# phy609 - Photovoltaic Physics

**Module label**: Photovoltaic Physics  
**Module code**: phy609  
**Credit points**: 6.0 KP  
**Workload**: 180 h  
(Attendance: 56 hrs, Self study: 124 hrs)

**Used in course of study**:  
- Master's Programme Engineering Physics > Schwerpunkt: Renewable Energies

**Contact person**:  
- Module responsibility: Martin Kühn

**Entry requirements**:  
Solid-state Physics, semi-conductor Physics, Module Renewable Energy Technologies I

**Skills to be acquired in this module**:  
- describe schematically the events around the pn-junction under bias in the dark and under illumination, calculate the width of the space charge region, use solar cell data sheets in their professional career, discuss the concepts of solar cell materials, design and optimization, choose a PV technology for a given project

**Module contents**:  
This specialization module covers the physics of photovoltaics. The behaviour of solar cells is discussed from a fundamental physical point of view to explain the differences in performance and limits of various photovoltaic materials. Students learn how solar cells function, are designed and optimized, Optical and electronic properties of semiconductors, light absorption, Charge carrier generation/recombination/life time, Charge carrier transport across the pn-junction in equilibrium and under light and voltage bias, Transport equations, Current-voltage characteristics, efficiency, Quantum efficiency, Design concepts to optimize the efficiency. Overview of the most important PV technologies

**Reader's advisory**:  
S. Hegedus, A. Luque, Handbook of Photovoltaic Science and Engineering, published John Wiley and Sons (2nd Edition 2011); Christiana Honsberg and Stuart Bowden, PVCDROM,  
[http://www.pveducation.org/pvcdrom/instructions](http://www.pveducation.org/pvcdrom/instructions), Access date 2.10.2014; lecture notes for the respective courses

**Links**:  
**Language of instruction**: English  
**Duration (semesters)**: 1 Semester  
**Module frequency**: Sommersemester  
**Module capacity**: unlimited  
**Modullevel**: MM (Mastermodul / Master module)  
**Modulart**: Wahlpflicht / Elective  
**Lern-/Lehrform / Type of program**: Lecture: 4 hrs/week

### Examination  
**Time of examination**  
**Type of examination**  
**Final exam of module**  
1 Exam

### Course type  
<table>
<thead>
<tr>
<th>Comment</th>
<th>SWS</th>
<th>Frequency</th>
<th>Workload attendance</th>
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</thead>
<tbody>
<tr>
<td>Lecture</td>
<td>2.00</td>
<td>SuSe or WiSe</td>
<td>28 h</td>
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<tr>
<td>Exercises</td>
<td>2.00</td>
<td>SuSe or WiSe</td>
<td>28 h</td>
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**Total time of attendance for the module**: 56 h