
Contribution ID: **20** Type: **not specified**

# Advanced course: QT

*Tuesday 6 February 2024 15:00 (1h 15m)*

The geometry and topology of supergravity.

In this set of lectures, I will give an introduction to the ongoing quest of discovering the mathematical theory of four-dimensional ungauged supergravity and developing its potential applications to geometry and topology.
In particular, I will use the cohomology of an appropriately chosen locally constant sheaf to implement the Dirac- Schwinger-Zwanziger integrality condition on four-dimensional classical ungauged supergravity, interpreting it geometrically to obtain its duality-covariant, gauge-theoretic, differential-geometric global model. Using this construction, I will prove that four-dimensional bosonic ungauged supergravity is completely determined by a choice of polarized Siegel bundle defined over the total space of a vertically Riemannian submersion equipped with a complete Ehresmann connection, showing that its gauge sector reduces to a polarized self-duality condition for connections on the underlying polarized Siegel bundle. Furthermore, I will explore the continuous and arithmetic U-duality groups of the theory, characterizing them through short exact sequences and realizing the latter through the automorphism group of the underlying Siegel bundle acting on its adjoint bundle. This elucidates the geometric origin of U-duality and justifies its miraculous existence in supergravity as a gauge group. Finally, and time permitting, I will discuss the structure of a simple class of supersymmetric solutions in supergravity, explaining how the concept of idealized gravitational wave arises naturally in this context

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