MAPSS

Report of Contributions

https://indico.cern.ch/e/1383626

Contribution ID: **5** Type: **not specified**

Symplectic Geometry

Monday, 15 July 2024 09:00 (45 minutes)

This course is an introduction to the foundations of symplectic geometry. We will discuss a motivating example—Hamiltonian mechanics—before defining what it means to be symplectic. Afterwards we will study some consequences of the general definitions. Importantly, we will show that locally, all symplectic spaces look the same: there are no local symplectic invariants! This is a consequence of Darboux's theorem.
Key words: Hamiltonian mechanics, symplectic manifolds, Darboux theorem

Presenter: HUBER-YOUMANS, Donald (Heidelberg University)

Contribution ID: **6** Type: **not specified**

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Contribution ID: **7** Type: **not specified**

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Key words: Hamiltonian mechanics, symplectic manifolds, Darboux theorem

Presenter: HUBER-YOUMANS, Donald (Heidelberg University)

Contribution ID: **9** Type: **not specified**

Symplectic reduction and its application in physics

Monday, 15 July 2024 17:15 (45 minutes)

After the introductory course in symplectic geometry, we analyze symplectic manifolds which are symmetric under the action of a Lie group, leading in particular to the symplectic quotient construction. The important concept is the notion of the moment map, generalizing the concept of momentum and angular momentum in classical mechanics, and capturing all preserved quantities coming from Noethers theorem. The symplectic quotient, or Marsden-Weinstein quotient, allows then to define reduced phase spaces. We will see many examples both physically and mathematically motivated.

Key words: Hamiltonian actions, moment maps, symplectic quotient, Noether theorem, Poisson manifolds

Presenter: THOMAS, Alexander (Heidelberg University)

Contribution ID: **10** Type: **not specified**

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Presenter: THOMAS, Alexander (Heidelberg University)

Contribution ID: **11** Type: **not specified**

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Key words: Hamiltonian actions, moment maps, symplectic quotient, Noether theorem, Poisson manifolds

Presenter: THOMAS, Alexander (Heidelberg University)

Contribution ID: **12** Type: **not specified**

What is superconductivity?

After a quick introduction on the physical background of superconductivity and its phenomenological models, I will address the mathematical formalism leading to the derivation of the Bardeen-Cooper-Schrieffer functional, present the state of the art and comment on open problems and possible research directions.

Presenter: SAFFIRIO, Chiara (University of Basel)

Contribution ID: **13** Type: **not specified**

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Presenter: SAFFIRIO, Chiara (University of Basel)

Contribution ID: **15** Type: **not specified**

Differential Geometry

Thursday, 18 July 2024 09:00 (45 minutes)

Differential geometry in 1, 2, 3 and more dimensions.
Imagine an n-dimensional Riemannian manifold and then set n=1, 2, 3, 4+.

Prerequisites: Come as you are. Understanding the notion of a differentiable manifold is assumed though.

Consequences: To embrace the mightiness of general relativity prepared thou shall be.

Key words: Riemannian and pseudo-Riemannian manifolds, metric tensor, connection, covariant derivative, curvature.

Presenter: CHEKERES, Olga

Contribution ID: **16** Type: **not specified**

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Presenter: CHEKERES, Olga

Contribution ID: **18** Type: **not specified**

General Relativity

Thursday, 18 July 2024 16:15 (45 minutes)

Abstract: General relativity is a beautifully geometric and mathematically rigorous theory describing our universe on large scales, where gravity plays a crucial role. After an introduction to differential and Riemannian geometry we will look in more detail at the mathematical underpinnings of this theory and talk about geodesics, normal coordinates, Einstein equations, and other interesting topics.

Keywords: spacetime, metric, curvature, geodesics, normal coordinates, Einstein equations

Presenter: VALACH, Fridrich (University of Hertfordshire)

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Presenter: VALACH, Fridrich (University of Hertfordshire)

Contribution ID: **21** Type: **not specified**

Algebraic Topology

Tuesday, 16 July 2024 09:00 (45 minutes)

Presenter: NIKOLAEV, Nikita (University of Birmingham)

Contribution ID: **22** Type: **not specified**

Algebraic Topology

Tuesday, 16 July 2024 11:00 (45 minutes)

Presenter: NIKOLAEV, Nikita (University of Birmingham)

Contribution ID: **23** Type: **not specified**

Algebraic Topology

Tuesday, 16 July 2024 10:00 (45 minutes)

Presenter: NIKOLAEV, Nikita (University of Birmingham)

Contribution ID: **24** Type: **not specified**

Supergeometry - oddities of the square

Tuesday, 16 July 2024 16:15 (45 minutes)

This course is an excursion into the marvelous world of supergeometry which plays an important role in mathematics and physics. On one hand, it is a natural, albeit at first glance unintuitive, generalization of ordinary geometry. On the other hand it plays a pivotal role in the theory of supersymmetry. Naively, one can replace "super"by "Z/2Z"-graded, alongside introducing the Koszul sign-rule. This naive idea has far reaching consequences leading to the definition of super-manifolds and supersymmetry.
Key words: Super algebras, super manifolds, odd coordinates, fuzzy points, Supersymmetry, super quantum mechanics

Presenter: HUBER-YOUMANS, Donald

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Presenter: HUBER-YOUMANS, Donald

Contribution ID: **27** Type: **not specified**

Singular ODes

Friday, 19 July 2024 09:00 (45 minutes)

Presenter: NIKOLAEV, Nikita (University of Birmingham)

Contribution ID: **28** Type: **not specified**

Singular ODes

Friday, 19 July 2024 10:00 (45 minutes)

Presenter: NIKOLAEV, Nikita (University of Birmingham)

Contribution ID: **29** Type: **not specified**

Singular ODes

Friday, 19 July 2024 11:00 (45 minutes)

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