### Module title
Advanced Magnetic Resonance Imaging

### Abbreviation
11-MRI-Int-201-m01

### Module coordinator
Managing Director of the Institute of Applied Physics

### Module offered by
Faculty of Physics and Astronomy

### ECTS
6

### Method of grading
Numerical grade

### Only after succ. compl. of module(s)

---

### Duration
1 semester

### Module level
Graduate

### Other prerequisites

---

### Contents
Nuclear magnetic resonance (NMR) is a quantum mechanical phenomenon that, through magnetic resonance imaging (MRI), has played a major role in the revolution in medical imaging over the last 30 years. Starting from the fundamentals of nuclear magnetic resonance (resonance principle, relaxation times, chemical shift) this course covers:

1. the NMR signal theory and signal evolution (Bloch equations)
2. the principles of spatial encoding, magnetic resonance imaging (MRI) and corresponding imaging sequences and measurement parameters,
3. the concept of k-space and Fourier imaging,
4. the physical, methodological and technical possibilities and limitations of MRI. Finally, typical application fields of MRI in biomedical research, clinical imaging and non-destructive testing will be covered.

### Intended learning outcomes
The students are familiar with the basics and the deepened aspects of NMR and MRI including the mathematical-theoretical description and the physical basics of modern MRI, MRI-instrumentation and image-formation/image-processing principles. The students gain a deep insight into the area of modern MRI and its interdisciplinary relations and applications.

### Courses
(V (3) + R (1)
Module taught in: English

### Method of assessment
(a) written examination (approx. 90 to 120 minutes) or b) oral examination of one candidate each (approx. 30 minutes) or c) oral examination in groups (groups of 2, approx. 30 minutes per candidate) or d) project report (approx. 8 to 10 pages) or e) presentation/talk (approx. 30 minutes).

If a written examination was chosen as method of assessment, this may be changed and assessment may instead take the form of an oral examination of one candidate each or an oral examination in groups. If the method of assessment is changed, the lecturer must inform students about this by four weeks prior to the original examination date at the latest.

Assessment offered: In the semester in which the course is offered and in the subsequent semester
Language of assessment: English

### Allocation of places
--

### Additional information
--

### Referred to in LPO I (examination regulations for teaching-degree programmes)
--

### Module appears in
Master’s degree (1 major) Physics International (2020)
Master’s degree (1 major) Quantum Engineering (2020)