

Atomic core, shaken not stirred

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Credit: Geo Martinez, 123rf.com.

When struck just right, protons and neutrons ring. The sub-atomic particles don't jingle like when a hammer hits a bell. But they do jiggle in an odd dance where the protons move in one direction and the neutrons move the other way.

Studying this particular particle movement has been difficult because of other motion within an atom's [nucleus](#). But now, researchers using the High Intensity Gamma Ray Source, or HIGS, located on Duke's campus, say they have gotten the best look yet at a nucleus as it starts its complex, resonant dance.

In the experiment, the researchers slammed a chunk of bismuth-209, which had 83 [protons](#) and 126 neutrons, with a polarized beam of high-energy photons.

The team then recorded all the gamma rays knocked from the nucleus after the collision. Based on the direction the gamma rays were traveling, the scientists were able to figure out the energy, width and strength of the resonance at which the particles' rang.

The results, which appear in the Nov. 25 issue of Physical Review Letters, along with future studies on the vibrations of other nuclei planned at the HIGS facility will help theorists write a clear, accurate mathematical description of how protons and neutrons behave and also for the state of matter in black holes, [neutrons](#) stars and even in star explosions called supernovae.

More information: New Method for Precise Determination of the Isovector Giant Quadrupole Resonances in Nuclei. Henshaw,S., Ahmed, M., Feldman, G., Nathan, A., and Weller, H. *PRL* 107, 222501 (2011). [DOI: 10.1103/PhysRevLett.107.222501](https://doi.org/10.1103/PhysRevLett.107.222501)

Provided by Duke University

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