Towards improved cross sections on medium and heavy unstable nuclides

The main contacts for this slide:

Goran Arbanas, ORNL (arbanasg@ornl.gov) (865) 574-4984 (ofc)
Kenneth Roche, PNL (Kenneth.Roche@pnl.gov) (206) 616-9906 (ofc)

Nuclear cross sections and their uncertainties are a key ingredient in design and modeling of nuclear reactors, nuclear medical equipment, and other applications. Therefore, we re-examine theoretical assumptions and approximations used in derivation of widely used expressions for statistical cross sections by modeling numerically the Kawai-Kerman-McVoy theory of statistical nuclear reactions.

Modeling of the Kawai-Kerman-McVoy theory requires computation of eigenvalues and eigenvectors of very large complex symmetric matrices. Thus the first ever parallelized complex symmetric eigensolver was developed by this collaboration, with a prospect of benefitting related fields. The eigensolver has been tested on few tens of processors, with an intent to scale to thousands for modeling of actinides.

About the graphics:

On the left: a ratio of the energy-averaged fluctuating part of the T-matrix and the optical T-matrix is plotted on the z-axis for all pairs of the channel indices on the x- and y- axis. Small ratios verify a central claim of the Kawai-Kerman-McVoy theory.

On the right: a histogram of all ratios from the graph on the left.

This collaboration involves Oak Ridge National Laboratory (Goran Arbanas, David Dean), Pacific Northwest National Laboratory (Kenneth Roche), University of Tennessee-Knoxville (Arthur Kerman), TAMU-Commerce (Carlos Bertulani, Karthik Ushkala).