

IQSE AMO QO Seminar Series

**Tuesday, March 8th, 11:30 am ZOOM & IQSE
seminar room (MPHY 578)**

Pizza will be served for IQSE members at 11:00 am. The talk will start around 11:30 am

Prof. Goong Chen

**Department of Mathematics & Institute for Quantum Science and
Engineering, Texas A&M University**

Modes of Motion of a Coronavirus

EVENT DETAILS: In this talk, we study coronavirus from a structural molecular biology point of view, with certain emphasis on how the mechanical motions of the coronavirus may play in the invasion process of healthy cells.

We first give a brief introduction and survey of the biological properties of a coronavirus concerning how it moves and how it invades healthy cells. The existing models of a coronavirus are mostly built atom-by-atom by microbiologists, to the best of our knowledge. A major finding by those researchers is the "wiggling" motion by the spikes of the virus. Such wiggling motion has been identified to play the important functions of browsing, surfing, and exploring activities in the virus' search and roaming to find healthy cells to invade.

A single coronavirus contains hundreds of millions or even billions of atoms. Therefore, we can build our model by continuum mechanics in lieu of a mass-spring-dashpot atom-by-atom model. A spherical shell with many spikes mimicking the shape of coronavirus has been chosen as the elasto-plastic continuum. For this small continuum, we can analyze its eigenmodes of vibration by Modal Analysis. We have found the null space of six zero-frequency modes as translations (along three coordinate axes) and rotations (pitch, roll and yaw) and then, in addition, several thousands more nontrivial modes. They include the wiggling motion, and many other more peculiar modal shapes such as twisting, compression, embracing, locking, punching, and shaking-off actions.

We also include the modal analysis of an IgG antibody. We make some hypothetical opinions regarding how a coronavirus may interact with an antibody based on their modal analysis.

Many animation videos from supercomputer computations and simulations will be shown to illustrate the motions of a coronavirus.

ZOOM information:

<https://tamu.zoom.us/j/98156251523?pwd=QVdSdGxtL1UyY0g1L083SU5QR0QrUT09>

Meeting ID: 981 5625 1523

Passcode: 297578

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