# Module Description

## Module Title
Topological Quantum Physics

## Abbreviation
11-TQP-161-m01

## Module Coordinator
Managing Director of the Institute of Theoretical Physics and Astrophysics

## Module Offered by
Faculty of Physics and Astronomy

## ECTS
6

## Method of Grading
Numerical grade

## Only after Succ. Compl. of Module(s)
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## Duration
1 semester

## Module Level
Graduate

## Other Prerequisites
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## Contents
The course is aimed at Masters students pursuing either experimental or theoretical work in their thesis. Depending on the lecturers emphasis, it is meant to provide an introduction to topological superconductors and insulators assuming only "Quantum mechanics II" (11-QM2) as a prerequisite. The contents may include:

1. Introduction to superconductivity (including BCS theory)
2. Majorana fermions and topological superconductors in 1D (Kitaev wires)
3. Topological superconductors in two dimensions (2D) (including Majorana edge states and non-Abelian statistics)
4. Integer quantum Hall effect and Chern insulators (Haldane model, Jackiw-Rebbi solitons and edge states)
5. Berry's phase and Chern invariants
6. Time reversal symmetry and topological insulators in 2D
7. Topological insulators in 3D

## Intended Learning Outcomes
In-depth understanding of the topological concepts of Quantum Physics relevant to current research projects of Condensed Matter Physics at the University of Würzburg.

## Courses
**Type, number of weekly contact hours, language — if other than German**
V (3) + R (1)
Module taught in: German or English

## Method of Assessment
**Type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus**
written examination (approx. 90 to 120 minutes) or oral examination of one candidate each (approx. 30 minutes) or oral examination in groups (groups of 2, approx. 30 minutes per candidate) or project report (approx. 8 to 10 pages) or 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: German and/or English

## Allocation of Places
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## Additional Information
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## Referred to in LPO I
(examination regulations for teaching-degree programmes)
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## Module Appears In
Master’s degree (1 major) Mathematics (2016)
Master’s degree (1 major) Physics (2016)
<table>
<thead>
<tr>
<th>Degree</th>
<th>Year</th>
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<tbody>
<tr>
<td>Master's degree (1 major) Nanostructure Technology</td>
<td>2016</td>
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<tr>
<td>Master's degree (1 major) Mathematical Physics</td>
<td>2016</td>
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<tr>
<td>Master's degree (1 major) Computational Mathematics</td>
<td>2016</td>
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<tr>
<td>Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB)</td>
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<tr>
<td>Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB)</td>
<td>2016</td>
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<tr>
<td>Master's degree (1 major) Computational Mathematics</td>
<td>2019</td>
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<tr>
<td>Master's degree (1 major) Mathematics</td>
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