

# CHEMISTRY DEPARTMENT

## GRADUATE RESEARCH SEMINAR SERIES

### Longitudinal and Transverse Ionic Current in Solid State Nanopore DNA Sequencing

Presented by: **Mohsen Farshad**

The idea of using nanopores for single molecule detection emerged over three decades ago<sup>1,2</sup>. Negatively-charged polynucleotides traverse in the direction of an electric field through a nanopore of suitable diameter. In 1996, Kasianowicz et al. suggested characterizing individual polynucleotide macromolecules by translocating them through  $\alpha$ -hemolysin under an applied electric field<sup>3</sup>. Here, I present all-atom molecular dynamics simulations on the possibilities of sequencing DNA through solid state silicon nitride ( $\text{Si}_3\text{N}_4$ ) nanopore solvated in 1 M KCL aqueous solution by measuring ionic currents through nanochannels and nanopores perpendicular to each other during translocation of homooligonucleotide. We also used similar system using carbon nanotube to evaluate the difference in ionic current for different types of homooligonucleotides. The ionic current signals for detection of four homooligonucleotides types are dependent on the differences of ion-nucleotide interaction forces. The solid-state nanopores can be integrated with electronic optical devices. In connection with this, we have studied the interaction of UV-Visible light with nucleotides, nucleosides, and nucleobases using TDDFT.

#### References

- (1) Bezrukov, S.; Vodyanoy, I.; Parsegian, V. Counting Polymers Moving Through a Single Ion Channel. *Nature* **1994**, *370*, 279-281.
- (2) Church, G., Deamer, D. W., Branton, D., Baldarelli, R. & Kasianowicz, J. Characterization of Individual Polymer Molecules Based On Monomer interface-Interactions. US Patent 5,795,782 (**1995**).
- (3) Kasianowicz, J.; Brandin, E.; Branton, D.; Deamer, D. Characterization of Individual Polynucleotide Molecules Using a Membrane Channel. *Proceedings of the National Academy of Sciences* **1996**, *93*, 13770-13773.

**RESCHEDULED:** Thursday, May 9, 2019 @ 11:00 am  
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