MICRO-390

Light, liquids and interfaces

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Cursus	Sem.	Type
Biomedical technologies minor	E	Opt.
Materials Science and Engineering	MA2, MA4	Opt.

Language of teaching	English
Credits	4
Session	Summer
Semester	Spring
Exam	Written
Workload	120h
Weeks	14
Hours	**4 weekly**
Courses	2 weekly
Exercises	2 weekly
Number of positions	

Summary

This course provides an overview of relevant interactions in liquids, combining thermodynamics, statistical physics and pair potetnials. Water and aqueos systm,es will be considered in detail. Optical techniques to investigate liquid and liquid interfacial structure will treated.

Content

Interactions in liquids and at interfaces
Probability and different length scales over which these interactions work
Water and aqueous solutions
Techniques to probe molecular properties in water and at liquid interfaces (linear and non-linear spectroscopy)
In addition to learning about interactions, water, interfaces and methods to probe them in-situ, this course aims to provide instructions and exercises on how to deal with the unknown. To do that, most of the exercises require a certain routine for solving them, which is the same routine that is useful for solving research questions.
Broadly speaking in most questions the following tasks need to be performed:
- Define the physics laws and system concepts that are appropriate for this question.
- Write / compute / derive an expression for the physical property we are looking for in terms of parameters that can be measured.
- Fill in appropriate numbers and compute a value, if needed.
In about 40 exercises you will have the chance to practice this problem solving procedure.

Learning Prerequisites

Required courses

THis course uses concepts from the following courses:
Analysis I-IV; Lin Algebra; Gen. Physics; Electrical Engineering; Adv. Gen. Chemistry
and also from:Biology for engineers; Surfaces and Interfaces; Theory of materials; Functional properties of materials
This course is normally scheduled to run in tandem with Soft Matter. Exceptionally in 2021 this will not be the case and therefore the material about interactions will be slightly longer at the cost of the later part of the course (optical methods).

Learning Outcomes

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

- Contextualise analytical interactions in a liquid
- Predict liquid / interfacial properties
- Theorize about appropriate methods

- Quantify interactions
- Interpret spectroscopic data
- Compare interactions and properties

Assessment methods

Written exam

Resources

Bibliography

parts of:
Jacob N. Israelachvili
Intermolecular and Surface Forces, Third Edition, 2011 Elsevier Inc.
ISBN: 978-0-12-375182-9
Dor Ben-Amotz, Understanding Physical Chemistry 1st Edition, 2013, Wiley.
ISBN: 978-1-118-71939-8
Peter W. Atkins and Julio de Paula, Physical Chemistry 8th Edition, 2006, Oxford University Press
ISBN: 9780198700722
and handouts / notes

Ressources en bibliothèque

- Find the references at the Library

Moodle Link

- https://go.epfl.ch/MICRO-390