科目ナンバリング	U-LAS70 10002 SE50						
授業科目名<英訳>	ILAS Seminar-E2 :How to Study Atoms and Molecules with the Help of Light（光を使って原子や分子を調べる） ILAS Seminar-E2 :How to Study Atoms and Molecules with the Help of Light			担当者所属職名・氏名	理学研究科　准教授　THUERMER, Stephan		
群	少人数群	単位数	2単位	週コマ数	1コマ	授業形態	ゼミナール（対面授業科目）
開講年度・開講期	2026・後期	受講定員(1回生定員)	15 (15) 人	配当学年	主として1回生	対象学生	全学向
曜時限	火5	教室	1共23			使用言語	英語
キーワード	Photon science / Colors / Laser / Molecule properties / Spectroscopy						

[授業の概要・目的]

Light lets you see and get to know the world around you. But we can only see a very small part of all the ‘light’ and it is impossible to see atoms and even big molecules with your eyes. In this seminar we will learn how different forms of light are used in physics and chemistry to ‘see’ the atoms, molecules, distant stars and the world around us. We will learn the fundamentals of light, get to understand light phenomena in your daily life and see how light can be used as a measurement tool in natural sciences. Students with any major are welcome.

可視光は私達の視覚に不可欠ですが、光あるいは電磁波は様々な波長やエネルギーを持ちます。電磁波は、原子や分子の構造や性質を調べる上で、最も強力な手段であり、分光学と呼ばれる手法は物理、化学、生物、工学のあらゆる分野で必要です。このセミナーでは、光の基礎的な性質から原子や分子を調べる方法までの基礎を、英語で学んで行きます。

[到達目標]

Students will gain the following form this seminar:
- Interest and fun to learn more about phenomena in nature and study topics on their own.
- Knowledge about light as a measurement tool in chemistry, (astro-)physics and biology.
- The ability to understand difficult theoretical and ‘invisible’ phenomena in an intuitive way.
- The ability to express their ideas, discuss and present topics of natural sciences in English.

光の性質、光の吸収や散乱を利用した原子や分子の研究方法を学びながら、英語で科学を学習したり議論するスキルを身につける。

[授業計画と内容]

This seminar is held in a causal and interactive way! Students can influence the selection of topics based on their interest!

The course will work though fundamentals of light, the interaction of light with materials, and methods of spectroscopy, which include the following topics. The plan below is not strict and rather serves as a guideline.

1. Introduction - What is light and how to use it? (4 weeks)
We will learn about ‘light’, its fundamentals and properties such as ‘color’ and how we can make use of light as a measurement tool.

2. Apples are red and water is blue? (3 weeks)

We get to know light’s behavior when interacting with different materials. We learn about the‘spectrum’ and the basics of spectroscopy. This knowledge answers questions like‘why do things have color?’or‘what can we learn about distant stars?’

3. Laser beams and rainbows (4 weeks)
We see how light is generated in light bulbs, lasers and other light sources. This light then can be selected, modified and redirected with the help of various spectroscopic tools. The same knowledge helps us to understand light phenomena in daily life such as rainbows, anti-reflective glasses or mirrors.

4. Dancing molecules (3 weeks)
We learn how light interacts with atoms and molecules (and induces molecular vibration and rotation in the process), and what this tells us about the shape and properties of molecules. This knowledge is a first look into chemical analysis and studying fundamental physics questions.

5. Feedback and presentation (1 week)

Depending on the available time and interest of the students, we may also discuss the use of light in technical applications and astronomy as well as spectroscopic methods in physics and chemistry or the operation principles of advanced spectroscopic devices.

[履修要件]

特になし

[成績評価の方法・観点]

Preparing homework (30%)
Small exercises during the seminar (30%)
Giving a short presentation at the end of the seminar (40%)

[教科書]

使用しない
No textbook is used. Lecture notes will be provided during class.

[参考書等]

（参考書）
Ian A. Walmsley 『Light: A Very Short Introduction』（Oxford University Press）ISBN:9780199682690（A good read about light, which is the basis of most spectroscopies）
J. Michael Hollas 『Modern Spectroscopy』（Wiley）ISBN:9780470844168（A more in-depth book about spectroscopy in general）
Simon Duckett, Bruce Gilbert, Martin Cockett 『Foundations of Molecular Structure Determination』（Oxford University Press）ISBN:9780199689446（This compact book gives a good overview over all relevant spectroscopic methods to study molecules）

[授業外学修（予習・復習）等]

Students are expected to review the lecture handouts after each class and look up unknown English terms themselves. Homework assignments need to be prepared before the next lecture. It is also encouraged to refer to additional sources of information (books, websites) for the specific topics. If something is unclear or difficult, the instructor can be asked at any time.

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[その他（オフィスアワー等）]

The lectures will be held in English, but some supporting material and explanations are also given in Japanese. Students are welcome to ask questions in English or Japanese during and after the class. Office hours are flexible. Appointments can be made directly or via email.

[主要授業科目（学部・学科名）]