally from a course in Local Homotopy Theory which some students will have taken, we will cover (without proof) the basic tenets of that theory. We will then move on the construction of $\mathbf{A}^1$ homotopy.

- Recollection of Local Homotopy Theory.
- Categories of Varieties.
- The Nisnevich topology.
- The local homotopy theory of schemes.
- Localization and the $\mathbf{A}^1$-homotopy theory.

4.3. **Stable $\mathbf{A}^1$ homotopy.**

- S^1-spectra.
- $\mathbf{P}^1$-spectra.

4.4. **Calculating with $\mathbf{A}^1$-homotopy.**

- The Sing construction.
- The Whitehead Theorem.
- Purity.
- The $\mathbf{A}^1$ connectivity theorem.
- Consequences of the $\mathbf{A}^1$ connectivity theorem.

4.5. **Applications.** This section will take as long as is available for it.

- Obstruction theory in $\mathbf{A}^1$ homotopy.
- Motivic cohomology.
- Algebraic cobordism.