NSERC CREATE **TOP-SET** Un programme *FONCER* du CRSNG

Séminaire

Le lundi 15 avril 2024, 13h
ARC 233, MS Teams
Le séminaire se déroulera en anglais.

Seminar

Monday, April 15, 2024, 1 p.m.
ARC 233, MS Teams

Quantum dot intermediate band solar cells: Basics and prospects

Federica Cappelluti, Politecnico di Torino, Italy

Abstract: Intermediate band solar cells were proposed nearly 30 years ago to overcome the Shockley-Queisser efficiency limit of single-junction cells by introducing a band of deep electronic states within the semiconductor bandgap. This creates a kind of triple-gap cell at the material scale, in which sequential absorption across the three bands allows the fraction of solar spectrum that can be absorbed to be extended at the same time minimizing thermalization losses. For this to happen, the incoming photon flux must keep the three bands in a non-equilibrium condition, with separate quasi-Fermi levels. The theoretical maximum efficiency is about 45% under 1 sun and 63% under full concentration. Quantum dots have been widely studied as a promising material system for the realization of the intermediate band concept. However, the demonstration of quantum dot intermediate band solar cells remains eluding. In this talk, I will review the basic operating principle of quantum dot intermediate band solar cells and discuss experimental results and prospects for further development with the help of numerical simulations based on a semiclassical model combining transport and intersubband transitions.

Bio: Federica Cappelluti is associate professor of electronic engineering at Politecnico di Torino, Italy. She received her PhD degree in Electronics and Communications Engineering from Politecnico di Torino in 2002 with a thesis on electroabsorption modulators, partly carried out at the University of California, Los Angeles in the United States. The leitmotiv of her research has been the circuit-level and physics-based modeling and simulation of semiconductor devices for various applications, from telecom to high-frequency electronics to energy. Since a decade, she has been mainly active in the field of photovoltaics, and she has established a new research team in Politecnico di Torino working on modeling of advanced solar cell concepts. Current research topics include quantum dot and intermediate band solar cells, light trapping approaches, novel tandem architectures, and radiative cooling. Federica has a long track record in international collaborations and research projects, either industrial or from public competitive calls, also as principal investigator and coordinator. She has co-authored more than 100 publications in peer-reviewed international journals and international conferences and two book chapters. She has a consolidated experience as reviewer for several international journals and funding agencies. She teaches electronic devices to master's students and fundamentals of electronic systems and technologies to undergraduate students. She is involved at the institutional level as the Rector's advisor for Open Science.

TOP-SET est un programme de formation FONCER du CRSNG en puissance optoélectronique ayant pour but de façonner une cohorte de personnel hautement qualifié détenant des connaissances approfondies en systèmes optoélectroniques pour joindre les rangs d'équipes de recherche et développement.

Pour de plus amples renseignements sur TOP-SET, veuillez consulter create-topseteecsuottawa.ca/fr/accueil/.

NSERC CREATE Training in Optoelectronics for Power: from Science and Engineering to Technology (**TOP-SET**) is a training program that aims to form a cohort of highly qualified personnel with comprehensive understanding of optoelectronic systems, capable of joining advanced R&D teams.

For further details regarding TOP-SET, go to create-topseteecsuottawa.ca.

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