Physics Seminar – 2021/10/04 Created on 2021/09/27

Structural biophysics of retinal proteins

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TIME: 3:00 PM

PLACE: Webex

ABSTRACT: Retinal proteins are a class of photoactive receptors involved in such diverse biological processes as ion conductance in bacteria to the sense of vision in higher organisms. The unique photophysics of the retinal chromophores in these proteins has been a source of intense study for over 30 years, and with the advent of ever higher resolution probes in both the optical domain (for tabletop ultrafast optical spectroscopies) and X-ray regime (for serial femtosecond crystallography, measurements recently made possible by free-electron laser facilities), they continue to surprise to this day.

First, I will give details of the ultrafast structural dynamics of the retinal chromophore in the visual receptor rhodopsin, determined using tabletop laser spectroscopy tuned to the electronic transitions of the chromophore itself. These experiments revealed the coherent vibrational motions that underpin our sense of vision on the fastest possible timescales. Second, SwissFEL, a new time-resolved X-ray facility in Switzerland which began user operation in 2019 will be described, and experiments using its brilliant ultrashort X-ray pulses as a probe for time-resolved crystallography of the photoactive sodium pump KR2 will be outlined. These experiments determined structural snapshots of both femtosecond and picosecond dynamics of the retinal chromophore itself, as well as more global functional motions associated with ion pumping on a nanosecond to millisecond timescale following initial ultrafast photoexcitation. Finally, future prospects for structural biophysics measurements in both a lab setting and at large-scale facilities will be discussed.

ALL ARE WELCOME!