



# 北京理工大学

## 数学与统计学院学术报告

### Geometric methods in fluid dynamics-discrete and continuous, reversible and irreversible.

**报告人:** François Gay-Balmaz 南洋理工大学

**时间:** 2026.5.19 (9:30--11:30AM) , 5.20 (9:30--11:30AM, 14:30--16:30PM)

**地点:** 良乡校区文萃楼I603 (5.19) , 文萃楼I405 (5.20)

**摘要:** In the first part of the lecture, we review the geometric formulation of mechanical systems on Lie groups and the associated variational formulations, symmetries, and conservation laws. This approach is illustrated in the infinite dimensional setting with Arnold's interpretation of ideal fluid motion as geodesics on diffeomorphism groups, and with applications to liquid crystals.

In the second part, we present a structure preserving discretization of this geometric setting based on finite dimensional approximations of groups of diffeomorphisms. The resulting finite element discretizations for fluids enjoy remarkable conservation properties. For instance, application to magnetohydrodynamics produces schemes that preserve energy, cross-helicity, magnetic helicity, mass, and total squared density to machine precision, both at the spatially and temporally discrete levels.

The last parts of the lecture are devoted to the extension of this geometric variational formulation to fluids experiencing irreversible processes, such as viscosity, heat conduction, and chemical reactions, in the context of nonequilibrium thermodynamics.

**个人简介:** François Gay-Balmaz 自2023年起担任新加坡南洋理工大学数学系副教授。此前，他曾任法国国家科学研究中心 (CNRS) 研究员，在巴黎高等师范学院 (ENS) 从事研究工作。他先后于2004年和2009年在瑞士洛桑联邦理工学院 (EPFL) 获得硕士和博士学位，并于2018年在索邦大学获得特许任教资格。2009年至2010年期间，他曾在洛桑联邦理工学院和加州理工学院从事博士后研究。他的研究重点是为流体动力学和非线性弹性力学中的偏微分方程开发保结构建模与离散化方法。其研究方法基于微分几何、辛几何与泊松几何以及几何力学衍生出的工具。他近期的研究兴趣包括地球物理流体动力学、等离子体物理和非平衡热力学。