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Abstract for an Invited Paper
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Physics of Multijunction and Multiband Solar Cells¹

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In the presentation I will discuss research on semiconductor materials for high efficiency solar power conversion devices. After reviewing the fundamentals of different types of cells, I will present our work on searching for new materials for multijunction and multiband devices. The work on the multijunction cells is based on the discovery that the band gaps of $\text{Ga}_x\text{In}_{1-x}\text{N}$ alloys span an energy range from 0.7 to 3.4 eV. This provides an almost perfect match to the solar spectrum and an interesting possibility of using this alloy system for the fabrication of high efficiency multijunction solar cells. In the second part of the talk I will present recent progress on the utilization of multiband semiconductors for high efficiency solar cells. We have synthesized group II-VI (ZnOTe) and group III-V (GaNASP) alloys with a mid gap intermediate band. The intermediate band serves as a “stepping stone,” allowing pairs of sub- bandgap photons to contribute to the current of the cell, leading to better utilization of the full solar spectrum. Ongoing efforts to produce simple, single junction multiband photovoltaics will be discussed.

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