

**2018 EAUMP-ICTP SUMMER SCHOOL AND WORKSHOP
ON HOMOLOGICAL METHODS IN ALGEBRA AND GEOMETRY
Dar Es Salaam, Tanzania
FROM 9TH JULY TO 28TH JULY 2018**

- **LINK FOR APPLICATION FOR THE SCHOOL WILL BE OUT IN FEBRUARY 2018**

AIMS OF THE SCHOOL

- To introduce participants to current trends at the interface of algebra, geometry and homological methods, and provide research topics for masters and PhD students
- To provide a forum for African mathematicians to interact, exchange ideas and initiate collaborations
- Identify talented students for possible PhD programs
- To produce digital lecture material for dissemination, which contributes to the training of master students in the East African region

JUNIOR PARTICIPANTS

The expected number of junior participants will be around 33 including 7 from Tanzania, 6 each from Kenya and Uganda, 3 each from Rwanda and Zambia, and 8 participants from elsewhere in Sub-Saharan Africa. We expect a minimum of 12-15 female participants. The target group will be Masters and Doctoral students and postdoctoral researchers.

SCHOOL STRUCTURE AND PROGRAMME

The local Course Director will be Dr Tarig Abdelgadir (UNSW, Australia), a specialist in non-commutative geometry. He will attend for the entire duration of the school/workshop to ensure cohesion of the program.

As in 2013-2017, during the last week of the school participants will be asked to submit mini-projects on the material studied, with the best submissions receiving prizes. Dr Abdelgadir has also agreed to coordinate the mini-project component.

Here is the detailed course plan. All lecturers have been contacted and have provisionally agreed to teach the courses listed. The lecture courses are relatively ambitious for week long courses but we deliberately aim high and will adjust to the students' needs accordingly.

WEEK 1 - INTRODUCTORY COURSES

Course 1: Advanced linear algebra

Lecturer: Chelsea Walton (Temple, United States)

Description: The course starts by reviewing some basic ideas from a first course in linear algebra: matrices up to similarity, eigenvalues, eigenvectors, characteristic polynomial and diagonalisation. It then moves on to the Jordan canonical form. We also aim to cover bilinear forms, multilinear forms and tensor products. After which we introduce the tensor, symmetric and exterior algebra with a view to representations of the general linear group.

Course 2: Galois theory

Lecturer: Ravi Ramakrishna (Cornell, United States)

Description: The goal of the course is to reach the fundamental theorem of Galois theory. Rings and fields are to be introduced along with field extensions. Normal and separable field extensions and

splitting fields. Galois groups are then introduced. The fundamental theorem of Galois theory is then used to show that general quintics are not soluble by radicals. Computer experimentation will be encouraged throughout the course.

WEEK 2 - ADVANCED COURSES

Course 3: Elementary algebraic geometry

Lecturer: David Ssevviiri (Makerere, Uganda)

Description: Affine algebraic sets are defined after introducing the necessary background. The course then covers the Nullstellensatz. The coordinate ring is also introduced and the correspondence between algebraic subsets and finitely generated algebras with no zero divisors detailed. The course then moves to projective varieties and finishes with a discussion on tangent spaces and singularity.

Course 4: Introduction to homological algebra

Lecturer: Michael Wemyss (Glasgow, Scotland)

Description: The course starts by reviewing kernels, cokernels and exact sequences. Concepts such as projective and injective modules along with resolutions are then introduced. These are then used to define the derived functors Ext and Tor. Complexes of modules and quasi-isomorphism are defined with a view to the derived category of an abelian category. Quivers and their categories of representations will be used as toy examples.

WEEK 3 - WORKSHOP WEEK

The week will revolve around the theme of 'monoidal structures in algebraic geometry'. The idea is to have two speakers give one and half hour long research talks each with appropriate breaks. Group discussions on the topics introduced are to follow.

THE LIST OF SPEAKERS FOR THE WORKSHOP :

- Raf Bocklandt (Amsterdam, Netherlands)
- John Boiquaye (Accra, Ghana)
- Alexandru Chirvasitu (Boulder, United States)
- Ivo Dell'Ambrogio (Lille, France)
- Sira Gratz (Glasgow, Scotland)
- Andre Saint-Eudes Mialebama Bouesso (AIMS, South Africa)
- Sue Sierra (Edinburgh, Scotland)
- Hermann Sore (Bobo-Dioulasso, Burkina Faso)
- Greg Stevenson (Glasgow, Scotland)
- Ralph Twum (Accra, Ghana)