A PERSPECTIVE ON DERIVED NON-COMMUTATIVE GEOMETRY

FEDERICO BAMBOZZI

In my talks, I will briefly recall the history of the problem of extending the spectrum functor from commutative to non-commutative rings. After that, I will use ideas from derived geometry to define a Grothendieck topology on the homotopy category of simplicial rings from which a spectrum functor can be deduced and present a few examples. If time permits, I will describe the problem of endowing the resulting spectrum with a structure sheaf and what is needed to overcome it.

ONE SIDED PERIODIC COTORSION PAIRS AND GORENSTEIN HOMOLOGICAL ALGEBRA

SERGIO ESTRADA

During the last few decades, complete cotorsion pairs have proven to be a highly useful tool in approximation theory. Additionally, properties of cycles of acyclic complexes, or in module-theoretic terms, properties of periodic modules with respect to a class, have gained popularity recently due to, among others, their applications in the study of homotopy categories. In these lectures, we focus on complete cotorsion pairs for which one of the involved classes satisfies specific periodic properties. We will show that there are natural Gorenstein global invariants attached to them and characterize when these global invariants are finite. The theory has applications from different directions: on one side, we establish Gorenstein analogues of classic results in absolute homological algebra by Stenström, Jensen, and Osofsky; on the other hand, we identify new classes of rings for which the class of Gorenstein projective modules is special precovering. We will also exhibit an Iyengar-Krause kind of equivalence for rings with finite Gorenstein weak global dimension. The talks are based on joint works with Lars Winther Christensen, Alina Iacob, Li Liang, Peder Thompson, and Junpeng Wang.

AN INTRODUCTION TO MODEL THEORY FOR REPRESENTATION THEORY

LORNA GREGORY

The interests of algebraists and model theorists often coincide. This is particularly true for Model Theory of Modules (over finite-dimensional algebras) where many concepts can be translated into and from purely algebraic statements. However, in doing so, some intuition and meaning is often lost.

These talks will serve two purposes. Firstly, they will give a brief introduction to Model Theory with a focus on tools and ideas that may be useful to algebraists. Secondly, they will explain the model theoretic importance of purity and roots of the Ziegler spectrum.

SALCE'S LEMMA

IVO HERZOG

Salce's Lemma, which states that a cotorsion pair is special precovering if and only if it is special preenveloping, may be regarded as the fundamental theorem of approximation theory. It provides a genuine transfer principle for proving results about one side of a complete cotorsion pair in terms of the other. In these two talks, we will give examples of this phenomenon, beginning with the proof of the Flat Cover Conjecture.

A slight variation of that proof gives rise to the notion of a special phantom precover, which serves as the inspiration for Ideal Approximation Theory, a generalization of the classical theory whose fundamental theorem is an ideal version of Salce's Lemma. We will describe the proof and show how it may be used 1) to prove the Benson-Gnacadja Conjecture for finite groups rings and 2) to show that if R is a ring whose pure-projective left modules are closed under extension, then every FP-projective left R-module is pure-projective. This is the dual of the result - due to Xu - that over a ring whose pure-injective modules are closed under extension, every cotorsion module is pure-injective.

PURE-INJECTIVES IN TRIANGULATED CATEGORIES

HENNING KRAUSE

For compactly generated triangulated categories, experience shows that many of the objects of interest are pure-injective. My lectures will be devoted to a systematic analysis of pure-injectives, illustrated (and also motivated) by various examples from representation theory.