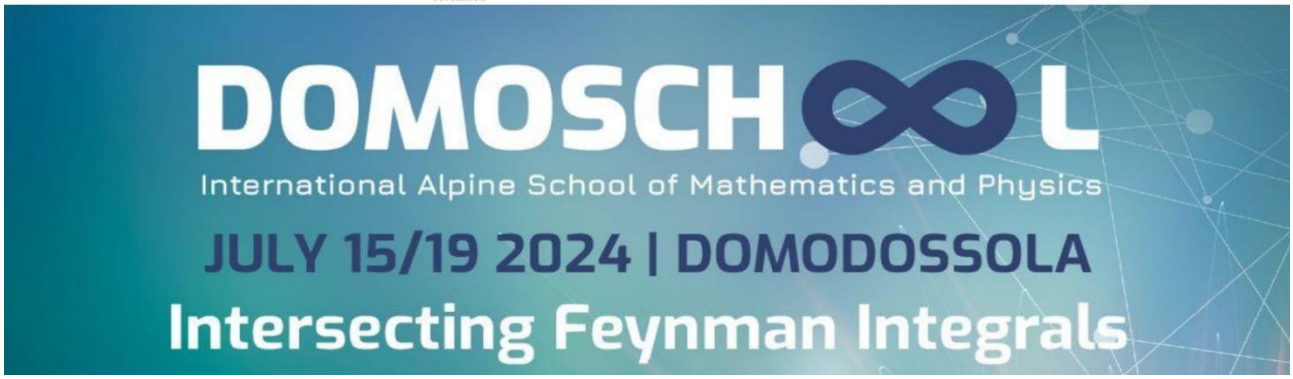


BOOKLET - 2024 EDITION

https://www.arsunivco.eu/domoschool/intersecting-feynman-integrals-program-2024/

SCIENTIFIC BOARD

- Sergio Luigi CACCIATORI (Coordinator) Università degli Studi dell'Insubria
- Laurent LAFFORGUE (Field Medal 2022) Huawei Technologies France
- Stefano PIGOLA Università degli Studi Milano Bicocca & GNFM -INDAM
- Pietro URSINO Università degli Studi dell'Insubria & INFN
- Alessandro CARLOTTO ETH Zurich & Institute for Advanced Study Princeton
- Olivia CARAMELLO Università degli Studi dell'Insubria
- Aleksander KAMENCHTCHIK Università Bologna
- Pengzi MIAO University of Miami
- Pietro Antonio GRASSI Università Piemonte Orientale
- Pierpaolo MASTROLIA Università di Padova
- Gabriele GIONTI S.J. Specola Vaticana
- Francesco D. BELGIORNO Politecnico di Milano
- Riccardo RE Università degli Studi dell'Insubria
- Mauro GIUDICI Università degli Studi di Milano
- Batu GUNEYSU TU Chemnitz, Germany
- Simone NOJA Heidelberg University

ORGANIZING COMMITEE

- Sergio Luigi CACCIATORI (Scientific Responsible and Coordinator - Università dell'Insubria)
- Andrea COTTINI (Secretary of ARS.UNI.VCO Association)
- Simone NOJA (Heidelberg University)
- Stefano PIGOLA (Università degli Studi di Milano Bicocca - GNFM -INDAM)
- Pietro URSINO Università degli Studi dell'Insubria & INFN
- Pierpaolo MASTROLIA (Università di Padova)

ORGANIZING SECRETARIAT

A. COTTINI, E. CRISTINA, D. PERNA, S. MAZZA
ARS.UNI.VCO ETS ASSOCIATION
VIA ANTONIO ROSMINI, 24 - I-28845 – DOMODOSSOLA (VB - ITALY)
+ 39 388 984 3952 - DOMOSCHOOL@ARSUNIVCO.EU

PROGRAMME

MONDAY July 15th

09:00 -- 10:30 Reception and Registration at Rosmini College (Via Rosmini 24)

