Instructor: B. Khesin

Course MAT1126HS
Spring 2025
"Lie groups and Hamiltonian PDEs"

Mini-paper topics:

[The project is to write a survey mini-paper based on 2-3 sources/papers (not Wiki or ChatGPT!). Start by reading the article *How to write mathematics* by P.R. Halmos, Enseignement Math. (2) 16 (1970), 123-152. Follow its advice.]

1. Integrability of a higher-dimensional rigid body.

2. Stability of rotations of higher-dimensional rigid body.

3. Examples of an infinite-dimensional rigid body.

4. Zeitlin's approximation for fluids on the 2D torus.

5. Zeitlin's approximation for fluids on the 2D sphere.

6. Central extensions and fluid dynamics.

7. The magneto-hydrodynamics (MHD) equations as geodesics.

8. Sub-Riemannian version of the Euler-Arnold equation.

9. Various discrete approximations of fluid dynamics.

10. A discrete version of the Euler-Arnold equation by Moser-Veselov.

11. (Bi)Hamiltonian properties of the nonlinear Schrödinger equation (NLS).

12. Integrability of point vortices on plane and torus.

13. Pentagram maps and Korteweg-de Vries (KdV)-type equations.

14. The Grassmannian approach to KP and KdV hierarchies.

15. The Miura transform for the KdV equation.

16. The Drinfeld-Sokolov reduction of KdV Poisson structures.

17. Compressible fluids as the Euler-Arnold-type equations.

Choose your topic by Mar. 17 the latest, turn in your mini-paper (4-5pp) by Apr. 7. (Topics outside of the list are also possible: please, discuss with the instructor.)