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Department of Physics

“Polarization-induced Doping in Nanowire Devices as an Alternative to Impurity Doping”



Dr. Santino Carnevale
The Ohio State University

Many technological advances over the past several decades have been made possible by semiconductor-based devices. Perhaps the most essential aspect of any semiconductor material is the ability to control its electrical conductivity. This is usually achieved by a process called impurity doping, whereby a small amount of impurity atoms is added to an otherwise highly pure semiconductor and the concentration of impurities controls conductivity. Unfortunately, impurity doping does not work well in some semiconductors, particularly wide band gap semiconductors, making it difficult to form highly conductive material. This difficulty has inhibited progress in certain applications that require the use of wide band gap semiconductors, such as LEDs that emit ultraviolet light. Luckily, an alternative approach to controlling conductivity called polarization-induced doping offers a way around the shortcomings of impurity doping. This talk covers the basics of polarization-induced doping and provides an overview of recent work using this method in III-nitride nanowires grown by molecular beam epitaxy. These nanowires have been used to fabricate ultraviolet LEDs on Si substrates that emit light over a wide range of wavelengths. Additionally, LEDs that function without the use of dopants have been fabricated for the first time. Taken together, these results demonstrate the power of polarization-engineering and the potential for new device designs that it enables.

Wednesday, February 18, 2014, 3:00pm
Science and Engineering South, Room 138

**Refreshments will be served at 2:45 pm outside of room 138*