

## **Announcing the Final Examination of XIN QIAO for the Degree of Doctor of Philosophy in Physics**

**Date:** Friday, June 30, 2017

**Time:** 9:00 a.m.

**Room:** PSB 433

**Dissertation title:**

SPHERICAL SELF-ASSEMBLY OF ROUS SARCOMA VIRUS CA, PROBED BY SOLID-STATE NMR AND THE STRUCTURE OF PROSTATE ACIDIC PHOSPHATASE AND REFLECTIN PROTEIN

**Abstract:**

In this dissertation, we investigate the morphology of three different protein assemblies, which are formed by prostate acidic phosphatase, residues 248-286 (PAP39), reflectin and Rous sarcoma virus capsid (RSV CA).

First of all, the main aim of this research is to study the structure of PAP39 which is derived from protease cleavage of Prostate Acidic Phosphatase. The PAP39 can form fibrils of different morphologies in phosphate-buffered saline (PBS) and NaBiCarb (25 mM sodium bicarbonate and 40 mM sodium phosphate, pH=8.83) buffer conditions, each exhibiting different potentials to enhance the infection of HIV *in vitro* due to different assemble pathways. In this project, we use solid state nuclear magnetic resonance (ssNMR) and Transmission electron microscopy (TEM) to probe the molecular structure and the fibril morphology in those two buffers.

In the second part, we study the optical property of reflectin and also apply ssNMR to evaluate its structure. Reflectin is a protein derived from in flat, structural platelets in reflective tissues of the Hawaiian bobtail squid which obtain unique self-assembling and optical properties. Its self-assembly manifest tunable iridescence and modulate incident light. It can be easily processed into thin films, photonic grating structures and fibrils. SsNMR and TEM are used to determine the structure of reflectin assembly and elucidate the mechanism for the iridescence.

In the last part, we study the spherical assembly of RSV CA, which consists of 12 CA pentamers. Therefore, the high resolution structural information of this RSV CA spherical assembly can provide essential information to understand how the same CA protein switches into conformation suitable for pentameric assembly and causes sharp curvature in authentic capsid. We use transmission electron microscopy (TEM) to screen appropriate assembly and obtain spherical assembly sample contains predominantly of T=1 capsid. A series of 2D and 3D spectra were acquired. The ssNMR spectra of the assembly exhibit similar resolution and resonance patterns to those of the RSV CA tubular assembly in our previous work. By referring to the assignments of the tubular assembly, we assign 200 residues of the 237-residue RSV CA in its spherical assembly. The assignments show some regions of RSV CA adopt different chemical shifts, in spite of overall similar resonances, which implies the structural rearrangements upon the spherical assembly and conformation variation of CA to switch between hexameric and pentameric state.

**Outline of Studies:**

Major: Physics

**Educational Career:**

M. S. University of Central Florida, USA, 2014

B.S. Northeastern University, Shenyang, China, 2012

**Committee in Charge:**

Dr. Bo Chen (Chair)

Dr. Alfons Schulte

Dr. Suren Tatulian

Dr. Alexander M. Cole (External Committee Member)

Approved for distribution by Dr. Bo Chen, Committee Chair, on June 16, 2017.

The public is welcome to attend.