## Dynamics of the Earth's Magnetosphere From Modern Data Analysis Tools

Anthony Tat Yin LUI Applied Physics Laboratory

It is well recognized that 99.9% of space is in a plasma state consisting of highly ionized gas. Many dynamical phenomena in the Plasma Universe may be prototyped within the environment of the Earth's magnetosphere. Since the dawn of space era with the launch of artificial satellites, we have the capability of making in situ measurements to probe the plasma dynamics in the magnetospheres of the Earth and the other planets in our solar system. In this lecture, some modern data analysis tools on in situ measurements will be described for the pursuit of identifying the physical processes responsible for some dynamic magnetospheric phenomena. These modern tools include wavelet analysis, multi-fractal analysis, phase-space density analysis, and Grad-Shafranov reconstruction. These enabling tools reveal clues about the underlying physical processes of magnetospheric phenomena and their plausible connection with the modern research of nonlinear dynamics such as self-organized criticality phenomena. Examples of how these tools are applied to advance our understanding of energetic events in the Plasma Universe will be presented.