International School of Mathematics «Guido Stampacchia» & Workshop

Topological Methods in Mathematical Physics

1-7 September, 2022

PROGRAMME

Lectures in the Dirac Lecture Hall (San Domenico monastery)
(**PURPLE** denotes virtual presentation)

THURSDAY, September 1

12:00 – 18:00 **Airport transfer & arrival to the Majorana Centre**
Registration Desk opens

FRIDAY, September 2

Day 1 - Morning Session 1 (Chair: Sumners)

8:30 – 8:40 **School & Workshop open: welcome greetings**

8:40 – 9:30 **Renzo RICCA**
Multi-valued potentials and physical reality

9:35 – 10:35 **Mitchell BERGER**
Definitions of twist, writhe, and absolute helicity in simply connected volumes

10:40 – 11:00 Coffee break

Day 1 - Morning Session 2 (Chair: Yahalom)

11:00 – 12:00 **Boris KHESIN**
Beyond Arnold's geodesic framework of an ideal hydrodynamics

12:05 – 13:05 **Antti NIEMI**
Timecrystalline vortices, saddle points and the Poincaré index formula

13:10 – 15:00 Lunch time

Day 1 - Afternoon Session 1 (Chair: Ricca)

15:00 – 16:00 **Sergei NECHAEV (by Microsoft Teams)**
Fractal dimension meets topology: statistics of collapsed polymers and beyond

16:05 – 17:05 **Urs SCHREIBER**
Knots for quantum computation from defect branes
17:10 – 17:30 Coffee break

Day 1 - Afternoon Session 2 (Chair: Sutcliffe)
17:30 – 18:00 **Matteo FORESTI**
Physical effects of global and localized twist phase on quantum vortex defects
18:05 – 18:35 **Benjamin BODE**
Stable knots and links in electromagnetic fields
18:35 – End of Day 1

SATURDAY, September 3

Day 2 - Morning Session 1 (Chair: Hornig)
8:30 – 9:30 **Mark DENNIS**
Skyrmionic hopfions: realising particle-like topologies in structured light
9:35 – 10:35 **De Witt SUMNERS**
Helicity of Seifert framed defects
10:40 – 11:00 Coffee break

Day 2 - Morning Session 2 (Chair: Schreiber)
11:00 – 12:00 **Koya SHIMOKAWA**
Untying pathways of vortex knots
12:05 – 13:05 **Daniel PERALTA-SALAS**
Topology of the nodal sets of eigenfunctions of Schrödinger operators
13:10 – 15:00 Lunch time

Day 2 - Afternoon Session 1 (Chair: Alexander)
15:00 – 16:00 **Vassily MANTUROV (by Microsoft Teams)**
The groups G_n^k and Γ_n^k and their applications in topology, algebra and geometry
16:05 – 17:05 **Robert SCHAREIN**
Introducing KnotPlot Redux for experiments in knot theory
17:10 – 17:30 Coffee break

Day 2 - Afternoon Session 2 (Chair: Barenghi)

17:30 – 18:00 **Jiří MINARČIK**
Minimal surface generating flow

18:05 – 18:35 **Katsuyuki NAKAYAMA**
An interactive topological organization of a vortex between vortical flow and bundle of vorticity lines

18:40 – 19:10 **Simone ZUCCHER**
Evolution of quantum knots driven by minimal surfaces

19:15 – End of Day 2

SUNDAY, September 4

Day 3 - Morning Session 1 (Chair: Cantarella)

8:30 – 9:30 **Xin LIU (by Microsoft Teams)**
Measuring topological complexity of physical knots and links to detect cascade evolution

9:35 – 10:35 **Yasuhide FUKUMOTO**
Nambu brackets for ideal fluid and MHD equations and their applications

10:40 – 11:00 Coffee break

Day 3 - Morning Session 2 (Chair: Voronov)

11:00 – 12:00 **Randall KAMIEN**
Topological lessons from liquid crystals

12:05 – 13:05 **Sofia LAMBROPOULOU (by Microsoft Teams)**
Topological surgery and applications

13:10 – 13:20 Photo session

13:20 – 14:45 Lunch time

Day 3 - Afternoon Session

14:45 – 18:45 Excursion to the archeological site of Segesta

20:30 – Social Dinner (restaurant Ulisse, Erice)

MONDAY, September 5

Day 4 - Morning Session 1 (Chair: Kamien)

8:30 – 9:30 **Carlo BARENGHI**
Tangled vortex lines

9:35 – 10:35 **Clayton SHONKWILER**
Topological polymers and random embeddings of graphs

10:40 – 11:00 Coffee break

Day 4 - Morning Session 2 (Chair: Niemi)

11:00 – 12:00 **Paul SUTCLIFFE**
Topological solitons as nuclei

12:05 – 13:05 **Alexander VORONOV**
Mysterious triality and M-theory

13:10 – 15:00 Lunch time

Day 4 - Afternoon Session 1 (Chair: Shimokawa)

15:00 – 16:00 **Louis KAUFFMAN (by Microsoft Teams)**
Reconnection number of vortex knots

16:05 – 17:05 **David MACTAGGART**
Magnetic helicity in multiply connected domains and the proof of Taylor's conjecture

17:10 – 17:30 Coffee break

Day 4 - Afternoon Session 2 (Chair: Fukumoto)

17:30 – 18:00 **Andrea BELLONI**
Proof of zero-helicity for the Gross-Pitaevskii equation by Noether theorem

18:05 – 18:35 **Christopher PRIOR**
Some results and open questions regarding vector field winding

18:40 – 19:10 **Hao GUAN**
New evolutionary pathways map for a system of physical knots and links

19:15 – End of Day 4

TUESDAY, September 6

Day 5 - Morning Session 1 (Chair: Peralta-Salas)

8:30 – 9:30 **Asher YAHALOM**
Noether currents for eulerian variational principles in non-barotropic magnetohydrodynamics and topological conservations laws

9:35 – 10:35 **Gunnar HORNIG**
Magnetohydrodynamic relaxation

10:40 – 11:00 Coffee break

Day 5 - Morning Session 2 (Chair: Dennis)

11:00 – 12:00 **Jason CANTARELLA**
Polygons in higher dimensions via conformal barycenter sampling

12:05 – 13:05 **Anthony YEATES**
Meaningful definitions of magnetic helicity in open domains

13:10 – 15:00 Lunch time

Day 5 - Afternoon Session 1 (Chair: Berger)

15:00 – 16:00 **Jean-luc THIFFEAULT (by Microsoft Teams)**
The Burau representation of the braid group and its application to dynamics

16:05 – 17:05 **Gareth ALEXANDER**
Topological chirality

17:10 – 17:30 Coffee break

Day 5 - Afternoon Session 2 (Chair: Yeates)

17:30 – 18:00 **Arron BALE**
Using writhe to produce realistic protein structure predictions from biosaxs data

18:05 – 18:35 **Nicola SANSONETTO**
Integrability and hamiltonisation of non-holonomic systems with symmetry

18:40 – End of Day 5 - School & Workshop close

WEDNESDAY, September 7

8:00 – **Departure and airport transfer**