



WINTER 2017

**Venue:**

Engineering Technology Building (ETB) 535

Tuesday, March 7th from 1:30 - 2:20 PM

# ENGINEERING

# PHYSICS

# SEMINAR SERIES

Department of Engineering Physics in  
the Faculty of Engineering at  
McMaster University, Canada.

**Jacob  
Krich**

Assistant Professor, Physics Department and School of Electrical  
Engineering and Computer Science, University of Ottawa

## Intermediate band solar cells and the path to high efficiency:

Intermediate band (IB) materials are a novel class of materials that, like semiconductors, have a band gap but also have an extra set of allowed electronic levels entirely contained inside the semiconductor band gap. Solar cells made from such materials have the potential to radically improve photovoltaic efficiencies. Current intermediate band devices are made from three classes of materials: quantum dots, highly-mismatched alloys, and hyperdoped semiconductors. None has simultaneously achieved high sub-gap absorption and sufficient carrier lifetime. I will describe theoretical and experimental work to understand carrier lifetimes and their impact on device efficiencies. I will introduce a figure of merit, which predicts the potential effectiveness of candidate IB materials in advance of device fabrication. This figure of merit captures in a single parameter the inherent tradeoff between enhanced absorption and enhanced recombination within an IB material, and it suggests a path toward efficient IB materials. I will give examples of measurements of the figure of merit and theoretical predictions for new systems.

TUESDAY MARCH 7 2017



**Biography:** Jacob Krich is an Assistant Professor in the Department of Physics and the School of Electrical Engineering and Computer Science at the University of Ottawa. He is a theoretical condensed matter physicist focusing on novel pathways to high efficiency photovoltaics and nonlinear spectroscopies of organic systems. He received his BA in Physics from Swarthmore College in Pennsylvania, followed by an MMath from Oxford University, where he was a Rhodes Scholar. He received his PhD in theoretical condensed-matter physics from Harvard University. After receiving his PhD, Jacob was a Ziff Fellow of the Harvard University Center for the Environment and a postdoctoral fellow in the Department of Chemistry and Chemical Biology at Harvard.