

Amnon Neeman

Room 2147, ph. 6125 4989, Amnon.Neeman@maths.anu.edu.au

(1): *K-theory via simplicial sets.*

Project description: The aim of the project will be to go through three descriptions of  $K_1$ , and see that they yield the same abelian group. The first will be the description due to Bass. The second will be Quillen's plus-construction, and the third will be Quillen's  $Q$ -construction.

(2): *Homological algebra and derived categories*

Homological algebra has been at the center of twentieth century mathematics. It has widespread applications to topology, algebra and geometry. In this project, we will cover the classical approach via derived functors, and then move to the more modern approach, by derived categories. [Note: The best exposition, of the beginning of this subject, is still the 1955 paper by Grothendieck, *Sur quelques points d'algèbre homologique*. This paper, as you undoubtedly guessed, is in French. If the student is willing to read French, that would be a great plus. But it is not entirely unavoidable; there are English versions.]

(3): *The algebraic geometry of the chiral Potts model*

The chiral Potts model is a statistical mechanics model. It gives rise to problems in algebraic geometry. Learning about them could be a great way to learn both some statistical mechanics, and some classical algebraic geometry, about curves and their Jacobians.