The University of Texas at San Antonio

UTSA Physics and Astronomy

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Single protein dynamics at soft interfaces: Can chemical physics solve a $100,000,000,000 problem?

Understanding nanoscale protein dynamics at interfaces is crucial for topics ranging from disease inception and drug delivery to separations science. Recent efforts by our group and others have shown the promise of applying single molecule methods to link mechanistic detail about protein adsorptions to macroscale observables. When we study one molecule at a time, we eliminate ensemble averaging, thereby accessing any underlying complexity. However, we must develop new methods to increase information content in the resulting low density and low signal-to-noise data and to improve space and time resolution.

I will highlight recent advances in super-resolution microscopy for quantifying the physics and chemistry that occur between target proteins and stationary phase supports during chromatographic separations. My discussion will concentrate on the newfound ability of super-resolved single protein spectroscopy to inform theoretical parameters via quantification of adsorption-desorption dynamics, protein unfolding, and nano-confined transport.

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