# Progress in III-V nanowire photovoltaics

**R. LaPierre, A. Chia**
McMaster University, Department of Engineering Physics, Hamilton, Ontario, Canada L8S4L7
Email of presenting author: lapierr@mcmaster.ca

The talk will focus on our progress in the development of III-V nanowire-based photovoltaic devices. Optimization of III-V nanowire arrays for optical absorption, electrical contacting, current matching in a multi-junction design, and doping will be presented. In particular, we will present an analytical solution to Poisson's equation for a radial p-n junction nanowire with surface depletion. This resulted in a model capable of giving radial energy band and electric field profiles for any arbitrary core/shell doping density, core/shell dimensions and surface state density. Specific cases were analyzed (see Figure 1) to extract pertinent underlying physics, while the relationship between nanowire specifications and the depletion of the nanowire were examined to optimize the built-in potential across the junction. Additionally, the model results were compared with experimental results in literature to good agreement. Finally, an optimum device design is proposed to satisfy material, optical and electrostatic constraints in high efficiency nanowire solar cells.

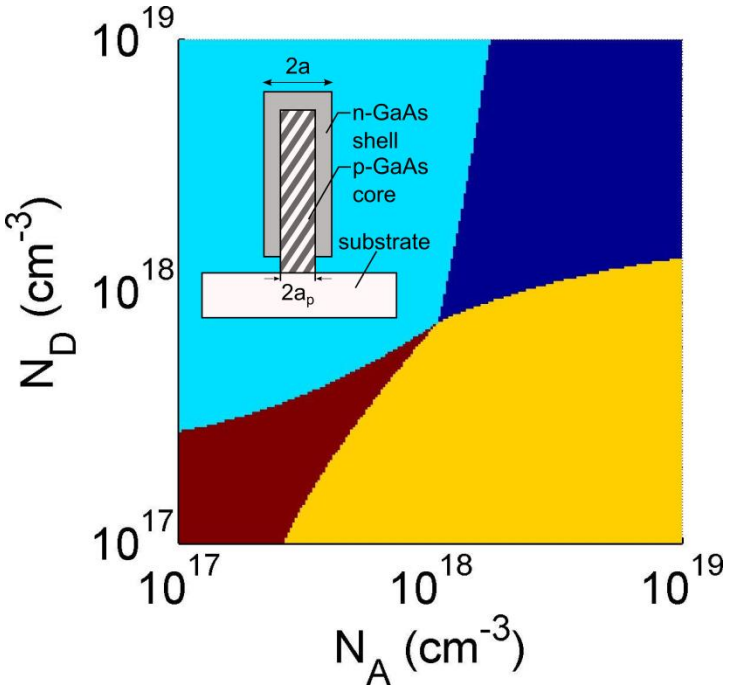


**Figure 1:** Contour plot showing different carrier depletion cases as a function of core doping ( $N_A$ ) and shell doping ( $N_D$ ) for $a_p = 50$ nm, $a = 90$ nm, and surface trap density $D_{it} = 10^{12}$ cm$^{-2}$eV$^{-1}$. Inset: Schematic of proposed design. Red: Fully depleted p-core and n-shell; dark blue: partially depleted p-core and n-shell; light blue: fully depleted p-core and partially depleted n-shell; yellow: partially depleted p-core and fully depleted n-shell.