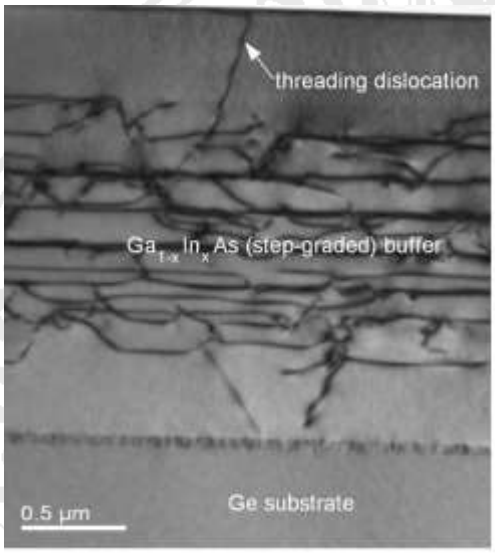
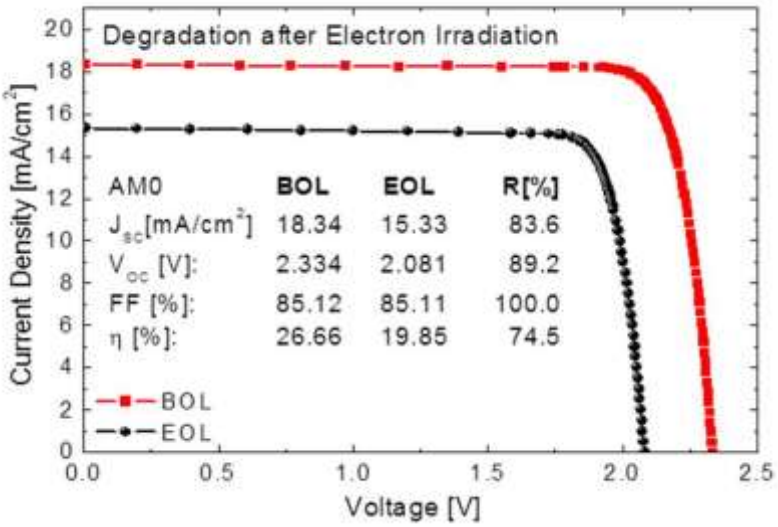
Physikalisches Institut
Fakultät für Mathematik und Physik
Albert-Ludwigs-Universität Freiburg

SONDERKOLLOQUIUM

AM 4. JUNI 2019 UM 15:00 UHR
IM SEMINARRAUM, GUSTAV-MIE-GEBÄUDE





UNDERSTANDING, ANALYSING AND DESIGNING MULTI-JUNCTION SOLAR CELLS

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Multi-junction solar cell architectures are one approach to overcome the fundamental Shockley-Queisser limit of 33.4% efficiency for solar cells using only absorber material. In multi-junction solar cells several different semiconductor materials are used to absorb the solar spectrum more broadly and to reduce the thermalisation losses. Typically more than 20 layers are used to realise a monolithic triple-junction solar cell. For the optimization of the solar cell efficiency the composition, the doping, the thicknesses of each layer as well as transport and optical properties must be taken into account. Simulation and modelling are essential tools for the success.

Multi-junction solar cells are already in use in satellites in space. However, the space environment provides high-energy electron and proton bombardment which harms the performance of the solar cell. The lecture discusses how the analysis and understanding of the degradation leads to new and improved cell architectures. Another application of multi-junction solar cells is use in concentrating photovoltaic systems. A special cell architecture using metamorphic growth concepts turned out to be superior to the standard lattice matched approach. Based on the deep understanding and advanced design of these cells world record efficiencies for both applications were achieved.