

## ***TOPOLOGY SEMINAR***

**Guest Speaker: Manuel Rivera**  
**University of Miami/CINVESTAV**

**Date:** Tuesday, January 15, 2019

**Time:** 2:30 PM

**Location:** 258 Hurley Hall



**Lecture Title:**

**The coalgebra of singular chains and the fundamental group**

**Abstract**

One knows in algebraic topology that homotopical properties of spaces can be recast into the language of topological groups through the based loop space construction. For example, the zeroth homology of the based loop space can be naturally identified with the group algebra of the fundamental group of the underlying space. This group algebra has a compatible coproduct determined by declaring the group elements to be “group-like”; making it into a structure known as a bialgebra. Conversely, the “group-like” elements in this bialgebra form a group equivalent to the given one. In this talk I will introduce the necessary ingredients in order to explain how this bialgebra determining the fundamental group and higher dimensional aspects can, in complete generality, be determined from the algebraic structure of the chains on the underlying space. The algebraic construction that does this produces a free differential algebra from a differential coalgebra and was introduced by Frank Adams sixty years ago for simply connected spaces. Remarkably, it is understood only now to work for all spaces if one adds something to it. The new idea beyond technique is to combine a duality theory for algebraic structures- known as Koszul duality- and the homotopical symmetry of chain approximations to the diagonal map on a space with the algebraic construction from the past. This is joint work with Mahmoud Zeinalian.