

# Mathematical Structures in Quantum Fluids

**Date:** January 23 (Mon) - 25 (Wed), 2023

**Place:** Zoom Meeting & Osaka Metropolitan University, Building E of Faculty of Science  
<https://www.omu.ac.jp/about/campus/sugimoto/>

**Organizers:**

Reika Fukuizumi (Tohoku University), Michikazu Kobayashi (Kochi University of Technology),  
Takashi Sakajo (Kyoto University), Makoto Tsubota (Osaka Metropolitan University)

**Support:** Osaka Central Advanced Mathematical Institute: MEXT Joint Usage/Research Center  
on Mathematics and Theoretical Physics JPMXP0619217849, Osaka Metropolitan University  
IEA-International Emerging Actions 2021 “MPM2S”

## January 23 (Mon), Place: Room E408

Opening  
12:50 - 13:00

Chair: [Reika Fukuizumi](#)

13:00 - 13:50 **Michikazu Kobayashi** (Kochi University of Technology)  
*Machine-learning approach for detecting Kosterlitz-Thouless transition in the Gross-Pitaevskii and continuous clock models*

14:00 - 14:50 **Yuki Kawaguchi** (Nagoya University)  
*Superfluids under external driving*

Tea Break  
15:00 - 15:30

Chair: [Michikazu Kobayashi](#)

15:30 - 16:20 **Tsuyoshi Yoneda** (Hitotsubashi University)  
*Mathematical reformulation of the Kolmogorov-Richardson energy cascade in terms of vortex stretching and related topics*

16:30 - 17:30 (Keynote address) **Koji Fukagata** (Keio University)  
*Applications of convolutional neural networks to classical fluid flow fields*

## January 24 (Tue), Place: Room E408

Chair: [Yohei Yamazaki](#)

10:00 - 10:50 **Tetsu Mizumachi** (Hiroshima University)  
*On linear stability of elastic 2-line solitons for the KP-II equation*

11:00 - 11:50 **Koji Ohkitani** (Kyoto University)  
*Remarks on models for quantum hydrodynamics: regularisation and anomalies*

Lunch Break  
12:00 - 14:00

Chair: Michikazu Kobayashi

- 14:00 - 14:20 **Yuto Sano** (Osaka Metropolitan University)  
*Emergent isotropy of a wave-turbulent cascade in the Gross-Pitaevskii model*
- 14:25 - 14:45 **Kota Takeda** (Kyoto University)  
*A Monte Carlo approach to the  $N$ -vortex problem on the unit sphere*
- 14:50 - 15:10 **Victor Kalt** (University of Rouen Normandy)  
*Identification of vortices in quantum fluids: finite element algorithms and programs*

Tea Break  
15:10 - 15:30

Chair: Takashi Sakajo

- 15:30 - 16:20 **Luminita Danaila** (University of Rouen Normandy)  
*Higher-order statistics and intermittency of a two-fluid HVBK quantum turbulent flow*
- 16:30 - 17:20 **Marc Brachet** (ENS Paris)  
*Coupling Navier-Stokes and Gross-Pitaevskii equations for the numerical simulation of two-fluid quantum flows*

## January 25 (Wed), Place: Room E408

Chair: Reika Fukuizumi

- 10:00 - 10:50 **Takeshi Matsumoto** (Kyoto University)  
*Optimizing kinematic dynamo in the Lagrangian coordinates*
- 11:00 - 11:50 **Yohei Yamazaki** (Kyushu University)  
*Center stable manifold for ground states of nonlinear Schrödinger equations with internal modes*

Lunch Break  
12:00 - 14:00

Chair: Reika Fukuizumi

- 14:00 - 14:50 **Jean-Guy Caputo** (INSA Rouen)  
*An Abelian Higgs model of pulsed field magnetization in superconductors*
- 15:00 - 15:20 **Masashi Yoneda** (Chiba University)  
*On asymptotic stability of solitons for discrete nonlinear Schrödinger equations*

Tea Break  
15:20 - 15:40

Chair: Takeshi Matsumoto

15:40 - 16:00 **Tomohiro Tanogami** (Kyoto University)

*Information flow in turbulence*

16:05 - 16:25 **Cyril Tain** (University of Rouen Normandy)

*Gauges in the Time Dependent Ginzburg Landau (TDGL) model of superconductivity*

16:30 - 17:20 **Ionut Danaila** (University of Rouen Normandy)

*Numerical methods for the Bogoliubov-de Gennes stability analysis of Bose-Einstein condensates*

Closing

17:20 - 17:30