| 科目ナンバリング | | | | | | | |
|---|---|---|---|---|---|---|---|
| 授業科目名 <英訳> | ILAS Seminar-E2 :The Life and Work of Albert Einstein（アルバート・アインシュタインの生涯と業績）<br>ILAS Seminar-E2 :The Life and Work of Albert Einstein | | | 担当者所属 職名・氏名 | 数理解析研究所 助教　Helmke, Stefan | | |
| 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 | 2025・前期 | 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26 | | | 使用言語 | 英語 |
| キーワード | Non-euclidean geometry / curvature / relativity | | | | | | |

## [授業の概要・目的]

In spite of what the title of this seminar may suggest, its main objective is to study the developments of geometry during the 19th century, which culminated in Einstein's general theory of relativity in the early 20th century. At this early time, the only experimental fact confirming Einstein's theory was the abnormal orbit of mercury. Shortly after, the bending of light in the gravitational field of the sun was also confirmed. We will develop the geometric tools necessary to understand those phenomena and also gravitational waves, whose recent discovery received the Nobel price in physics of the year 2017.

## [到達目標]

The aim of this course is to understand the interaction between mathematics and the natural sciences and to engage in English discussions on a scientific topic.

## [授業計画と内容]

The exact contents of the seminar is flexible and may depend on special interests of the students. But the topics to be covered will be essentially as follows.

The first four weeks we will study Einstein's special theory of relativity and its historical background. This includes a brief introduction to multidimensional calculus, electrodynamics and the four dimensional Minkowski space.

The following five weeks will be devoted to the developments of differential geometry, beginning with the notion of curvature of a plane curve due to Huygens and Newton in the 17th century, followed by Euler's definition of principal curvatures of a surface embedded into space, Gauss's intrinsic geometry of a surface and finally Riemann's concept of a manifold and its curvature. Parallel, we will also study the idea of Non-Euclidean geometry which developed during the same period of time and which turned out to be related to the above and of some importance for Einstein later.

We will then just need two more weeks to understand the basic ideas

ILAS Seminar-E2 :The Life and Work of Albert Einstein（アルバート・アインシュタインの生涯と業績）(2)へ続く↓↓↓

of the general theory of relativity, i.e. the equivalence principle and Einstein's field equations.

The last three weeks we will study the following applications of the general theory of relativity: 1. The mercury orbit and bending of light, 2. Simple cosmological models and 3. Gravitational waves.

**[履修要件]**

特になし

**[成績評価の方法・観点]**

The evaluation is based on a presentation, which will be given during the class.

**[教科書]**

使用しない

**[参考書等]**

（参考書）
授業中に紹介する

**[授業外学修（予習・復習）等]**

The students will be asked to prepare a short presentation.

**[その他（オフィスアワー等）]**

No particular office hour, but students can make arrangements after the class or by email.

**[主要授業科目（学部・学科名）]**