Computational Methods in Quantum Mechanics

Buğra Tüzemen (btuzemen@ifpan.edu.pl)
Daniel Pęcak (pecak@ifpan.edu.pl)
Institute of Physics, Polish Academy of Sciences
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Logistics

- Lectures: Thursdays, 12:00
- Location: room 15/XV, Institute of Physics PAS (al. Lotników 32/46)
- Start date: October 8, 2026
- Duration: 15 weeks, one 2-hour session per week
- Weeks 14–15: project presentations
- Weekly homework: a short task to complete at home after each session
- Grading: based on participation in the weekly tasks and the final project

Prerequisites

- Basic knowledge of at least one programming language: C/C++, Fortran, Python, MATLAB, Julia, etc.
- Basic knowledge of quantum mechanics

Project

Students may choose their own project topic or pick from a list of topics suggested by the instructors. Projects are presented during the final two weeks of the course.

Weekly Schedule

Week	Topic
1	Introduction: numerical methods
2	Schrödinger Equation (imaginary time)
3	Schrödinger Equation (exact)
4	Exact diagonalization (fermions)
5	Exact diagonalization (bosons)
6	Gross–Pitaevskii Equation for bosons
7	Bogoliubov–de Gennes Method for bosons
8	Hartree–Fock Equations
9	Hartree–Fock Equations
10	Bogoliubov–de Gennes Method for fermions
11	Bogoliubov–de Gennes Method for fermions
12	Time-dependent Bogoliubov–de Gennes Method
13	Time-dependent Bogoliubov–de Gennes Method
14	Project presentations
15	Project presentations