

IUTAM SYMPOSIUM
**Helicity, Structures and Singularity
in Fluid and Plasma Dynamics**

*Palazzo Franchetti, Istituto Veneto
Venice, Italy*

11-15 April, 2016

PROGRAMME

Lectures are held in the Lecture Theatre “Portego”
Coffee break and lunch are served in the Coffee Room
Wi-Fi is freely available to conference participants

SUNDAY, APRIL 10

17:00 – 19:00 **Registration Desk Opens** (Lobby, Palazzo Franchetti)

MONDAY, APRIL 11

Monday Morning

8:30 – 9:15 Registration (Lobby, Palazzo Franchetti)

9:15 Conference Opening

9:15 – 9:25 **Renzo Ricca** (Conference Chair)

Welcome from the Conference Chair

Keith Moffatt (IUTAM Representative)

Welcome from the IUTAM Representative

AM Session 1 (Chair: R. Ricca)

9:25 – 10:05 **Daniel PERALTA-SALAS**

Helicity is the only integral invariant of volume-preserving transformations

10:10 – 10:25 **Yasuhide Fukumoto**

Are all the topological invariants of vorticity representable as cross-helicities?

10:30 – 11:00 Morning coffee

AM Session 2 (Chair: K. Millett)

11:00 – 11:15 **Jean-Jacques Aly**

New formulae for relative magnetic helicity and field line helicity

11:20 – 11:35 **Chris Prior**

A definitive definition of the open field magnetic helicity

11:40 – 11:55 **Petr Akhmet'ev**

Generalizations of the Arnol'd inequality in MHD

12:00 – 12:15 **Jason Parsley**

Submanifold helicities

12:20 – 12:35 **Mitchell Berger**

Helicity on compact surfaces

12:40 – 14:00 Lunch at Palazzo Franchetti Coffee Room

Monday Afternoon

PM Session 3 (Chair: D. Hughes)

14:00 – 14:40 **Gunnar HORNIG**

Relaxation of braided magnetic fields

14:45 – 15:00 **Anthony Yeates**

The global distribution of magnetic helicity in the Sun's corona

15:05 – 15:20 **Etienne Pariat**

Magnetic helicity conservation in a solar active event

15:25 – 15:40 **Egor Illarionov**

Reconstruction of magnetic flux tubes and magnetic field lines from observational and simulated data

15:45 – 16:00 **Irina Makarenko**

Methods of topological data analysis to compare MHD simulations with observations

16:05 – 16:35 Afternoon Tea

- PM Session 4** (Chair: Z. Yoshida)
- 16:35 – 16:50 **Chris Smiet**
Self-generating magnetic knots in plasma
- 16:55 – 17:10 **Francesca Maggioni**
Groundstate magnetic energy vs. bending energy of knots and links
- 17:15 – 17:30 **Clayton Shonkwiler**
Homotopy string links and the $[k]$ -invariant
- 17:35 – 17:50 **Philipp Reiter**
The elastic trefoil is the twice covered circle
- 17:55 – 18:10 **Piotr Surówka**
Chiral anomalies, helicity and information geometry
- 18:15 End of Day 1

TUESDAY, APRIL 12

Tuesday Morning

- AM Session 5** (Chair: R. Kerr)
- 8:45 – 9:25 **William IRVINE**
The life of vortex knots and links and the conservation of helicity across scales
- 9:30 – 9:45 **Yuji Hattori**
Role of vortex reconnection in creation of strong vortices
- 9:50 – 10:05 **Yoshifumi Kimura**
Reconnection of skewed vortex and magnetic flux tubes
- 10:10 – 10:25 **Xin Liu**
Cascade of vortex knots detected by HOMFLYPT polynomial
- 10:30 – 11:00 Morning coffee

AM Session 6 (Chair: Y. Fukumoto)

- 11:00 – 11:15 **Keith Moffatt**
Magnetic relaxation and the Taylor conjecture
- 11:20 – 11:35 **Asher Yahalom**
Variational principles for non-barotropic magneto-hydrodynamics and local topological conservation laws
- 11:40 – 11:55 **Taliya Sahihi**
Topology of flows and finite-time singularity: on the kernel of helicity and spirality
- 12:00 – 12:15 **David Pontin**
Existence of force-free magnetic fields, and formation of electric current singularities
- 12:20 – 12:35 **Francisco Torres de Lizaaur**
Periodic orbits of analytic Euler fields
- 12:40 – 14:00 Lunch at Palazzo Franchetti Coffee Room