10:30 - 11:00 **Welcome and Introduction to the Domoschool 2024 Edition**

11:05 -- 12:00 **Marco BERTOLA**

Rieman Surfaces. Theta Functions

12:05 -- 13:00 **Marco BERTOLA**

Rieman Surfaces. Theta Functions

13:00 -- 14:30 **lunch break**

14:35 -- 15:30 **Yoshiaki GOTO**

TWISTED HOMOLOGY and COHOMOLOGY GROUPS

15:35 -- 16:30 **Yoshiaki GOTO**

TWISTED HOMOLOGY and COHOMOLOGY GROUPS

16:35 -- 17:00 **Vsevolod CHESTNOV** **(ST1)**

INTERSECTION NUMBERS, POLYNOMIAL DIVISION, AND RIEMANN SURFACES

17:05 -- 17:30 **coffee break**

17:35 -- 18:30 **Tiziano PERARO**

INTERSECTION NUMBERS and FINITE FIELDS

TUESDAY July 16th

09:00 -- 9:55 **Tiziano PERARO**

INTERSECTION NUMBERS and FINITE FIELDS

10:00 -- 10:55 **Claudia FEVOLA**

EULER-MELLIN-FEYNMAN INTEGRALS

11:00 - 11:30 **coffee break**

11:35 - 12:30 **Claudia FEVOLA**

EULER-MELLIN-FEYNMAN INTEGRALS

12:35 -- 12:55 **Federico SCALI** – (ST2)

ASYMPTOTICALLY SCHWARZSCHILD SOLUTIONS
IN F (R) EXTENSION OF GENERAL RELATIVITY

13:00 – 14:30 **lunch break**

GUIDED TOUR – bus leaving at 2.35

2.35 PM: Meeting after lunch at the Centro Sociale (Via Romita) and shuttle to Crodo.

3.00 PM: Crodo. Visit IPSIA Fobelli - Agricoltural Institute and products with prof. Giuseppe Lozzia

4.00 PM: visit to the erba bona consortium, medicinal herbs with prof. Giuseppe Lozzia

5.00 PM from then with a 15 min walk you can visit Orridi di Uriezzo and Marmitte dei Giganti

7.00 PM: **Appetizer and Gala Dinner at Trattoria Campagna in Verampio**

At the end shuttle to Domodossola

WEDNESDAY July 17th

09:00 -- 9:55 **Claudia FEVOLA**

EULER-MELLIN-FEYNMAN INTEGRALS

10:00 -- 10:55 **Claudia FEVOLA**

EULER-MELLIN-FEYNMAN INTEGRALS

11:00 - 11:30 **coffee break**

11:35 - 12:30 **Marco BERTOLA**

RIEMAN SURFACES. THETA FUNCTIONS

12:35 -- 12:55 **Anthony MASSIDDA** (ST3)

ASYMPOTIC HODGE THEORY FOR FEYNMAN INTEGRALS

13:00 – 14:30 **lunch break**

14:35 -- 15:30 **Yoshiaki GOTO**

TWISTED HOMOLOGY and COHOMOLOGY GROUPS

15:35 -- 16:30 **Tiziano PERARO**

INTERSECTION NUMBERS and FINITE FIELDS

16:35 -- 17:00 **Gaia FONTANA**– (ST4)

