EPFL

MATH-514

Nonlinear Schrödinger equations

Genoud François

Cursus	Sem.	Type
Ing.-math	MA1, MA3	Opt.
Mathématicien	MA1, MA3	Opt.

Language of teaching	English
Credits	5
Session	Winter
Semester	Fall
Exam	Oral
Workload	150h
Weeks	14
Hours	**4 weekly**
Courses	2 weekly
Exercises	2 weekly
Number of positions	

Summary

This course is an introduction to nonlinear Schrödinger equations (NLS) and, more generally, to nonlinear dispersive equations. We will discuss local and global well-posedness, conservation laws, the existence and stability of standing wave solutions, and solutions which blow up in finite time.

Content

Keywords

nonlinear Schrödinger equations; Hamiltonian dynamics; conservation laws; symmetries; standing waves; orbital stability; finite time blow-up

Learning Prerequisites

Required courses

Introduction to partial differential equations

Recommended courses

Equations aux dérivées partielles d'évolution; Analyse fonctionnelle I; Mesure et intégration; Equations différentielles ordinaires

Important concepts to start the course

résultats de base en intégration (convergence dominée, etc.); espaces de Sobolev, de Banach; convergence faible / forte; solutions faibles d'équations elliptiques; arguments de point fixe dans les espaces métriques

Learning Outcomes

By the end of the course, the student must be able to:

- Define the main objects studied in the course
- Prove properties of solutions of NLS, similar to the exercises
- Prove (or sketch the proof of) the main results given in the lectures
- Discuss qualitative properties of NLS solutions
- Compute quantitative estimates useful to study the NLS dynamics
- Apply the methods developed in the course to NLS and related equations

Teaching methods

blackboard lectures + exercise sessions

Assessment methods

oral