

SMSTC, Structure and Symmetry

Alex Sisto, Heriot-Watt

a.sisto@hw.ac.uk

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- ★ **Topology** Topology is a more abstract branch of mathematics that studies the properties of space that are preserved under continuous transformations, such as stretching or bending, but not tearing or gluing.

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Each of these fields offers unique insights and tools for understanding mathematical concepts!

Theme overview

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Semester 1 core courses

★ **Algebraic Geometry**

- Giulia Gugiatti, **University of Edinburgh**
giulia.gugiatti@ed.ac.uk
- Ivan Cheltsov, **University of Edinburgh**
I.Cheltsov@ed.ac.uk

★ **Differential Topology**

- Jim Belk, **University of Glasgow**
jim.belk@glasgow.ac.uk

Supplementary Modules (separate presentations)

★ Conformal Field Theory and Vertex Operator Algebras

- Anatoly Konechny, [Heriot-Watt University](#)
A.Konechny@hw.ac.uk

★ Homotopy Theory

- Irakli Patchkoria, [University of Aberdeen](#)
irakli.patchkoria@abdn.ac.uk
- Mark Powell, [University of Glasgow](#)
mark.powell@glasgow.ac.uk

★ D-modules

- Gwyn Bellamy, [University of Glasgow](#)
Gwyn.Bellamy@glasgow.ac.uk

Theme overview

Semester 2 core courses

★ **Representation Theory**

- Christian Korff, [University of Glasgow](#)
Christian.Korff@glasgow.ac.uk

★ **Algebraic Topology**

- Livio Ferretti, [University of Glasgow](#)
Livio.Ferretti@glasgow.ac.uk

Supplementary Modules, Part 1

★ Gravity

- Sayantani Bhattacharya, University of Edinburgh
sbhatta5@ed.ac.uk

★ Resurgence

- Murad Alim, Heriot-Watt University
M.Alim@hw.ac.uk

★ Stable Homotopy Theory

- Irakli Patchkoria, University of Aberdeen
irakli.patchkoria@abdn.ac.uk
- Mark Powell, University of Glasgow
mark.powell@glasgow.ac.uk

Supplementary Modules, part 2

★ Low-dimensional topology

- Matt Cordes, [Heriot-Watt University](#)
M.Cordes@hw.ac.uk
- Alex Sisto, [Heriot-Watt University](#)
A.Sisto@hw.ac.uk

★ Geometric group theory

- Alex Martin, [Heriot-Watt University](#)
A.Martin@hw.ac.uk

★ Geometry of elliptic curves

- Elena Denisova, [University of Glasgow](#)
e.denisova@sms.ed.ac.uk

Prerequisites

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- ★ **Algebraic Geometry**
 - ▶ Commutative algebra.

Prerequisites

★ Algebraic Geometry

- ▶ Commutative algebra.

★ 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).

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.
 - Permutations, symmetric groups, Lagrange's theorem, normal subgroups and factor groups.

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★ Algebraic Topology

- ▶ Working knowledge of metric space and topological spaces.
- ▶ Linear algebra.
- ▶ Group theory.

Algebraic Geometry

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- (3) Schemes and (quasi-)coherent sheaves.

Differential Topology

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- (2) More general vector bundles and fibre bundles.
- (3) Calculus on manifolds (Lie derivative, exterior derivative, connections, holonomy, curvature, Stokes' Theorem).
- (4) de Rham cohomology.
- (5) (Hope) Chern-Weil theory and characteristic classes.

Representation Theory

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- Representation theory of finite groups
 - ▶ Algebras, group/matrix algebras, representation/modules, Schur's lemma.
 - ▶ 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.

Algebraic Topology

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- (1) Fundamental groups and higher homotopy groups.
- (2) Homology, computations and applications.
- (3) An introduction to cohomology.

Enjoy the Theme!