REDUCTION TO MASTER INTEGRALS AND TRANSVERSE INTEGRATION IDENTITIES

17:05 -- 17:30 **coffee break**

17:35 -- 18:30 **Tiziano PERARO**

INTERSECTION NUMBERS and FINITE FIELDS

THURSDAY July 18th

09:00 -- 9:55 **Claudia FEVOLA**

EULER-MELLIN-FEYNMAN INTEGRALS

10:00 -- 10:55 **Marco BERTOLA**

RIEMAN SURFACES. THETA FUNCTIONS

11:00 - 11:30 **coffee break**

11:35 - 12:30 **Yoshiaki GOTO**

TWISTED HOMOLOGY and COHOMOLOGY GROUPS

12:35 -- 12:55 **Sid SMITH (ST5)**

HIDDEN STRUCTURES IN INTERSECTION THEORY

13:00 – 14:30 **lunch break**

14:35 -- 15:30 **Marco BERTOLA**

RIEMAN SURFACES. THETA FUNCTIONS

15:35 -- 16:30 **Marco BERTOLA**

RIEMAN SURFACES. THETA FUNCTIONS

16:35 -- 17:00 **Hadrien BROCHET (ST6)**

MULTIVARIATE INTEGRATION IN D-MODULES

SACRO MONTE CALVARIO TOUR - PROGRAMME:

5.15 PM: Meeting point at Collegio Rosmini and with a 30 min walk you will be guided to Sacro Monte Calvario

5.45 PM: Visit to the ancient building, and to the Viewpoint on Domodossola and Ossola Valley

6.30 PM: return to Domodossola Centre

THURSDAY EVENING July 18th

9.00 P.M. – 10.30 P.M. **public conference for citizenship open to all**

(optional - free - italian language)

LA FUSIONE NUCLEARE NEL CONTESTO ENERGETICO GLOBALE

It is a public event, free and free, open to the population, created within Domoschool 2024, the International Alpine School of Mathematics and Physics, and it will be held on the staird of Rosmini College.

For the 2024 edition, moderated by **Arianna Parsi** we had as guests:

Sergio CACCIATORI – Marco VALISA

FRIDAY July 19th

09:00 -- 9:55 **Tiziano PERARO**

INTERSECTION NUMBERS and FINITE FIELDS

10:00 -- 10:55 **Tiziano PERARO**

INTERSECTION NUMBERS and FINITE FIELDS

11:00 - 11:30 **coffee break**

11:35 - 12:30 **Yoshiaki GOTO**

TWISTED HOMOLOGY and COHOMOLOGY GROUPS

12:35 -- 12:55 **Giacomo BRUNELLO** (ST7)

LOOP INTEGRALS IN EXPANDING UNIVERSES

13:00 – 14:30 **lunch break**

14:35 -- 15:30 **Yoshiaki GOTO**

TWISTED HOMOLOGY and COHOMOLOGY GROUPS

15:35 -- 16:00 **Polina PETRIAKOVA** (ST8)

IR FINITE CORRELATION FUNCTIONS IN DE SITTER SPACE

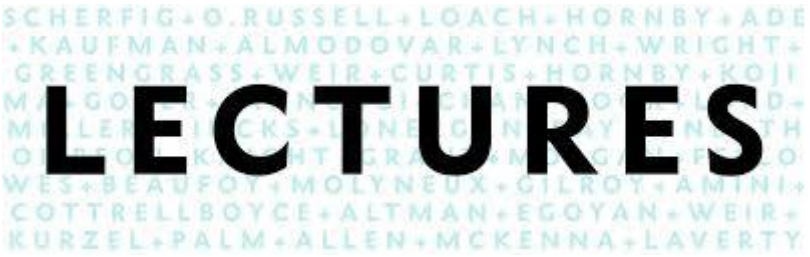
AND A SMOOTH MASSLESS LIMIT

16:05 -- 16:25 **coffee break**

16:30 -- 16:55 **Wojciech FLIEGER** (ST9)

DEFORMED AMPLITUHEDRON

17:00 **Conclusion**



Titles and Abstracts

Prof. **Yoshiaki Goto**

General Education, Otaru University of Commerce, Japan

Researcher in twisted (co)homology groups, Hypergeometric functions, Special functions

Lecture's title: **"TWISTED HOMOLOGY and COHOMOLOGY GROUPS"**

Topics:

1. Regularization of cycles
2. Twisted homology groups and intersection numbers
3. Twisted cohomology groups and intersection numbers
4. Twisted period relations
5. Some comments for several variable cases (if time allows)

******

Dr. **Claudia Fevola**

Centre Inria de Saclay, France

Claudia is interested in algebraic geometry and connections to combinatorics, real algebraic geometry, and nonlinear algebra. Her current research focuses on algebro-geometric questions in particle physics and integrable systems.

