Department of Physics
Arizona State University

COLLOQUIUM

Thursday, April 27th 2023

Refreshments at 3:15pm in PSF 186
Colloquium from 3:30 PM – 4:30 PM in PSF 101

Enzyme Studies with Single-molecule Picometer Resolution

Professor Jens Gundlach

University of Washington

Abstract:

My group has been at the nexus of developing nanopore sequencing of DNA and establishing nanopores as a new tool for single-molecule biophysics. Much of our work is based on the engineered protein pore MspA. Here, I will show the stunning capabilities of using nanopores to observe enzyme mechanics in real-time as these enzymes move along DNA or RNA. We easily achieve ten times better position and time resolution than optical tweezers, while simultaneously measuring the exact nucleotide sequence in the enzyme. I will show hereto unseen detail in the motion of helicases, DNA and RNA polymerases, reverse transcriptases, etc. Besides establishing decisive kinetic enzyme models our method reveals many surprising properties of these enzymes. Of particular contemporary interest are the data we collected with the SARS-CoV-2 helicase nsp13.

Biography:

My background is in fundamental physics and precision measurement, but in 2002 I became interested in sequencing of DNA. While I still maintain my interest in fundamental physics (I am PI of a world-class group in experimental gravity lab) my bio group has been at the forefront of biophysics and biotechnology: my group developed the key components of nanopore sequencing (Butler et al., 2008), put them together and got it to work (Manrao et al., 2012); this has now become a widely used industrial process. Then, we topped this with introducing a conceptually new single-molecule tool that has unprecedented precision and capabilities (Derrington et al., 2015). This single-molecule tool, which is also based on a nanopore, allows real-time observation of the motion of molecular motors such as helicases or polymerases revealing hereto unseen behavior of these enzymes. Most rewardingly, this nanopore single-molecule tool is now being used by other labs around the world to answer some of the most exciting and pressing questions about the biological basis of life.

Host: Prof. Stuart Lindsay

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