UNIVERSITÄT DUISBURG ESSEN

PHYSIK E=

Physikalisches Kolloquium

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Multi-optical concepts for solar cells

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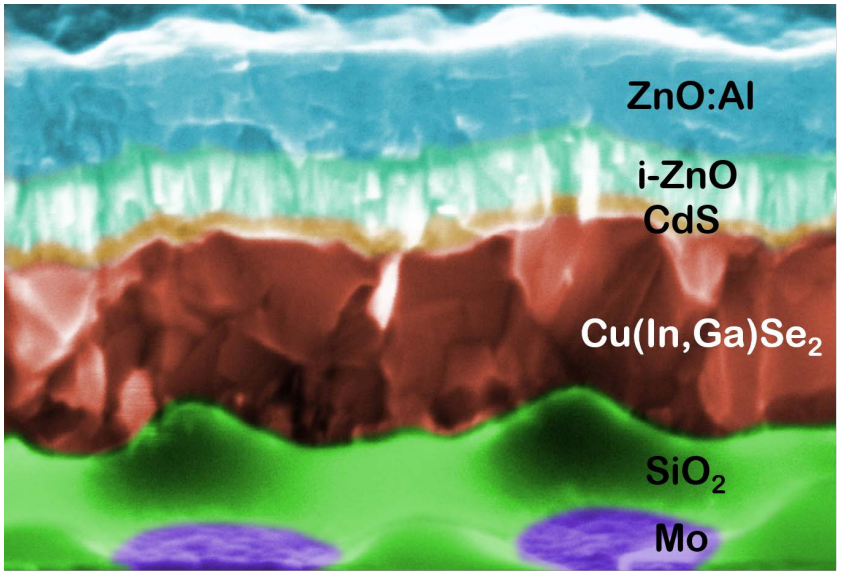

A solution to our world's increasing energy demand is right out there: the sun! Chalcopyrite solar cells, made mostly from Cu, In, Ga and Se, have the potential of contributing a significant share to the photovoltaic market. Addressing the limited supply of indium, which will restrain their production in the upper GW scale, we fabricate ultra-thin and micrometer-sized absorbers. Losses emerging from the reduction of absorber material are tackled by optical concepts on the nano- and microscale.

Chances of plasmonic metal nanoparticles and challenges arising from their integration into chalcopyrite solar cells are presented. Dielectric nanostructures giving rise to resonant and waveguide modes are investigated as chemically stable and lossless alternatives leading to localization of electromagnetic energy in ultra-thin absorber layers. Light concentration on a larger scale is followed in microconcentrator solar cells utilizing concentrator lenses to focus incident radiation onto the restrained absorber area.

In the long term, Chalcopyrite solar cells have enormous potential to address further material reduction and efficiency enhancement, not least because of the tunability of their band gap. The combined consideration of optical, electrical and thermal effects on various length scales for full exploitation of the solar spectrum offers a vast field for future research.