Grupper til talentprogrammet 2018

Theoretical few-body physics

Members:
Nikolaj Zinner, Dimitri Fedorov, Aksel S. Jensen

Prerequisites:
Quantum mechanics, so the projects must be in the spring term.

Theoretical derivations and calculations, including:
Solutions of the Schrödinger equation - both analytical and numerical
Systems in one and two dimensions with short- or long-range interactions
Energies of particles in geometries with non-trivial curvature
Spin models and manipulation of transport properties
Quantum spin transistors in cold atoms and in superconducting circuits
The project will naturally be as close to the research topics of the group as possible.

Skills/competencies:
Analytical derivations
Programming of numerical implementations
Graphical presentation of results
Collaboration with researchers and older students toward common goals
Oral presentations and discussion at the group meetings

Evaluation:
Report

Materials science

Members:
Peter Balling and Brian Julsgaard.

Keywords:
Materials and light, synthesis of new materials, laser-excited materials, light from silicon, efficient solar cells

Competencies:
· Micro- and nano-scale fabrication and analysis methods (e.g. under the theme ”Samples from Cradle to grave”).
· Optical characterization techniques

· Participation in an active research group with many different students and activities.

Evaluation:
A brief written report and a presentation at a group meeting.

XRING-group

Members
Henrik B. Pedersen

Keywords
Theme 1: Molecular VUV-photoabsorption, atmospheric physics, detachment and ionization, photodissociation, ion traps, ion storage rings, ASTRID2, synchrotron radiation
Theme 2: Classical non-linear dynamics, standing waves on a string, motion of pendulum

Competences
Labview programming, numerical simulations, experience with experimental work and data analysis, experience with non-linear problems, presentation skills

Evaluation
20-30 min. oral presentation for the group

Formidling af fysik

Gruppe-ansvarlig:

Jacob Sherson

Beskrivelse:

Sammen med gruppens fysikere, didaktikere, læringspsykologer, grafikere og spilprogrammører vil I blive bedt om at lave en digital formidling af koncepter fra klassisk og kvantemekanik. Det kunne f.eks. være harmoniske bevægelser, altså fysikken bag en gynge, kræfter og energiformer eller kvantefysiske fænomener som superposition, bølge-partikel dualitet, entanglement, eller kvantetunnelering.

Kompetencer:

- Didaktiske overvejelser omkring formidling til et givet publikum heriblandt identificering af potentielle faldgrupper for læring samt fokusgruppe interviews
- Tværfagligt samarbejde
- Brug af online læringsaktiviteter såsom spørgsmål, video, simuleringer og spil Statistiske og metodiske værktøjer til at teste effekt af læring
- Øvelse i mundtlig og skriftlig formidling af læringsmateriale

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Molekylefysik

Gruppe-ansvarlige:

Lars H. Andersen, Steen Brøndsted Nielsen

Nøgleord:

Molekylære reaktioner; Molekylers fotofysik, Biokromoforer; Eksotiske molekyler; Instrumentudvikling- og design.

Kompetencer:

Lasererfaring (ns og fs); Massespektrometri; Spektroskopi; Acceleratorfysik; Ion-lagring; Molekylære kvantefysikberegninger; Numerisk modellering; LabView programmering; Laboratoriepraksis; Litteratursøgning; Præsentation og formidling af

videnskabeligt arbejde.

Evaluering:

Rapport (5 sider) og mundtlig præsentation (30 min) for hele gruppen.

Ion trap group, Thermodynamics of coupled harmonic oscillators: From the classical to the quantum regime

Members

Alberto Imparato, Aurelien Dantan, and Michael Drewsen

Keywords
Classical/Quantum thermodynamics, harmonic oscillators, ion trapping, ion cooling, nano-optomechanics, fluorescence imaging, optical interference, power spectra analysis

Competencies:
A range of theoretical (T) and experimental (E) skills, including: Ion trapping (E/T), Handling of lasers (E), Ion cooling (E/T), Fluorescence imaging (E/T), Optical interference (E/T), Beat-frequency analysis – power spectra (E/T), Thermal motion of single oscillators – classical/quantum (T/E), Coupled motion of harmonic oscillators – classical/quantum (T/E), Energy flows between harm. osc.'s – energy fluctuations (T/E).
During the project you will become familiar with various computer programs for theoretical simulations, data acquisition and data analysis.

Examination:
A 30 min. oral presentation of results for the three researchers' group members.

Asteroseismology for Galactic Archaeology (iSIMBA)

Members:

Victor Silva Aguirre, Kuldeep Verma, Jakob R. Mosumgaard, Amalie Stokholm

Main topic:

bayesian inferences of stars and reconstruction of the Milky Way history using Big Data analysis

Keywords:

asteroseismology; stars; Galaxy structure, evolution and formation

Competencies:

programming in Python, Bayesian statistics, chemo-dynamical modelling of the Galaxy, presentations skills, data visualisation

Evaluation:

5 pages report and oral presentation
