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AT THE FOREFRONT OF NANO SCIENCE

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NANOSCIENCE COLLOQUIUM

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A direct thin-film path towards low-cost large area III-V photovoltaics and optoelectronics

III-V photovoltaics (PVs) have demonstrated the highest power conversion efficiencies for both single- and multi-junction cells. However, expensive epitaxial growth substrates, low precursor utilization rates, long growth times, and large equipment investments restrict applications to concentrated and space photovoltaics (PVs). In this talk, I will discuss our recent work on the vapor-liquid-solid (VLS) growth of *high-quality* III-V *thin-films* on metal foils as a promising platform for large-area terrestrial PVs overcoming the above obstacles. We have demonstrated growth of 1-3 □m thick InP thin-films on non-epitaxial substrates with *ultra-large* grain size up to 1mm, which is ~1000 times larger than those obtained by conventional vapor-solid growth processes. The films exhibit electron mobilities as high as 500 cm^2/V-s and minority carrier lifetimes as long as 80 ns. Furthermore, under 1-sun equivalent illumination, photoluminescence efficiency measurements indicate that an open circuit voltage of up to 930 mV can be achieved with our films, only 40 mV lower than what we measure on a single crystal reference wafer. The work presents a new pathway for low-cost III-V solar cells with high efficiencies. Finally, I will discuss the use of this technique towards direct growth of single-crystalline micro and nano patterned InP structures on amorphous substrates.

Host: Lars Samuelson (Solid State Physics)