

SMSTC, Structure and Symmetry

Alex Sisto, Heriot-Watt

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- ★ **Geometry** (from the Ancient Greek: geo- "earth", -metron "measurement") is a branch of mathematics concerned with questions of shape, size, relative position of figures, and the properties of space.
- ★ **Topology** (from the Greek topos, place, and logos, study) is concerned with the properties of a geometric object that are preserved under continuous deformations, such as stretching, twisting, crumpling and bending, but not tearing or gluing.

Theme overview

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Semester 1

★ Representation Theory

- Misha Bershtein, University of Edinburgh
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- Iordanis Romaidis, University of Edinburgh
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★ Algebraic Topology

- Alex Sisto, Heriot-Watt University
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- Csaba Nagy, University of Glasgow
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Supplementary Modules (separate presentations)

★ Geometry of Gauge Fields

- José Figueroa O'Farrill, University of Edinburgh
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★ Riemann surfaces

- Ruadháil Dervan, University of Glasgow
ruadhail.dervan@glasgow.ac.uk

Theme overview

Semester 2

★ Algebraic Geometry

- Clark Barwick, University of Edinburgh
`Clark.Barwick@ed.ac.uk`

★ Differential Topology

- Murad Alim, Heriot-Watt University
`murad.alim@uni-hamburg.de`

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★ Differential Topology

- Murad Alim, Heriot-Watt University
murad.alim@uni-hamburg.de

Supplementary Modules (separate presentations)

★ Hopf Algebras

- Andy Baker, University of Glasgow
Andrew.J.Baker@glasgow.ac.uk

★ Introduction to geometric group theory

- Laura Ciobanu, Alex Martin, Alex Sisto, Heriot-Watt University
a.sisto@hw.ac.uk

★ Homological algebra

- Pavel Safronov, University of Edinburgh
p.safronov@ed.ac.uk

Prerequisites

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★ Representation theory

- ▶ Basic linear algebra and basic algebra concepts.
 - Definitions and examples of groups, rings and fields.
- ▶ Basic notions of group theory.
 - Lagrange's theorem, normal subgroups and factor groups.

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★ Algebraic Topology

- ▶ A course in metric spaces or topological spaces. (Negotiable, see email.)
- ▶ A course in group theory.
 - Group actions.
 - Finitely generated abelian groups.

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★ Differential Topology

- ▶ Multivariable calculus.
- ▶ Point-Set Topology.
- ▶ First course in Differential Geometry, for example on curves and surfaces.

Note: If you're interested in a course, but worried about prerequisites, please contact the lecturer(s).

Representation Theory

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 - ▶ Tensor products, Maschke's theorem and (lots of examples of) characters.

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 - ▶ Tensor products, Maschke's theorem and (lots of examples of) characters.
- Representations of the symmetric group and the general linear group.
 - ▶ Young diagrams
 - ▶ Schur-Weyl duality
 - ▶ Outlook on further aspects.

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- (5) An introduction to cohomology.

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- (1) Affine varieties.
- (2) Schemes and sheaves.
- (3) Projective varieties, morphisms and fibre products.
- (4) vector bundles, (quasi-)coherent sheaves and sheaf cohomology.

Differential Topology

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- (5) de Rham cohomology.
- (6) Introduction to Chern-Weil theory and characteristic classes

Enjoy the Theme!