NITheCS
National Institute for Theoretical and Computational Sciences

NITheCS Mini-School
Tuesday, 5, 12, 19 and 26 October 2021, 14h00

Dr Amartya Goswami (UJ) and Prof Zurab Janelidze (SU)

"Elementary Introduction to Category Theory"

ABSTRACT

This mini-school aims to give a basic introduction to a branch of mathematics called category theory. Anyone who is familiar with numbers and basic arithmetic operations, namely addition and multiplication, will be able to follow at least the first lecture. For the second and subsequent lectures, some encounter with basic mathematical structures, such as vector spaces and groups (nothing more than undergraduate level), will be useful.

Category theory can be seen as a language that allows one to formalise high-level structural ideas in potentially any subject of study, in a simple mathematical framework. This often leads to revealing essential features of the subject in question, as well as to uncovering new conceptual links between different subjects. This simple framework can be illustrated in terms of the physical world, without the need to delve into complex mathematical detail. This makes it possible to start learning category theory without much background in mathematics.

Category theory has a dual nature of basic and applied science. As a basic science, it is a vast and thriving discipline of pure mathematics. But, in most cases, the development of this discipline is motivated by its applications within and outside mathematics. The nature of applications of category theory is, however, different from traditional applied mathematics. If the latter aims to aid one to solve specific problems in the context of a complex system, the former aids one in organising knowledge about the complex system. This leads to a better conceptual understanding of the complex system and, at a more basic level, a language for thinking about the complex system. In this mini-school, we will take an in-depth look at the most fundamental components of this language: the notions of category, functor and natural transformation.

BIOGRAPHIES

AMARTYA GOSWAMI

After obtaining an MSc from Calcutta University (India), Amartya obtained his PhD at UKZN. Before joining the UJ, he worked at the Universities of Zululand and Limpopo. His current research interests are in abstract algebra, category theory, and commutative algebra. For the past five years he has been co-organising a special session in Categories, Algebra, Topology and Logic at the South African Mathematical Society annual congress.

ZURAB JANELIDZE

Zurab is a mathematician working at SU since 2009. He leads there the Undergraduate Programme in Mathematical Sciences of the Faculty of Science and coordinates Foundations of Abstract Mathematics modules, courses at 2nd and 3rd year levels, designed for undergraduate students to develop mathematical research skills. He serves on the editorial boards of major international journals in category theory *Applied Categorical Structures* and *Cahiers de Topologie et Géométrie Différentielle Catégoriques*.

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