Tuesday Afternoon

PM Session 7 (Chair: A. Russel)

- 14:00 – 14:40 **Emmanuel DORMY**
Models for the geodynamo
- 14:45 – 15:00 **Dmitry Sokoloff**
Magnetic helicity and higher helicity invariants as constraints for dynamo action
- 15:05 – 15:20 **David Hughes**
The role of helicity in dynamos driven by rapidly rotating convection
- 15:25 – 15:40 **Steven Tobias**
Helicity and dynamo waves at high magnetic Reynolds number
- 15:45 – 16:00 **Michael Proctor**
Nonlinear behaviour of the Yousef shear dynamo
- 16:05 – 16:35 Afternoon Tea

- PM Session 8** (Chair: M. Proctor)
- 16:35 – 16:50 **Krzysztof Mizerski**
Mean MEF in current sheets
- 16:55 – 17:10 **Shigeo Kida**
Helicity dynamics in the flow driven by a precessing sphere
- 17:15 – 17:30 **Stephen Childress**
Eroding dipoles and vorticity growth for Euler flows in R^3
- 17:35 – 17:50 **Makoto Hirota**
Variational formalism for linear growth rates of collisionless tearing modes
- 17:55 – 18:10 **Andrew Soward**
Spin-down in a rapidly rotating cylinder container with mixed rigid and stress free boundary conditions
- 18:15 End of Day 2
- 20:00 – 22:30 Conference Dinner (Palazzo Franchetti Coffee Room)

WEDNESDAY, APRIL 13

Wednesday Morning

- AM Session 9** (Chair: H. Kudela)
- 8:45 – 9:15 **Andrew GILBERT**
The life and science of Konrad Bajer
- 9:20 – 9:35 **Jens Eggers**
Free surface cusps and air entrainment
- 9:40 – 9:55 **Dominik Dierkes**
Time-dependent helical coordinates: derivation of the fundamental system and new conservation laws
- 10:00 – 10:15 **Marc Brachet**
Helicity, topology and Kelvin waves in reconnecting quantum knots
- 10:20 – 10:50 Morning Coffee

AM Session 10 (Chair: De W. Sumners)

10:50 – 11:05 **Luca Galantucci**

Quantum vortex dynamics and reconnections in trapped Bose-Einstein condensates

11:10 – 11:25 **Niklas Hietala**

The intrinsic twist of superfluid vortices: Can a line be twisted?

11:30 – 11:45 **Hayder Salman**

Helicity conservation and twisted Seifert surfaces for superfluid vortices

11:50 – 12:05 **Simone Zuccher**

Cascade process of linked quantum vortex loops

12:10 – 12:30 Group Photograph

12:30 End of Day 3 – Free afternoon

21:00 – 23:00 **Martin Jones** (Conservatorio “B. Marcello” Concert Hall)

Piano Concert with Ryme and Rhythm

THURSDAY, APRIL 14

Thursday Morning

AM Session 11 (Chair: W. Irvine)

8:45 – 9:25 **De Witt SUMNERS**

Conservation of writhe helicity under anti-parallel reconnection

9:30 – 9:45 **Antti Niemi**

Non-linear Schrödinger equation, helicity and strings with applications to proteins

9:50 – 10:05 **Kenneth Millett**

Entanglement transitions in confined fluid flows

10:10 – 10:25 **Andrew Gilbert**

Geometric generalised Lagrangian mean theories

10:30 – 11:00 Morning Coffee

AM Session 12 (Chair: M. Brachet)

- 11:00 – 11:15 **Maurice Rossi**
Helical vortices: linear and nonlinear dynamics
- 11:20 – 11:35 **Katsuyuki Nakayama**
Relationships between eigen-vortical-axis line and vorticity line
- 11:40 – 11:55 **Stéphane Le Dizès**
Curvature instability in vortex rings and helical vortices
- 12:00 – 12:15 **Waleed Mouhali**
Cyclonic vortices inside precessing cylinders: instability and change of topology
- 12:20 – 12:35 **Kai Schneider**
Helical vortices generated by flapping wings of bumblebees
- 12:40 – 14:00 Lunch at Palazzo Franchetti Coffee Room

