Surprising nucleon behavior

July 30 2010

Data from DOE's Oak Ridge National Laboratory on neutron interactions with isotopes of platinum contradict a basic assumption underpinning random matrix theory, nuclear physics models and quantum chaos.

For more than a half century, scientists have assumed that highly excited states in intermediate- to heavy-mass nuclides are chaotic, and that data support this assumption.

However, new data from the Oak Ridge Electron Linear Accelerator strongly disagree.

The new results suggest that the roughly 200 nucleons inside the platinum nuclei studied act in unison to exhibit regular rather than chaotic properties. Given the relatively high energy and large number of nucleons involved, such collective behavior is totally unexpected and unexplained.

A possible explanation is that an even more fundamental tenet of theory--something known as form invariance--is violated.

"Either way, as these assumptions underpin the nuclear statistical model, the impact of these new findings could be very broad throughout nuclear physics, nuclear astrophysics and in applications such as nuclear energy," said ORNL physicist Paul Koehler.

Provided by Oak Ridge National Laboratory