Lectures' title: **“EULER-MELLIN-FEYNMAN INTEGRALS"**

Topics:

1. Why Euler?: Nilsson-Passare convergence
2. Why Mellin?: twisted de Rham cohomology, Mellin transform and shift relations
3. Why Hypergeometric?: GKZ systems.

Prof. **Marco Bertola**

Concordia University, Monréal, Canada

Expert in Mathematical Physics, Integrable systems, Inverse problems, Asymptotics in nonlinear integrable equations, Moduli spaces

Lecture's title: **“RIEMAN SURFACES. THETA FUNCTIONS”**

The course aims at introducing the notion of Riemann surface, i.e., a complex manifold (typically compact and smooth) of complex dimension one. The tone will not be overly rigorous.

Topics:

1) Riemann surfaces: Definitions, examples. Euler characteristic.
1.1) Algebraic and Plane curves, their compactification.
1.2) Alternative definition in terms of set-theoretical quotient (Fuchsian presentation).
1.3) Elliptic curves and functions thereof. Fun identities.

2) Basic topology: fundamental group, homology and intersection number. Torelli markings. Canonical dissection of a Riemann surface
2.1) Differential calculus: differentials (smooth, harmonic, (anti)-holomorphic). Cohomology (de Rham) as dual space of homology.
2.2) Riemann Bilinear Identity, various versions and applications.
2.3) Residue calculus. Reciprocity theorems.
2.4) Practical computation of differentials in some simple cases (hyper elliptic).

3) Riemann—Roch theorem and some consequences.
3.1) q-differentials (in particular quadratic differentials)
3.2) Holomorphic differentials, Abel map and the (polarized) Jacobian of the curve.
3.2) Abel theorem and Jacobi inversion theorem.

4) Theta functions and applications (time permitting)
4.1) Definitions, properties;
4.2) How to use Theta functions to construct functions and differentials on a Riemann surface.
4.3) Cauchy, Szegö kernels: forward and inverse spectral problem for rational matrices.

Prof. **Tiziano Peraro**

Università degli Studi di Bologna, Italy

His main scientific interests are the development and usage of advanced techniques for making theoretical predictions in quantum field theory, focusing on scattering amplitudes and their usage for high-precision phenomenology for collider experiments. He is author of public codes, such as Ninja, regularly used in phenomenological studies for LHC, and FiniteFlow, which has been used to produce cutting-edge results for amplitudes and form factors, both analytic and numeric.

Lecture's title: **“INTERSECTION NUMBERS and FINITE FIELDS”**

Topics:

1. Finite fields and functional reconstruction techniques
2. Scattering amplitudes, Feynman integrals as a vector space: reduction to master integrals and differential equations
3. Reduction to master integrals via intersection numbers
4. Intersection numbers over finite fields, via polynomial expansions

talks

Titles and Abstracts (link)

Gaia FONTANA (Short Talk 1 – ST1)

Reduction to master integrals and transverse integration identities

Federico SCALI (ST2)

Asymptotically Schwarzschild Solutions in f (R) Extension of General Relativity

Anthony MASSIDDA (ST3)

Asympotic Hodge Theory for Feynman Integrals

Vsevolod CHESTNOV (ST4)

Intersection numbers, Polynomial Division, and Riemann Surfaces

Sid SMITH(ST5)

Hidden Structures in Intersection Theory

Hadrien BROCHET(ST6)

Multivariate integration in D-modules

Giacomo BRUNELLO (ST7)

Loop Integrals in Expanding Universes

Polina PETRIAKOVA (ST8)

IR finite correlation functions in de Sitter space and a smooth massless limit

Wojciech FLIEGER (ST9)

Deformed Amplituhedron

Domodossola (Italy) - July 2024

Edited by
ARS.UNI.VCO ETS Association