Condensed Matter Physics

Module No.: MN-P-SP-CondMat, MN-P-PN-CondMat, MN-P-WaMa

Course:
Solar energy conversion

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Category	Type	Language	Teaching Hours	CP	Semester
Specialized Course	Lecture	English	2	3	WiSe

Requirements for participation:
Basic knowledge of thermodynamics and semiconductor physics

Type of module examinations:
Oral examination

Duration of the course:
1 semester

Aims of the course:
Understanding the current state of the art in how solar energy is used as renewable energy source

Contents of the course:
The lecture introduces different concepts how solar energy can be harvested as well as the physical concepts behind the devices. Topics covered are

- Status and potential of solar energy harvesting
- The sun-earth system
- Solar thermal harvesting (Carnot process and the heat engine)
- Photovoltaic basics (pn junctions, Shockley equation, device characteristics)
- Silicon solar cells – fabrication, performance, and module design
- Established thin film technologies (aSi, CdTe, CIGS)
- Emerging technologies (dye sensitizes, organic, and perovskite solar cells)
- Tandem solar cell applications
- Concentrator cells
- Photosynthesis and solar water splitting

Recommended literature:

- Skriptum (available during the course)
- Vos, Thermodynamics of solar energy conversion
- Sze, Physics of Semiconductor Devices
- McEvoy (Ed.), Solar cells