

Fall 2019 Colloquium

Department of Physics & Astronomy, TAMU-Commerce

Oct 10, Thursday, 4-5 PM in Science Building 127

(coffee and cookies will be served at 3:50 PM)

Nuclear physics

The anatomy of atomic nuclei

Dr. Calvin Johnson

San Diego State University



Dr. Calvin Johnson earned a BS (1985) in Physics and in Mathematics at the University of California, Davis, and a Ph.D. degree (1989) in Physics at the University of Washington, studying neutrino physics and the nuclear shell model. He worked as a postdoc at Caltech and then at Los Alamos, and was a faculty member at Louisiana State University from 1995 to 2001; in 2002 he moved to San Diego State University, where he is now a full professor, as well as an associate editor at Physical Review C. His research involves the nuclear shell model, weak interaction physics, high performance computational physics, and, most recently, quantum computing. He currently teaches a course on science and science fiction.

More information about Dr. Johnson and his research can be found at

<http://sci.sdsu.edu/johnson/>

Abstract

In the early days of nuclear physics, atomic nuclei were visualized as little liquid drops which could vibrate and spin, explaining their characteristic spectra. Later the nuclear shell model described nuclei as built from a finite number of discrete protons and neutrons. While these two pictures may seem completely different, a uniform description can be found in the mathematics of quadrupole deformations and angular momentum, based in the group $SU(3)$. Applying group theory to nuclei can seem abstract and forbidding, but the alternative, brute force 'first principles' calculations using supercomputers and enormous Hilbert spaces, can seem equally difficult to understand. To paraphrase mathematician Richard Hamming, how do we get insight from billions of numbers? The paradoxical answer is to use group theory to analyze huge calculations, and I will show how, even if one knows almost nothing about groups--I certainly don't--one can still use it to graphically visualize the underlying 'anatomy' of nuclear wave functions.