

The University of Texas at San Antonio

# UTSA Physics and Astronomy

***Friday, April 12, 2024 at 11:00 AM, AET 0.204***

## **Cytoskeletal Structures in Physiological and Pathological Conditions**

***Dr. Marcelo Marucho***

*P&A, UTSA*

Actin and tubulin proteins adopt a variety of conformations ranging from monomers, oligomers, and filamentous to higher-order filament structures, including bundles and networks. These conformations change dynamically in response to biological environment alterations and external stimuli and are essential for critical biological and electrical activities in eukaryotic cellular processes. While high-resolution microscopy experiments provide valuable information on cytoskeleton structures and organization in cells, they usually give an incomplete molecular understanding of the biophysical principles underlying these phenomena. In this talk, I will introduce a multi-scale approach based on multi-physics theories and interaction potential models able to account for the atomistic details of the protein molecular structure, its biological environment, and its impact on the biophysical properties of these structures and their functions. I will also present ongoing research on dysfunctional cytoskeleton filament structures and their role in neurodegenerative diseases. Finally, I will discuss the potential application of electrical conducting properties of cytoskeleton filaments in biocomputers, bionanosensors, wearable/implantable brain-machine interfaces, and the electro-mechanical properties of cytoskeleton filaments in artificial cells.



**Dr. Marucho** received interdisciplinary research training at the Maurice Morton Institute of Polymer Science at the University of Akron (Ohio State) in theoretical polymer Physics, at the Institute for Molecular Design at the University of Houston in theoretical and computational chemical physics, and later on, at the Center for Computational Biology at Washington University School of Medicine (Missouri State) in computational and theoretical biophysics. In 2010, he joined the Department of Physics and Astronomy at UTSA and developed and sustained an active biophysics research group. He has garnered ~ \$1.9M in extramural funding from NIH during the past seven years. Ongoing studies are focused on elucidating the biophysical principles underlying the properties and functions of cytoskeleton structures and their role in health and technology. His group also investigates the self-adaptation ability of novel, biocompatible colloidal nanoparticles for reliable cancer treatments.

**Faculty Host: Dr. Andrey Chabanov**