Van Horn Lecture Series
Tuesday, April 17th, 2018
White 411 at 4:00 pm

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Fueling Human Progress with Sunlight

Research in nanophotonic materials and design is yielding advances that are opening conceptually new paths to address “grand challenges” that have not previously been achievable. One of these is the challenge of bringing next-generation solar energy technology to fruition. The recent rapid, global growth of solar photovoltaics has moved scientific research frontiers for solar energy conversion towards new opportunities such as i) ultrahigh efficiency (\(\eta = 30\text{-}50\%\) and beyond) photovoltaics and ii) direct synthesis of energy-dense chemical fuels from solar energy, including hydrogen and products from reduction of carbon dioxide. I will illustrate several examples of how photonic design combined with material synthesis advances can enable progress in each of these areas. Photonic design with highly luminescent semiconductors has opened new directions for ultrahigh efficiency photovoltaics. Semiconductors coupled to water oxidation and reduction catalysts have enabled approaches to stable, >10% efficiency solar-to-hydrogen generation using artificial photosynthetic structures. Present work and future directions in electrocatalytic and photocatalytic materials for artificial photosynthesis aimed at catalytic reduction of carbon dioxide will also be discussed.