Thursday Afternoon

PM Session 13 (Chair: C. Barenghi)

- 14:00 – 14:40 **Robert KERR**
What trefoil reconnection says about Navier-Stokes regularity
- 14:45 – 15:00 **Bartosz Protas**
Helicity-enhanced extreme vortex states and the hydrodynamic blow-up problem
- 15:05 – 15:20 **Miguel Bustamante**
Atypical late-time singular regimes accurately diagnosed in stagnation-point-type helical solutions of 3D Euler flows
- 15:25 – 15:40 **Rodion Stepanov**
Helical bottleneck effect in 3D homogeneous isotropic turbulence
- 15:45 – 16:00 **Paolo Orlandi**
A toy for turbulence
- 16:05 – 16:35 Afternoon Tea

PM Session 14 (Chair: K. Schneider)

- 16:35 – 16:50 **Ganapati Sahoo**
Role of the helicity in the energy transfer in three-dimensional turbulence
- 16:55 – 17:10 **Nobumitsu Yokoi**
Flow induction and transport suppression due to helicity, with its implication to subgrid-scale modelling of turbulence
- 17:15 – 17:30 **Chui-Jie Wu**
Optimal dynamical systems of Navier-Stokes equations based on generalized helical-wave bases and the fundamental elements of turbulence
- 17:35 – 17:50 **Sergei Golovin**
Exact solutions describing MHD vortex flows
- 17:55 – 18:10 **Andrei Shafarevich**
Asymptotic solutions for linear and nonlinear MHD systems with a rapid jump near a surface
- 18:15 End of Day 4

FRIDAY, APRIL 15

Friday Morning

AM Session 15 (Chair: B. Protas)

- 8:45 – 9:25 **Rama GOVINDARAJAN**
Instabilities in viscosity and density stratified flow
- 9:30 – 9:45 **Denis Kuzzay**
Tracking dissipative structures from PIV measurements: a new criterion to detect singularities in experimental flows
- 9:50 – 10:05 **Vladislav Pukhnachev**
Singularities in viscous flows
- 10:10 – 10:25 **Zesho Yoshida**
Rattleback: a prototype of chiral dynamics
- 10:30 – 11:00 Morning Coffee

AM Session 16 (Chair: E. Dormy)

- 11:00 – 11:15 **Chiara Oberti**
Magnetic energy and helicity of torus knots and unknots
- 11:20 – 11:35 **Simon Candelaresi**
Topology conserving magnetic field relaxation in plasma
- 11:40 – 11:55 **Alex Russell**
Field line helicity and magnetic reconnection
- 12:00 – 12:15 **Francesco Pegoraro**
Magnetic connection hypersurfaces in relativistic magnetohydrodynamics
- 12:20 – 12:35 **Dmitry Kharzeev**
Chiral magnetic effect and the evolution of magnetic helicity in relativistic fluids
- 12:40 – 14:00 Lunch at Palazzo Franchetti Coffee Room

Friday Afternoon

PM Session 17 (Chair: M. Farge)

- 14:00 – 14:40 **Makoto TSUBOTA**
Numerical simulation of quantum turbulence in superfluid helium - Inhomogeneous quantum turbulence
- 14:45 – 15:00 **Giorgio Krstulovic**
Finding topological defects in turbulent superfluid flows
- 15:05 – 15:20 **Carlo Barenghi**
Helicity of a small patch of quantum vorticity in superfluid helium
- 15:25 – 15:40 **Gabriele Ferrari**
Atomic superfluids: a new context for topological fluid dynamics
- 15:45 – 16:00 **Henryk Kudela**
Collision of point vortices
- 16:05 – 16:35 Afternoon Tea

PM Session 18 (Chair: D. Sokoloff)

16:35 – 16:50 **Luduvine Oruba**

Eye formation in rotating convection

16:55 – 17:10 **Francesco Volponi**

Hybrid convection in astrophysical discs

17:15 Conference Closing

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