

Spring 2019 Colloquium

Department of Physics & Astronomy, TAMU-Commerce

Jan 31, Thursday, 4-5 PM in Science Building 127

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

Nuclear Physics

Quark-Meson-Coupling Model for finite nuclei, nuclear matter and beyond

Dr. Jirina Stone

University of Oxford (UK), University of Tennessee (USA)



Dr. Stone earned Ph.D. degree (1975) in Physics at the Charles University of Prague, Czechoslovakia. Her Ph.D. research topic was on low energy nuclear spectroscopy. She worked as an associated Professor in Physics at the Technical University of Prague and did her research at the Nuclear Physics Institute of the Czechoslovak Academy of Sciences in Rez near Prague and the Joint Institute for Nuclear Research in Dubna (USSR) till 1983 when she moved to the University of Oxford and worked as a research associate and a college lecturer. Her research included experimental physics in Oxford, Daresbury and CERN ISOLDE as well as mean-field models of nuclear structure and nuclear matter. In 2005 she moved to the United States and became an Adjunct Professor of Physics at the University of Tennessee, Knoxville while still holding a position of an Academic visitor in

Oxford in the condensed matter and later the astrophysics sub-department. She also held a position of a Visiting Professor in Chemistry at the University of Maryland, College park (1993-2018) and temporary positions at RIKEN, Japan and University of Adelaide, Australia. Her current research is focused on microscopic approaches to theory of neutron stars and in-medium nuclear forces.

Abstract

The fundamental problem of low energy nuclear structure is the understanding the change of the free nucleon-nucleon force in the nuclear medium. Commonly used forces of the Skyrme or Gogny type, with their empirical medium density dependence, cannot be determined uniquely. Hundreds of such forces have been constructed, fitting their numerous correlated parameters to selected experimental data. I will report a single, four-parameter form of the density dependent effective nucleon-nucleon force based on modification of the nucleon structure in-medium on the quark level, which represents a new paradigm for nuclear physics. The model yields predictions for the ground-state binding energies, electromagnetic properties and shapes of even-even nuclei, from the lightest to superheavy, in agreement with experiment within less than a few percent [1]. At the same time, it describes properties of high density nuclear matter and cold neutron stars, containing a full baryon octet, consistent with observation [2]. Critical comparison with other models and future developments will be presented.

[1] P.A.M.Guichon, J.R. Stone, A.W. Thomas, 2018, Progress in Nuclear and Particle Physics 100, 262 (2018)

[2] J.R.Stone, Eur. Phys. J. A 52, 66 (2016)