

CSU Department of Physics Seminar:

Designing Next-Generation Nanopore Sensing Technologies

Dr. Sebastian Sensale Rodriguez
Duke University

Wednesday, March 29

10:30-11:30am

Location: WH118



Nanopore sensors for nucleic acid and protein disease biomarkers promise radical reduction in detection time and cost. Counting individual biomolecules through the detection of changes in the electrical current, nanopore devices also promise ultra-sensitivity with single-molecule resolution and little-to-no pretreatment. However, the involvement of high electric fields and complex ion dynamics presents both hurdles as well as opportunities for better performance. In this talk, the fundamental principles of nanopore sensing will be introduced, as well as the latest advances made towards reaching the sensitivity and selectivity requirements needed to effectively apply nanopore technologies for nucleic acid sensing applications. New electrokinetic and electrostatic phenomena related to solid-state nanopores will be discussed, such as the effects of high electric fields on the ionic cloud surrounding charged molecules and the pinning of single stranded molecules to the entrance of the pore by means of edge-field leakage, which can heavily modify the observed resistive signals. We will also discuss future avenues of research for impedance-based biosensors, in particular through coupling of these sensors with DNA origami nanostructures, which promise to improve their selectivity due to the programmability of DNA hybridization.